



THE MADURA COLLEGE (AUTONOMOUS)

(Affiliated to Madurai Kamaraj University, Reaccredited (3rd cycle) with “A” Grade by NAAC)

TPK Road, Madurai – 625 011, Tamil Nadu

www.maduracollege.edu.in

ACADEMIC COUNCIL

20.07.2022



ESTD : 1889

Learning Shines with Righteousness

BOOK 3 of 3

(Syllabi Pages : 1904-2852)



THE MADURA COLLEGE (AUTONOMOUS)
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Ordinary Meeting of the Academic Council

Venue : Seminar Hall

Date : 20.07.2022

Time : 10.30 a.m.

Members are requested to bring with them this copy as well as the copy of the appendices.

R.Eswaran
Member Secretary

Dr.J.Suresh
Principal & Chairman



THE MADURA COLLEGE (AUTONOMOUS)

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ACADEMIC COUNCIL

Date: 21.06.2022

NOTICE

An ordinary meeting of the Academic Council will be held on **20th July 2022 at 10:30 a.m.** at Seminar hall. Resolutions from Board of Studies and Private resolutions may be submitted to the Member Secretary, Academic Council (eswaran@maduracollege.edu.in) on or before 25.06.2022. The deadline for withdrawal of resolutions will be 27.06.2022 up to 3:00 p.m.

The agenda and resolutions to be discussed will be made available to the members sufficiently in advance.

Dr.R.Eswaran
Member Secretary

Dr.J.Suresh
Principal & Chairman



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ACADEMIC COUNCIL

MEMBERS IN THE ACADEMIC COUNCIL

Dr.J.Suresh

The Principal & Chairman

Dr.R.Eswaran

Member Secretary

EXTERNAL MEMBERS

Sri.S.Sridharan,,

President,
Madura College Board,
Madurai.

C.A.S.Natanagopal,

Secretary,
Madura College Board,
Madurai.

Sri.N.Anand Srinivasan,

Treasurer,
Madura College Board,
Madurai.

Dr. M. Thangaraj

Professor & Head
Department of Computer Science
School of Information Technology
Madurai Kamaraj University
Madurai – 625 021

Dr. G. Kumaresan

Professor & Head, Chairperson
Department of Genetics
School of Biological Sciences
Madurai Kamaraj University
Madurai – 625 021

Dr. T. Dharmaraj.

Professor & Head, Chairperson
Department of Folklore and Culture Studies
School of Performing Arts
Madurai Kamaraj University
Madurai – 625 021

Dr.S.Vaidhya Subramanian,

Dean, (Member representing Education)
SASTRA University,
Tirumalai Samudiram,
Thanjavur – 613 401.

Sri.S.Sankaran,

(Member representing Profession)
Director – Madura College Board,
Madurai.

Sri.R.Sridharan,

(Member representing Profession)
Director – Madura College Board,
Madurai.

Sri.K.K.Raman,

(Member representing Industry)
President,
Sundaram Industries (TVS Rubber)
Madurai.

INTERNAL MEMBERS

Boards of Studies Chairmen	-	All Heads/Coordinators of the Department
Members of Academic Council	-	All Permanent Faculty Members
Special invitees	-	Nominated by Chairman
(Teachers on probation/Senior Faculties of SF stream)		



THE MADURA COLLEGE (AUTONOMOUS)
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ACADEMIC COUNCIL

AGENDA FOR THE MEETING ON 20.07.2022

1. Prayer
2. Welcome Address : The Chairman, Academic Council
3. Confirmation of the Minutes of the previous Academic Council Meeting held on 17.06.2021
4. Business brought forward by the Chairman
5. Resolutions of Boards of Studies from various Departments
6. Any other subjects brought forward by the Chairman
7. Observation & Remarks by the External Members
8. Vote of Thanks : Member Secretary
9. National Anthem

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I. CONFORMATION OF MINUTES OF THE PREVIOUS ACADEMIC COUNCIL MEETING HELD ON 17.06.2021.



THE MADURA COLLEGE

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MADURAI - 625 011

MEETING OF THE ACADEMIC COUNCIL

Date: 17.06.2021 (Thursday)

Venue: Online at Google Meet
(<https://meet.google.com/igp-iops-gsm>)

Time: 10:30 a.m.

MINUTES OF THE ACADEMIC COUNCIL MEETING

A meeting of the Academic Council was held in online mode (<https://meet.google.com/igp-iops-gsm>) on Thursday, 17th June 2021.

1. The meeting was called to order by the Principal-cum-Chairman of the Academic council, Dr. J. Suresh and the meeting started with the college prayer. The Chairman welcomed Sri. N.S. Krishnan, President, Madura College Board (MCB), Sri. S. Natanagopal, Secretary, MCB, Sri. N. Anand Srinivasan, Treasurer, MCB, Sri. S. Sankaran, Director, MCB, Sri. R. Sridharan, Director, MCB, Sri. K.K. Raman, Industrial representative, University nominees: Dr. V. Chinniah, Dr. R. Sudha and Dr. H. Shakila, all Heads of the Departments (HoDs), Deans, Controller of Examinations, Deputy Controller of Examinations, special invitees and all other members of the Academic Council.
2. The Chairman, in his exordium of welcome address, highlighted the statutory and constructive role played by the Academic council to ensure academic quality, assurance, accountability in the compliance of UGC (University Grants Commission) regulations. He also overviewed the adoption of flexible curriculum, Outcome Based Education (OBE) model, and the effective evaluation pattern after extensive analysis by the staff members. He further necessitated the faculties to view the institute as a whole when we deliberate the academic pattern. The democratic nature of taking decisions in the Academic council ensured all the permanent faculties to air their views and made them comprehend the importance of such deliberations. He also appreciated the sincere efforts taken by the member secretary, office bearers of OBE review committee and Board of Studies for their contributions towards the design and implementation of OBE curriculum.
3. The Minutes of the previous Academic Council meeting held on 26.08.2020 and the resolutions passed by circulation on 22.10.2020 were confirmed and passed.
4. The resolution moved by chairman was taken up for discussion. The resolution was “Students who join B.Sc. Physics programme from the academic year 2021-2022 will study Chemistry as their first ancillary and Maths as their second ancillary course”. He overviewed the introduction of one ancillary one year in the UG programmes by following the UGC model curriculum. He also stressed and necessitated the offering of two ancillary per year by the Chemistry department i.e., students of Botany and Physics for the 1st year and students of Zoology and Maths for the second year. Hence, the PMC will be PCM from the academic year 2021-22 and onwards. Dr. Theenathayalan suggested the use of the word Allied instead of ancillary. The chairman highlighted the traditional use of the word allied in the B.Com and CS programmes in our college and use of the word ancillary in Maths, Chemistry, Botany and Zoology Programme. He also assured the usage of a word Allied when the need arise.
Then, the motion was put to vote and CARRIED.
5. Resolutions No. 1.1 to 1.12 were moved by **Dr. S. Dhanasamy**, Chairman, Board of Studies (BoS) in Tamil and seconded by **Dr. A. Atheeswari**.
Then, the motion was put to vote and CARRIED.

6. Resolutions No. **2.1 and 2.2** were moved by **Prof. S. Murali**, Chairman, BoS in Hindi and seconded by **Dr. S. Dinakaran**. The chairman asked to apprise the title of the certificate course. Prof. S. Chellapandian queried the Chairman “Whether to mention the title as Certificate course in Hindi is enough? or need to mention as Basics in Hindi”. The chairman clarified and advised the HoD to mention the title of the certificate course in the resolution if they offer a single certificate course or else they can mention as “certificate courses” if they offer more than one certificate courses but they need to mention the title in the skeleton. (just to avoid mention as many certificate courses). Prof. S. Murali mentioned the title as “Hindi for Beginners”. Prof. S. Murali assented to add the title in the resolution.
Then, the motion was put to vote and CARRIED.
7. Resolutions No. **3.1 and 3.2** were moved by **Prof. P. Manikandan**, Chairman, BoS in Sanskrit and seconded by **Prof. S. Murali**. Dr. Theenathayalan suggested to change the title of certificate course as either Introduction to spoken Sanskrit or Basics of Spoken Sanskrit. Prof. Manikandan agreed to change the title as “Introduction to Spoken - Sanskrit”
Then, the motion was put to vote and CARRIED.
8. Resolutions No. **4.1 to 4.10** were moved by **Dr. R. Subramony**, Chairman, BoS in English and seconded by **Dr. Sheela P. Karthick**. The forum unanimously agreed the resolutions.
Then, the motion was put to vote and CARRIED.
Sri. S. Natanagopal, Secretary, MCB, suggested to mention the changes in the syllabi pages because they read only the pages and could not refer the whole content in hand. The chairman explained that hard copies of the Academic council books could not be printed on time due to the closure of Printing Press owing to COVID lockdown. He, further asked HoDs to mention the changes in the syllabi pages while presenting resolutions. And corrections would be executed in the revised copy of Academic council books. Further, he also assured to supply the corrected copy to the departments and members concerned.
Then, the motion was put to vote and CARRIED.
9. Resolutions No. **5.1 to 5.6** were moved by **Dr. S. Theenathayalan**, Chairman, BoS in Economics and seconded by **Dr. P. Kannan**. The forum unanimously agreed the resolutions.
Then, the motion was put to vote and CARRIED.
10. Resolutions No. **6.1 to 6.16** were moved by **Dr. A. Mayil Murugan**, Chairman, BoS in Commerce and seconded by **Dr. S. Selvakumar**. Dr. Mayil Murugan clarified to the forum that the courses offered for the first year of all variants of B.Com. (General, Professional Accounting, Banking&Insurance, and Capital Marketing) are same. In the second year, four courses offered are the same and the other two papers are designed to cater to the expertise required for each programme.
The chairman probed the introduction of advanced learning course on Indian Constitution for the Commerce students and questioned of the usefulness for the students in acquiring branch wise knowledge. Dr. Mayil Murugan clarified that the learning of constitution of India by the commerce students would be very helpful to clear competitive examinations. While presenting resolutions about offering two certificate courses on 1. Goods and Services Tax and Accounting Package and 2. Entrepreneurial development and start Ups to all the UG and PG students, Dr. Muthukumar queried about the course syllabi content required to cater to the needs of PG students. Dr. Mayil Murugan explained that the two courses would justify and enable the students to become an Entrepreneur.
While reading the resolution **6.14**, the chairman suggested to revise the resolution as “Resolved to pass, two online certificate courses on ‘Derivative Market’ and ‘Foreign Exchange and Currency Markets’ in III semester. Further, four certificate courses on ‘Capital Market Operations’, ‘Back Office’, ‘Depository Operations & Clearing’ and ‘Settlement & Risk Management’ in the IV semester offered by National Stock Exchange (NSE) Academy for the B.Com (Capital Marketing) students who joined in the Academic year 2020– 21 and onwards”. Dr. Mayil Murugan also assented to revise the resolution.
Then, the motion was put to vote and CARRIED.

11. Resolutions No. **7.1 to 7.8** were moved by **Dr. S. Muthukumar**, Chairman, BoS in Mathematics and seconded by **Dr. C. Thangapandi**.
While reading the resolution, **7.2.**, Dr. S. Muthukumar pleaded the forum to allow the errata i.e., In Mathematical Statistics course, allow to replace the content in Unit-IV, which Unit-III content copied also in Unit IV. The chairman explained the forum that Dr. Muthukumar already submitted errata to me and allow the passing of resolutions.
Also while reading the resolution, **7.3.**, Dr. S. Muthukumar requested the forum to accept the errata submitted to The Chairman. i.e., in Real Analysis course, by typographical errors, Unit-II copied also in Unit-III. The forum agreed to allow the errata.
Then, the motion was put to vote and CARRIED.
12. Resolutions No. **8.1 to 8.3** were moved by **Dr. S. Muthukumar**, Chairman, BoS in Statistics and seconded by **Dr. C. Thangapandi**.
The chairman suggested to remove the word “course” after I B.Sc. Statistics. Dr. Muthukumar agreed for the change in resolution
Then, the motion was put to vote and CARRIED.
13. Resolutions No. **9.1 to 9.8** were moved by **Dr. R. Saravanan**, Chairman, BoS in Physics and seconded by **Dr.M.Prema Rani**.
The forum unanimously agreed to pass the resolutions.
Then, the motion was put to vote and CARRIED.
14. Resolutions No. **10.1 to 10.9** were moved by **Dr. A. Xavier**, Chairman, BoS in Chemistry and seconded by **Dr. P.S. Harikrishnan**.
The forum unanimously agreed to pass the resolutions.
Then, the motion was put to vote and CARRIED.
15. Resolutions No. **11.1 to 11.9** were moved by **Prof. S. Chellapandian**, Chairman, BoS in Botany and seconded by **Dr. P. Kannan**.
While reading resolution 11.6., Prof. S. Chellapandian clarified that the Diploma programme on Gardening consists of two theory papers and two practicals of 30 hour duration each. Hence, it is offered for a total of 120 hour for a total of 8 credits. Dr. Muthukumar questioned whether the programmes offered for all the students? Prof S. Chellapandian clarified that the course offered to all UG students. The chairman added that the errata submitted by the department and he also clarified that absolutely no mistake from the side of department.
While reading resolution 11.7., He precluded that the duration of PG Diploma programme on “Plant Identification” was given as 60 hours. He requested the forum to allow for the submission of revised programme skeleton and syllabi for 120 hour. The chairman clarified that the matter already discussed with the Programme coordinator and course designer, hence requested the BoS chairman to withdraw the resolution. Further, he added that we may allow the course to be conducted but the syllabi will be ratified in the subsequent meeting of academic council. Prof. S. Chellapandian agreed to withdraw the resolution 11.7.
Then, the motion was put to vote and CARRIED.
16. Resolutions No. **12.1 to 12.7** were moved by **Dr. S. Dinakaran**, Chairman, BoS in Zoology and seconded by **Dr. L.D. Devasree**.
The forum unanimously agreed to pass the resolutions.
Then, the motion was put to vote and CARRIED.

17. Resolutions No. **13.1 to 13.6** were moved by **Er. J. Rajendran**, Chairman, BoS in Computer Science and seconded by **Prof. R. Umasankari**. Er. J. Rajendran explained the errata in the programme skeleton with respect to credits, hours etc. The chairman informed the forum that the errata has been submitted to the Academic council, hence, he requested the forum to allow the passing of resolutions. The forum unanimously agreed to pass the resolutions.
Then, the motion was put to vote and CARRIED.
18. Resolutions No. **14.1 to 14.7** were moved by **Prof. K. Rajasaravanakumar**, Chairman, BoS in Information Technology and seconded by **Dr. N. Paneerselvam**.
The forum unanimously agreed to pass the resolutions.
Then, the motion was put to vote and CARRIED.
19. Resolutions No. **15.1 to 15.9** were moved by **Dr. N. Paneerselvam**, Chairman, BoS in Microbiology and seconded by **Prof. K. Rajasaravanakumar**. While reading the resolution 15.7, Dr. Muthukumar queried whether the certificate courses offered to microbiology students only or for all the students. Dr. Paneerselvam replied that the certificate courses offered for all the students of UG programmes. The chairman intervened and suggested rephrasing the resolution 15.7 as “Resolved to introduce the certificate courses for students of Undergraduate science programmes admitted from the Academic year 2020-21 and onwards”. Dr. N. Paneerselvam agreed for the change in resolution
Then, the motion was put to vote and CARRIED.
20. Resolutions No. **16.1 to 16.8** were moved by **Dr. N. Paneerselvam**, Chairman, BOS in Microbiology and seconded by **Prof. K. Rajasaravanakumar**.
While reading the resolution 16.8, The chairman suggested to correct the resolution and asked to mention I B.Sc. Biotechnology programme instead of I B.Sc. Microbiology. Dr. Paneerselvam agreed to correct the resolution.
Then, the motion was put to vote and CARRIED.
21. Resolutions No. **17.1** was moved by **Dr. S.V. Karthikeyan**, Chairman, BoS in NCC and seconded by **Dr. K. Kathirvelpandian**. The forum unanimously agreed to pass the resolution.
Then, the motion was put to vote and CARRIED.
22. Resolution No. **18.1** was moved by was moved by **Dr. Y. Natarajan** and seconded **Dr.S.V. Karthikeyan**. The forum unanimously agreed to pass the resolution.
Then, the motion was put to vote and CARRIED.
23. Resolution No. **19.1** was moved by **Dr.S.Selvakumar**, Chairman, Board of studies in YRC and seconded by **Dr. Y. Natarajan**. The forum unanimously agreed to pass the resolution.
Then, the motion was put to vote and CARRIED.
24. Resolution No. **20.1** was moved by **Dr.K. Kathirvelpandian**, Chairman, Board of studies in Physical Education and seconded **Dr.S.V. Karthikeyan**. The forum unanimously agreed to pass the resolution.
Then, the motion was put to vote and CARRIED.
25. Resolution No. **21.1 and 21.2** (addendum) were moved by **Dr.V.Sriman Narayanan**, Controller of Examinations (CoE), and seconded by **Dr.S.Karuppusamy**, Deputy Controller of Examinations (DCoE). While reading resolution 20.1, Dr. Muthukumar suggested to mention suitable word than “atleast”. The chairman suggested to mention as “...75% marks or more” and also asked to remove the word “atleast”.
Resolution 20.2. read as addendum as “Resolved to ratify the conduct of November 2020 and April 2021 semester examinations in online mode as per directions of Higher Education Department, Government of Tamilnadu following the guidelines of UGC”. The chairman clarified to the forum that we conducted November 2020 and

April 2021 semester examinations through online mode by following Guidelines of Government of Tamilnadu, UGC and Madurai Kamaraj University. He further added that “it is a formal approval we seek from the Academic council and also it help us to move to the next level approval i.e, Governing council”, He said.

The forum unanimously agreed to pass the resolution.

Then, the motion was put to vote and CARRIED.

26. Resolution No. **22.1** was moved by **Prof. S. Sivaramakrishnan**, Dean (Academic) and seconded by **Dr. I. Sahul Hamid**,”. He asked the members to read the year in the resolution as “2021-22” and onwards”
The forum unanimously agreed to pass the resolution.
Then, the motion was put to vote and CARRIED.
27. The chairman requested the University nominee, Dr. H. Shakila to give her observations and remarks. She appreciated and complimented the efforts taken by all the departments for the successful presentation of the syllabi. Further, she queried about the admission strength in the certificate courses. The chairman replied that the students show overwhelming response to the certificate courses and able to admit at least 30 students per certificate course and in some of the courses, the student strength is more than 60 due to enchanting content of the course to augment job opportunities. Dr. Shakila appreciated all the faculties and also congratulated the management for their support.
28. The chairman requested the President, MCB, Er. N.S. Krishnan, to present his views. He appreciated all the members for the deliberations. He also suggested to present the resolutions to the office bearers MCB for the better understanding and support. He, further, added that the expertise available in the MCB can also be utilized for the certificate courses offered by the college. He also suggested to consider the title of the certificate course offered by the Sanskrit department as “Introducing spoken Sanskrit” instead of “Introduction to spoken Sanskrit”.
29. The Chairman requested Secretary, MCB, Mr.S.Natanagopal, to present his observations. He reminisced his participation in the Academic council meetings for 10 times. He reviewed and appreciated the constructive steps taken by the college towards academic accomplishments. He wished all the best to everyone.
30. When the chairman requested the members for any other views, Dr. S. Gnaanasaraswathi clarified the total credit for the Diploma programme in Gardening as 8 credits. Finally, the chairman appreciated the entire faculty teams for their support and help.

The member Secretary, Dr. R. Eswaran proposed vote of thanks.

The meeting was adjourned sine die.



Dr. R. Eswaran
Member Secretary



Dr. J. Suresh
Principal & Chairman

II. BUSINESS BROUGHT FORWARD BY THE CHAIRMAN

III. RESOLUTIONS BROUGHT FORWARD BY HEADS OF VARIOUS DEPARTMENTS

1) FROM THE BOARD OF STUDIES OF TAMIL DEPARTMENT

Dr.S.Dhanasamy, Chairman, Board of Studies in Tamil, shall move and **Dr.A.Atheeswari** shall second the following resolutions, passed in the Board of Studies meeting held on 19.01.2022.

- 1.1. Resolved to ratify the revised mapping of course outcomes against program outcomes for Part 1 Tamil courses for those who joined the course from the academic year 2020-2021 **(pp 1-6)**.
- 1.2. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.A. TAMIL for students who joined the programme from the Academic Year 2020-21. The curriculum includes an Inter-disciplinary course titled 'OPPILAKKIYAM' offered jointly by the department of ENGLISH **(pp 7-108)**.
- 1.3. Resolved to introduce the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.A. TAMIL for students who joined the programme from the Academic Year 2021-22. The curriculum includes a Multi-disciplinary course titled 'NATTUPURAVIYAL' offered jointly by the departments of ECONOMICS, BOTANY **(pp 111-200)**.
- 1.4. Resolved to approve the metric and weight calculation for the attainment of programme outcomes against the course outcomes for B.A. Tamil and M.A. Tamil for Regulation 2020 and Regulation 2021 respectively **(pp 213-216)**.
- 1.5. Resolved to introduce add-on courses titled 'Research methodology' to be offered during the third semester of M.A. TAMIL for those students who join the programme from the Academic Year 2021-22 **(pp 128-133)**.
- 1.6. Resolved to ratify the certificate course 'ARULNERIK KALAI' for UG & PG students from the Academic Year 2021-22 **(pp 210-212)**.
- 1.7. Resolved to ratify the certificate course 'Kambaramayanam (Sundarakandam)' for UG & PG all departments' students from the Academic Year 2021-22 **(pp 201-204)**.
- 1.8. Resolved to ratify the Diploma course 'Kambaramayanam (Balakandam)' for UG & PG all departments' students from the Academic Year 2021-22 **(pp 205-209)**.
- 1.9. Resolved to introduce a certificate course 'PANNISAI' for UG students from the Academic Year 2022-23 **(pp 109-110)**.

2) FROM THE BOARD OF STUDIES OF HINDI DEPARTMENT

Prof.S.Murali, Chairman, Board of Studies in Hindi, shall move and **Dr.S.Dinakaran** shall second the following resolutions, passed in the Board of Studies meeting held on 19.01.2022.

- 2.1. Resolved to ratify the revised mapping of course outcomes against program outcomes for Part-I Hindi courses for those who joined the course from the academic year 2020-2021 **(pp 217-222)**.

3) FROM THE BOARD OF STUDIES OF SANSKRIT DEPARTMENT

Prof.P.Manikandan, Chairman, Board of Studies in Sanskrit, shall move and **Prof.S.Murali** shall second the following resolutions, passed in the Board of Studies meeting held on 19.01.2022.

- 3.1. Resolved to ratify the revised mapping of course outcomes against program outcomes for Part-I Sanskrit courses for those who joined the course from the academic year 2020-2021 **(pp 223-228)**.

4) FROM THE BOARD OF STUDIES OF ENGLISH DEPARTMENT

Dr.R.Subramony, Chairman, Board of Studies in English, shall move and **Dr.Sheela P.Karthick** shall second the following resolutions, passed in the Board of Studies meeting held on 19.01.2022.

- 4.1. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.A English for students who joined the programme from the Academic Year 2020-21. The curriculum includes an Inter-disciplinary course titled 'Cultural Studies in Feminism' offered jointly by the department of Tamil **(pp 229-326)**.
- 4.2. Resolved to introduce the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.A. English for students who joined the programme from the Academic Year 2021-22. The curriculum includes a Multi-disciplinary course titled 'Green Studies' offered jointly by the department of Botany **(pp 332-411)**.
- 4.3. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes, for B.A. English for Regulation 2020 **(pp 412-417)**.
- 4.4. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes for M.A English for Regulation 2021 **(pp 418-421)**.
- 4.5. Resolved to ratify the revised programme structure for the B. A. English programme for the students who joined from the academic year 2020 – 21 and onwards **(pp 327-331)**.
- 4.6. Resolved to ratify the revised programme structure for the M. A. English programme for the students who joined from the academic year 2020 – 21 and onwards **(pp 335-338)**.
- 4.7. Resolved to pass the revised /new curriculum for II M.A. English programme for students who joined the programme from the Academic Year 2021-22 as prescribed by TANSCH.

- 4.8. Resolved to add an additional elective paper for I & II semesters for M.A. English programme for the students who joined the programme from the Academic Year 2021-22 as prescribed by TANSCHÉ.
- 4.9. Resolved to pass the curriculum for third year B.A. English to be offered to students who joined the course from the Academic year 2020-21 as prescribed by TANSCHÉ.
- 4.10. Resolved to ratify Mapping of Course Learning Outcomes with Program Specific Outcomes for M. A. English programme for I & II semesters.
- 4.11. Resolved to ratify the title and course code for B. Com. programme as 20U4NEK2 – SOFT SKILLS for students who join the programme from the Academic year 2020-21.
- 4.12. Resolved to ratify the title for B. A. English programme for the paper “A Field of Adoption Studies” as “A Field of Adaptation Studies” and “Transferring the Linguistic and Entities” as “Transferring Linguistic Entities” for students who join the programme from the Academic year 2020-21 **(pp 303-308, 315-320)**.

5) FROM THE BOARD OF STUDIES OF ECONOMICS DEPARTMENT

Dr.S.Theenathayalan, Chairman, Board of Studies in Economics, shall move and **Dr.P.Kannan** shall second the following resolutions, passed in the Board of Studies meeting held on 19.01.2022.

- 5.1. Resolved to pass the syllabi for final year B.A. Economics Programme with Outcome Based Education under Choice Based Credit System for students who joined from the Academic year 2020-21 and onwards **(pp 422-510)**.
- 5.2. Resolved to pass the syllabi for second year M.A. Economics Programme with Outcome Based Education under Choice Based Credit System for students who joined from the Academic year 2021-22 and onwards **(pp 511-577)**.
- 5.3. Resolved to ratify the nature of course, rationale and activities having direct bearing on nature of course offered to third year B.A. Economics and second year M.A. Economics courses for the students who have joined the programmes from the Academic Year 2020-21 and onwards.
- 5.4. Resolved to offer Multidisciplinary Course on “Dimensions of Economics” from three Post Graduate Departments namely: Tamil, Statistics and Commerce along with core subject in the place of Demography/Welfare Economics course for Third Semester as per UGC Guidelines. In this regard the paper offered in Third Semester that is Entrepreneurship Development is shifted to Fourth Semester retaining Tamil Nadu Economy as it is **(pp 536-541, 564-573)**.
- 5.5. Resolved to offer Interdisciplinary Course on “Health Economics” with the Department of Microbiology for the students of Economics in the Fifth Semester as per the UGC Guidelines **(pp 553-557)**.

- 5.6. Resolved to approve the metric and weight calculation for the attainment of programme outcomes against the course outcomes for B.A. Economics and M.A. Economics for Regulation 2020 and Regulation 2021 respectively **(pp 578-587)**.
- 5.7. Resolved to ratify the course offered in the Current Semester (IV) for II – B.A. Economics entitled “Soft Skills” is retitled into “Personality Development – 20U4VSM2” as per the decision taken in the Department Staff Meeting. The reason for the change of course title is that, the same course title is offered by the Department of English. Based on the advice of the Principal/Chairman Academic Council, the course title has been changed **(P 424)**.

6) FROM THE BOARD OF STUDIES OF COMMERCE DEPARTMENT

Dr.A.Mayil Murugan, Chairman, Board of Studies in Commerce, shall move and **Dr.S.Selvakumar** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 6.1. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Com (Aided & SF) for students who joined the programme from the Academic Year 2020-21. The curriculum includes a Multi-disciplinary course titled ‘Behavioural Applications and Technology’ offered jointly by the Departments of Mathematics and Department of Computer Science **(pp 588-729)**.
- 6.2. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Com (Professional Accounting) for students who joined the programme from the Academic Year 2020-21. The curriculum includes a Multi-disciplinary course titled ‘Behavioural Applications and Technology’ offered jointly by the Departments of Mathematics and Department of Computer Science **(pp 588-729)**.
- 6.3. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Com (Banking & Insurance) for students who joined the programme from the Academic Year 2020-21. The curriculum includes a Multi-disciplinary course titled ‘Behavioural Applications and Technology’ offered jointly by the Departments of Mathematics and Department of Computer Science **(pp 588-729)**.
- 6.4. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Com (Capital Markets) for students who joined the programme from the Academic Year 2020-21. The curriculum includes a Multi-disciplinary course titled ‘Behavioural Applications and Technology’ offered jointly by the Departments of Mathematics and Department of Computer Science **(pp 588-729)**.
- 6.5. Resolved to introduce the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.Com. for students who joined the programme from the Academic Year 2021-22. The curriculum includes an Multi-disciplinary course titled ‘Insurance, Actuarial Science and Economics’ offered jointly by the departments of Statistics and Economics **(pp 730-794)**.
- 6.6. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes, for B.Com (Aided & SF), B.Com (Professional Accounting), B.Com (Banking & Insurance) and B.Com (Capital Markets) for Regulation 2020 **(pp 797-820)**.

- 6.7. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes for M.Com for Regulation 2021 **(pp 821-824)**.
- 6.8. Resolved to introduce diploma programme on “Diploma in Banking and Finance” in collaboration with Indian Institute of Banking and Finance, Mumbai to the students of all discipline from the academic year 2022-23 onwards.
- 6.9. Resolved to introduce Certificate Course on “Accounting Software with GST” to the students of all discipline from the academic year 2022-23 onwards **(pp 795-796)**.
- 6.10. Resolved to ratify the change of Course title as “Interpersonal Skills” instead of “Soft Skills” (Course Code: 17U6KSM6) for the students who have joined during the academic year 2019-20 only.

7) FROM THE BOARD OF STUDIES OF MATHEMATICS DEPARTMENT

Dr.S.Muthukumar, Chairman, Board of Studies in Mathematics, shall move and **Dr.C.Thangapandi** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 7.1. Resolved to ratify the Revised programme structure for students who joined the B.Sc., mathematics program from the Academic year 2020-21 **(pp 828-832)**.
- 7.2. Resolved to pass the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Sc. Mathematics for students who joined the programme from the Academic Year 2020-21. The curriculum includes a Multi-disciplinary course titled “Operations Research and Web Technology” offered jointly by the departments of Mathematics, Commerce and Computer Science **(pp 825-960)**.
- 7.3. Resolved to ratify the revised curriculum structure for students who joined the M.Sc., Mathematics program from the Academic year 2021-22 **(pp 1060-1063)**.
- 7.4. Resolved to pass the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.Sc. Mathematics for students who joined the programme from the Academic Year 2021-22. The curriculum includes a Multi-disciplinary course titled “Stochastic processes and point groups of Molecules” offered jointly by the departments of Mathematics, Physics and Chemistry **(pp 961-1059)**.
- 7.5. Resolved to pass the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.Sc. Mathematics for self financed students who joined the programme from the Academic Year 2021-22. The curriculum includes a Multi-disciplinary course titled “Stochastic Processes, Statistical Mechanics and Biological Macromolecules” offered jointly by the departments of Mathematics, Physics and Microbiology **(pp 961-1059, 1064-1070)**.
- 7.6. Resolved to ratify the inclusion of the chapters and section numbers in the recommended book for the paper “ordinary differential equations” subject code 21P1MMC4 M.Sc., Mathematics students who joined the programme in the Academic year 2021-22 **(pp 1077-1078)**.

- 7.7. Resolved to ratify the inclusion of the chapters and section numbers in the recommended book for the paper “Fuzzy sets and its Applications”, subject code 21P2MME2(A) M.Sc., Mathematics students who joined the program in the Academic year 2021-22 (**pp 1071-1076**).
- 7.8. Resolved to ratify the inclusion of one more paper namely “Numerical analysis”, subject code 21P1MME1(B) as core elective –I paper in First semester and one more paper namely “Fluid Dynamics” 21P2MME2(B) as core elective –II paper in Second semester for I year M.Sc., Mathematics students the Academic year 2021-22 (**pp 1079-1091**).
- 7.9. Resolved to approve the syllabus of “Add on course entitled “Research Methodology and Research Ethics” to II year M.Sc., Mathematics students who joined the course from the Academic year 2021-22 (**pp 1092-1093**).
- 7.10. Resolved to approve the syllabus for “Certificate Course entitled “Math tricks using Ancient Methods” to under graduate and Post graduate students (**P 1094**).
- 7.11. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes, for B.Sc. Mathematics for Regulation 2020 (**pp 1095-1101**).
- 7.12. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes for M.Sc. Mathematics for Regulation 2021 (**pp 1102-1105**).

8) FROM THE BOARD OF STUDIES OF STATISTICS DEPARTMENT

Dr.P.Vetriselvi, Chairman, Board of Studies in Statistics, shall move and **Dr.P.Madhanagopal** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 8.1. Resolved to ratify the revised programme structure for the B.Sc. Statistics for students who joined the programme from the Academic Year 2021-22 and onwards (**pp 1106-1109**).
- 8.2. Resolved to pass the revised curriculum for second year B.Sc. Statistics for students who joined the programme from the Academic Year 2021-22 (**pp 1110-1157**).
- 8.3. Resolved to ratify the revised programme structure for the M.Sc. Statistics for students who joined the programme from the Academic Year 2021-22 and onwards (**pp 1163-1164**).
- 8.4. Resolved to pass the revised curriculum for second year M.Sc. Statistics for students who joined the programme from the Academic Year 2021-22. The curriculum includes Multi-disciplinary course titled ‘Econometrics and Cost Analysis ‘offered jointly by the departments of Statistics, Economics and Commerce (**pp 1160-1242**).
- 8.5. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes for M.Sc. Statistics for Regulation 2021 (**pp 1245-1249**).

- 8.6. Resolved to introduce add-on courses titled ‘Combinatorics’ and ‘Statistics for Big Data’ to be offered during the third and fourth semester B.Sc. Statistics for those students who join the programme from the Academic Year 2021-22 **(pp 1153-1156)**.
- 8.7. Resolved to introduce add-on courses titled ‘Research and Publication Ethics’ to be offered during the fourth semester M.Sc. Statistics for those students who join the programme from the Academic Year 2021-22 **(P 1243)**.
- 8.8. Resolved to introduce self study courses titled ‘Time series Analysis to be offered during the fourth semester B.Sc. Statistics for those students who join the programme from the Academic Year 2021-22 **(P 1157)**.
- 8.9. Resolved to introduce a certificate course ‘Quantitative Population Studies’ for B.Sc. Statistics students from the Academic Year 2021-2022 **(pp 1158-1159)**.
- 8.10. Resolved to introduce a certificate course ‘Biostatistics’ for M.Sc. Statistics students from the Academic Year 2021-2022 **(P 1244)**.
- 8.11. Resolved to ratify the typography error in text book chapters in core paper “Descriptive Statistics” in semester I for B.Sc. Statistics.
- 8.12. Resolved to ratify the K levels in Formative assessment in core paper “Distribution Theory” in semester I for M.Sc. Statistics.
- 8.13. Resolved to ratify to add the CLO’s in Statistical Practical –II in semester II for M.Sc. Statistics.

9) FROM THE BOARD OF STUDIES OF PHYSICS DEPARTMENT

Dr.M.Prema Rani, Chairman, Board of Studies in Physics, shall move and **Mr.V.Meenakshi Sundaram** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 9.1. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Sc. Physics for students who joined the programme from the Academic Year 2020-21. The curriculum includes an Inter-disciplinary course titled ‘Nano science and Nanotechnology ‘offered jointly by the departments of Physics and Chemistry **(pp 1250-1348)**.
- 9.2. Resolved to introduce the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.Sc. Physics. for students who joined the programme from the Academic Year 2021-22. The curriculum includes a Multi-disciplinary course titled ‘Materials Science’ offered jointly by the departments of Physics, Chemistry and Mathematics **(pp 1349-1418)**.
- 9.3. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes, for B.Sc. Physics for Regulation 2020 **(pp 1422-1428)**.
- 9.4. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes for M.Sc. Physics for Regulation 2021 **(pp 1429-1433)**.

- 9.5. Resolved to introduce add-on courses titled ‘Research methodology and Research ethics’ to be offered during the third semester of M.Sc. Physics for those students who join the programme from the Academic Year 2021-22 (**pp 1419-1420**).
- 9.6. Resolved to ratify a certificate course ‘Designing and Servicing of some Electronic appliances’ for students from the Academic Year 2021-22 (**P 1421**).

10) FROM THE BOARD OF STUDIES OF CHEMISTRY DEPARTMENT

Dr.A.Xavier, Chairman, Board of Studies in Chemistry, shall move and **Dr.P.S.Harikrishnan** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 10.1. Resolved to introduce the revised curriculum, programme structure, syllabus and evaluation pattern for III year B.Sc. Chemistry major students who joined the programme from the academic year 2020-21. The curriculum includes an Interdisciplinary course titled ‘Solid State Chemistry’ (20U5CIDC) offered jointly by the departments of Chemistry & Physics (**pp 1434-1556**).
- 10.2. Resolved to introduce the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.Sc. Chemistry major students who joined the programme from the academic year 2021-22. The curriculum includes a Multidisciplinary course titled ‘Polymer and Nano Chemistry’ (21P3CMDC) offered jointly by the departments of Chemistry, Physics & Mathematics (**pp 1557-1676**).
- 10.3. Resolved to approve the Metric and weight calculation for attainment of Programme outcomes against course outcomes, for B.Sc. Chemistry for Regulation 2020 (**pp 1693-1698**).
- 10.4. Resolved to approve the Metric and weight calculation for attainment of Programme Outcomes against course outcomes, for M.Sc. Chemistry for Regulation 2021 (**pp 1699-1703**).
- 10.5. Resolved to approve the exchange of 4th and 5th units in Ancillary Chemistry offered to II B.Sc. (Mathematics) and II B.Sc. (Zoology) (**pp 1677-1692**).
- 10.6. Resolved to introduce one more elective paper for PG programme in all semesters viz.,
- I semester - Forensic Analysis (21P1CME2) (**pp 1568-1574**)
- II semester - Supra molecular Chemistry (21P1CME4) (**pp 1575-1580**)
- III semester - Polymer, Nano and Fundamentals of Mathematics (21P3CMDC) (**pp 1605-1611**)
- IV semester - Agro Chemicals (21P4CME8) (**pp 1660-1668**).

11) FROM THE BOARD OF STUDIES OF BOTANY DEPARTMENT

Prof.S.Chellapandian, Chairman, Board of Studies in Botany, shall move and **Dr.P.Kannan** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 11.1. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Sc. Botany for students who joined the programme from the Academic Year 2020-21. The curriculum includes an Inter-disciplinary course titled 'Molecular Biology' offered jointly by the departments of Botany and Zoology (**pp 1704-1818**).
- 11.2. Resolved to introduce the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.Sc. Botany for students who joined the programme from the Academic Year 2021-22. The curriculum includes an Multi-disciplinary course titled 'Forestry and Economic Botany' offered jointly by the departments of Botany, Tamil and English (**pp 1819-1886**).
- 11.3. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes, for B.Sc. Botany for Regulation 2020 (**pp 1892-1898**).
- 11.4. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes for M.Sc. Botany for Regulation 2021 (**pp 1899-1903**).
- 11.5. Resolved to ratify a PG Diploma course in 'Plant Identification' for PG students from the Academic Year 2021-2022 (**pp 1887-1891**).
- 11.6. Resolved to ratify a change in title of the certificate course as Employability skills instead of Life skills for students from the Academic Year 2021-2022.

12) FROM THE BOARD OF STUDIES OF ZOOLOGY DEPARTMENT

Dr.S.Dinakaran, Chairman, Board of Studies in Zoology, shall move and **Dr.L.D.Devasree** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 12.1. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Sc. Zoology for students who joined the programme from the Academic Year 2020-21. The curriculum includes an Inter-disciplinary course titled 'Biodiversity and Conservation Biology' offered jointly by the departments of Zoology and Botany (**pp 1904-2040**).
- 12.2. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes, for B.Sc. Zoology for Regulation 2020 (**pp 2041-2046**).

13) FROM THE BOARD OF STUDIES OF COMPUTER SCIENCE DEPARTMENT

Er.J.Rajendran, Chairman, Board of Studies in Computer Science, shall move and **Prof.R.Umasankari** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 13.1. Resolved to Ratify the revised programme structure for the students who have joined in B.Sc. Computer Science degree from the Academic year 2020-21 onwards **(pp 2047-2055)**.
- 13.2. Resolved to pass the Revised curriculum for Core and core practical papers of third year B.Sc. Computer Science Programme (V and VI semesters) for students who have joined the programme from the Academic year 2020-21 onwards **(pp 2056-2167)**.
- 13.3. Resolved to introduce a Multi-disciplinary course in combined with department of Commerce and Mathematics with the title “E-commerce applications and Management” during Vth semester B.Sc. CS degree for students those who have joined from the academic year 2020-21 onwards **(pp 2073-2078)**.
- 13.4. Resolved to pass the revised curriculum for core Elective papers and skill based elective paper (SBE) to be offered in Vth and VIth semesters to students who have joined in B.Sc. Computer Science from the Academic year 2020-21 onwards **(pp 2056-2167)**.
- 13.5. Resolved to introduce the students project work under add-on course type and conduct external viva-voce examination during VIth semester of the final year of B.Sc. Computer science programme for the students those who have joined from the Academic Year 2020-21 onwards **(pp 2166-2167)**.
- 13.6. Resolved to ratify the nature of course, rationale and activities having direct bearing on nature of course offered to third year B.Sc. Computer science course for students who have joined from the Academic Year 2020-21 onwards.
- 13.7. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes, for B.Sc. (Computer Science) for Regulation 2020 **(pp 2168-2174)**

14) FROM THE BOARD OF STUDIES OF INFORMATION TECHNOLOGY DEPARTMENT

Prof.K.Rajasaravanakumar, Chairman, Board of Studies in Information Technology, shall move and **Dr.N.Paneerselvam** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 14.1. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Sc. Information Technology (I.T) for students who joined the programme from the Academic Year 2020-21. The curriculum includes an Inter-disciplinary course titled ‘Bio-Applications in Artificial Intelligence’ offered jointly by the departments of Information Technology & Biotechnology **(pp 2175-2313)**.

- 14.2. Resolved to pass the revised syllabi for allied courses to be offered to students who joined B.Sc. (Statistics) in the Academic Year 2021-22 onwards **(pp 2314-2337)**.
- 14.3. Resolved to introduce the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.Sc. Computer Science for students who joined the programme from the Academic Year 2021-22. The curriculum includes a Multi-disciplinary course titled 'Internet of Things' offered jointly by the departments of Computer Science, Mathematics & Physics **(pp 2338-2427)**.
- 14.4. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes, for B.Sc. (I.T) for Regulation 2020 **(pp 2428-2434)**.
- 14.5. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes for M.Sc. Computer Science for Regulation 2021 **(pp 2435-2439)**.
- 14.6. Resolved to introduce add-on courses titled 'Values and Ethics in Research' to be offered during the third semester of M.Sc. Computer Science for those students who join the programme from the Academic Year 2021-22 **(pp 2378-2380)**.

15) FROM THE BOARD OF STUDIES OF MICROBIOLOGY DEPARTMENT

Dr.N.Paneerselvam, Chairman, Board of Studies in Microbiology, shall move and **Prof.K.Rajasaravanakumar** shall second the following resolutions, passed in the Board of studies meeting held on 19.01.2022.

- 15.1. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Sc., Microbiology for students who joined the programme from the Academic Year 2020-21. The curriculum includes an Inter-disciplinary course titled 'Bioeconomics' offered jointly by the Departments of Microbiology and Economics **(pp 2440-2556)**.
- 15.2. Resolved to introduce the revised curriculum, programme structure, syllabus and evaluation pattern for II year M.Sc., Microbiology for students who joined the programme from the Academic Year 2021-22. The curriculum includes a Multi-disciplinary course titled 'Forensic Science' offered jointly by the Departments of Microbiology, Computer Science and Mathematics **(pp 2557-2638, 2672-2673)**.
- 15.3 Resolved to ratify the course content for the following courses: Food and Dairy Microbiology (21P1PME1), Computational Biology (21P2RME2), Lab in Microbial Taxonomy and Biochemistry (21P1RMP1), Lab in Microbial Physiology and bioinstrumentation (21P1RMP2), Lab in Cell and Molecular Biology and Microbial Genetics (21P2RMP3) and Lab in Immunology and Research Methodology (21P2RMP4) for the students who joined from the Academic year 2021-22 and onwards **(pp 2639-2652, 2660-2671)**.
- 15.4. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes for B.Sc., Microbiology for Regulation 2020 **(pp 2674-2681)**.

15.5. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes for M.Sc., Microbiology for Regulation 2021 (pp 2682-2686).

15.6. Resolved to introduce add-on course titled 'Values and Ethics in Research' to be offered during the third semester of M.Sc., Microbiology for those students who joined the programme from the Academic Year 2021-22 (pp 2653-2659).

16) FROM THE BOARD OF STUDIES OF BIOTECHNOLOGY DEPARTMENT

Dr.N.Panneerselvam, Chairman, Board of studies of Biotechnology, shall move and **Prof.K.Rajasaravanakumar**, shall second the following resolutions, passed in the meeting of the Board of studies in Biotechnology held on 19.01.2022.

16.1. Resolved to introduce the revised curriculum, programme structure, syllabus, and evaluation pattern for III year B.Sc. Biotechnology for students who joined the programme from the Academic Year 2020-21. The curriculum includes an Inter-disciplinary course titled 'Computer-aided drug design' offered jointly by the departments of Biotechnology and Computer Science (pp 2687-2800).

16.2. Resolved to approve the metric and weight calculation for attainment of programme outcomes against course outcomes, for B.Sc. Biotechnology for Regulation 2020 (pp 2801-2808).

16.3. Resolved to ratify the course content for the courses 'Concepts in Biotechnology (20U3LAC1) and Allied Practical-II (20U3LAP1)' for students from the Academic Year 2021-2022.

16.4. Resolved to ratify the syllabi for allied Biotechnology courses (20U1LAC1, 20U1LAP1, 20U2LAC2 & 20U2LAP2) offered to I B.Sc. Microbiology students who have joined from the Academic year 2021-2022 and onwards (pp 2809-2826).

17) FROM DEAN (ACADEMICS)

Prof.S.Sivaramakrishnan, Dean (Academics), shall move and **Dr.I. Sahul Hamid** shall second the following resolutions:

17.1. Resolved to adopt the manual of calculation of attainment of outcomes for students who are admitted to their respective programmes under outcome Based Education (Regulation 2020 onwards) (pp 2827-2852).

IV. Any Other Subject

Dr. R. Eswaran
Member Secretary

Dr. J. Suresh
Principal & Chairman



DEPARTMENT OF ZOOLOGY

Revised Curriculum
(Choice Based Credit system with Outcome Based Education)
Academic Year 2020-2021 onwards

V and VI semesters (B.Sc. Zoology)



THE MADURA COLLEGE (AUTONOMOUS), MADURAI-11
DEPARTMENT OF ZOOLOGY

B.Sc. Zoology (with Botany and Chemistry ancillary)
Theory & Practical (Major)

Semester	Course Code	Title of the Course	Hours/ Week	Credits	Nature of Course			Scope of Focus			Percentage of Revision/ New
					Emp	Entr	Skill	Local	National	Global	
I	20U1T/H/SLA1	Tamil/Hindi/Sanskrit-I	6	3							
	20U1NEN1	English-I	6	3							
	20U1ZMC1	Invertebrata-I	3	3			YES		YES	YES	53.3
	20U1ZMC2	Invertebrata-II	3	3			YES		YES	YES	64.29
	20U1ZMP1	Major Practical-I	3	2			YES	YES	YES	YES	0
	20U1CAC1	Ancillary Chemistry-I	4	4							
	20U1CAP1	Ancillary Chemistry Practical-I	2	1							
	20U1VE&PE	Value Education & Professional Ethics	3	3							
II	20U2T/H/SLA2	Tamil/Hindi/Sanskrit-II	6	3							
	20U2 NEN2	English-II	6	3							
	20U2ZMC3	Chordata-I	3	3			YES		YES	YES	64
	20U2ZMC4	Chordata-II	3	3			YES		YES	YES	57.5
	20U2ZMP2	Major Practical-II	3	2			YES	YES	YES	YES	23.68
	20U2CAC1	Ancillary Chemistry –II	4	4							
	20U2CAP2	Ancillary Chemistry Practical-II	2	1							
	20U2E&GS	Equity & Gender Studies	3	3							
		Extension Activity	-	1							

III	20U3T/H/SLA3	Tamil/Hindi/Sanskrit-III	6	3							
	20U3 NEN3	English-III	6	3							
	20U3ZMC5	Cell Biology & Biochemistry	5	5			YES		YES	YES	42.62
	20U3ZMP3	Major Practical-III	3	2			YES	YES	YES	YES	19.23
	20U3ZSM1	Applied Entomology	2	2		YES		YES	YES		12
	20U3BAC1	Ancillary Botany-I	4	4							
	20U3BAP1	Ancillary Botany Practical-I	2	1							
IV	20U3NM1	Non-Major Elective	2	2							
	20U4T/H/SLA4	Tamil/Hindi/Sanskrit-IV	6	3							
	20U4 NEN4	English-IV	6	3							
	20U4ZMC6	Developmental Biology	5	5			YES		YES	YES	New (85.18)
	20U4ZMP4	Major Practical-IV	3	2			YES	YES	YES	YES	New (100)
	20U4ZSM2	Medical Zoology	2	2			YES	YES	YES	YES	0
	20U4 BAC2	Ancillary Botany –II	4	4							
V	20U4 BAP2	Ancillary Botany Practical-II	2	1							
	20U4NM2	Non-Major Elective	2	2							
	20U5ZMC7	Genetics	5	5			YES	YES	YES	YES	47.45
	20U5ZMC8	Animal Physiology	5	5			YES		YES	YES	57.97
	20U5ZMC9	Evolution	5	5			YES		YES	YES	87.93
	20U5ZMP5	Major Practical-V	3	2			YES	YES	YES	YES	0.04
	20U5ZMP6	Major Practical-VI	3	2			YES	YES	YES	YES	50
	20U5ZSM3	Ornamental fish culture	2	2		YES		YES	YES		22.92
	20U5ZIDC	Biodiversity & Conservation Biology	4	3			YES	YES	YES	YES	15.94
	20U5ZME1	a. Forensic Science	3	2	YES			YES	YES	YES	92.21
		b. Animal behaviour					YES	YES	YES	YES	New (90.90)

VI	20U6ZMC10	Microbiology & Immunology	5	5			YES		YES	YES	57.33
	20U6ZMC11	Biotechnology	5	5			YES		YES	YES	63.79
	20U6ZMC12	Ecology	5	5			YES	YES	YES	YES	New (100)
	20U6ZMP7	Major Practical-VII	3	2			YES	YES	YES	YES	36.36
	20U6ZMP8	Major Practical-VIII	3	2			YES	YES	YES	YES	33.33
	20U6ZSM4	Vermiculture	2	2		YES		YES	YES		New (100)
	20U6ZME2	a. Biophysics, Biostatistics & Bioinformatics	4	3			YES	YES	YES	YES	35.59
		b. Entomology					YES	YES	YES	YES	New (100)
		c. Preventive and Social Medicine					YES	YES	YES		New (100)
	20U6ZME3	a. Animal Farming	3	2		YES		YES	YES		New (100)
		b. Fisheries Biology				YES		YES	YES		New (100)



THE MADURA COLLEGE (AUTONOMOUS), MADURAI-11
DEPARTMENT OF ZOOLOGY

Ancillary Zoology
B.Sc. Chemistry and Botany (ancillary)
Theory & Practicals

Semester	Course Code	Title of the Course	Hours/Week	Credits	Nature of Course			Scope of Focus			Percentage of Revision/ New
					Emp	Entr	Skill	Local	National	Global	
I	20U1ZAC1	Fundamentals of Invertebrates & Chordates	4	4			YES	YES	YES		17.14
	20U1ZAP1	Zoology Ancillary Practical-I	2	1			YES	YES	YES	YES	0
II	20U2ZAC2	Applied Zoology	4	4			YES	YES	YES		32
	20U2ZAP2	Zoology Ancillary Practical-II	2	1			YES	YES	YES	YES	0
III	20U3ZAC1	Essentials of Invertebrates & Chordates	4	4			YES	YES	YES		65.71
	20U3ZAP1	Zoology Ancillary Practical	2	1			YES	YES	YES	YES	0
IV	20U4ZAC2	Human Physiology, Microbiology & Immunology	4	4			YES	YES	YES		0
	20U4ZAP2	Zoology Ancillary Practical	2	1			YES	YES	YES	YES	0



THE MADURA COLLEGE (AUTONOMOUS), MADURAI-11
DEPARTMENT OF ZOOLOGY
Non-Major Elective (NME)

Semester	Course Code	Title of the Course	Hours/Week	Credits	Nature of Course			Scope of Focus			Percentage of Revision/ New
					Emp	Entr	Skill	Local	National	Global	
III	20U3ZNM1	Essentials of Zoology	2	2			YES		YES	YES	32.14
IV	20U4ZNM2	Economic Zoology	2	2		YES		YES	YES	YES	24

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core	20U5ZMC7	Genetics	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

By the end of the course, students will be able to:

1. Understand the basic principles of inheritance at the molecular, cellular and organism levels.
2. Describe the significance of linkage, crossing over and chromosomal abnormalities.
3. Appraise the mechanism of mutation and the changes that occurs in an organism due to mutation.
4. Give an idea about hereditary disorders and the need for genetic counseling.
5. Understand causal relationships between molecule/cell level phenomena ("modern" genetics) and organism-level patterns of heredity ("classical" genetics).

Unit	Description	Hours	K-Level	CLO
I	Mendelian Genetics Mendelian Laws of Inheritance –Test cross & Back Cross - Multiple alleles – Polygenic inheritance -Incomplete dominance – Co-dominance – Importance of drosophila in genetics – sex identification – Mutants of <i>Drosophila</i> .	15	Up to K2	1
II	Linkage & Crossing Over Epistasis, Lethal genes. Linkage in Drosophila, Crossing over – Mechanism and theories. Chromosomal maps & its construction. Chromosomal Aberrations, Gene Mutations – Physical & Chemical mutagens – DNA repair.	15	Up to K3	2
III	Inheritance Sex determination in animals –X linked & Y linked inheritance – Genic Balance theory - Barr bodies -Chromosomal variation & Nondisjunction – Euploidy, Aneuploidy, Monosomy, Trisomy (Klinefelter, Turner & Down syndromes) – Cytoplasmic inheritance.	15	Up to K3	3
IV	Mutations Sickle cell anemia, Inborn errors of Metabolism: Phenylketonuria – Alkaptonuria– Albinism. Pedigree Analysis, Eugenics, Euthenics, Genetic Counselling, Inbreeding and Out breeding.	15	Up to K4	4
V	Modern Genetics Concept of Gene: Cistron – split gene – promoter – repetitive DNA – Transposons. Bacterial genome- Transformation – Conjugation – F	15	Up to K4	5

	factor -Sexduction – Transduction –Generalised & Specialised - Plasmids. – Operon concept- Lac & trp operons (outlines).			

Books for Study

1. Meyyan, R.P. 2014. *Fundamendals of Genetics*, Saras Publication Nagercoil.
2. Verma, P.S. & Agarwal, V.K. 2009. *Genetics*, S. Chand Publishers, New Delhi.

Books for References

1. Gardner, E.J., Simmons, M.J. & Snustad, D.P. 2006. *Principles of Genetics* 8th Edison. Wiley.
2. Primrose, S.B. & Twyman, R. 2013. *Principles of gene manipulation and genomics*. John Wiley & Sons.
3. Strickberger, M.W. 2015. *Genetics*, Pearson Education India.

Web resources

1. <http://www.dnaftb.org/1/bio.html>
2. <https://www.britannica.com/science/genetic-counseling>
3. <https://www.britannica.com/science/mutation-genetics>
4. <https://www.pstu.ac.bd/files/materials/1593754478.pdf>

Rationale for Nature of the course

This course will enable the students to comprehend the knowledge on concepts of inheritance, linkage, crossing over, chromosomal abnormalities, mutations, inborn errors of metabolism, pedigree analysis, genetic counselling and concept of gene.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on genetics will help the students to identify genetic disorders, investigate chromosomal abnormalities, analyse inheritance patterns, risk of recurrence and genetic prognosis. The knowledge gained in genetics will help them to undertake research activities in the field of medical genetics and provide genetic counselling

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Course Designer:

1. Dr. L. D. Devasree

Lecture Schedule (Total hours: 75)

Unit	Description	Staff Name	Hrs	Mode
I	Mendelian Laws of Inheritance –Test cross & Back Cross		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Multiple alleles – Polygenic inheritance		3	
	Polygenic inheritance -Incomplete dominance		4	
	Co-dominance – Importance of drosophila in genetics		2	
	Sex identification – Mutants of <i>Drosophila</i> .		3	
			15	
II	Epistasis		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Lethal genes		2	
	Crossing over - Mechanism and theories		3	
	Chromosomal maps & its construction.		2	
	Chromosomal Aberrations		2	
	Mutations–Physical & Chemical mutagens		4	
	DNA repair			
			15	
III	Sex determination in animals –X linked & Y linked inheritance		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Genic Balance theory - Barr bodies		4	
	Chromosomal variation & Nondisjunction		2	
	Euploidy, Aneuploidy, Monosomy, Trisomy (Klinefelter, Turner & Down syndromes)		3	
	Cytoplasmic inheritance		2	
			15	
IV	Sickle cell anemia, Inborn errors of Metabolism: Phenylketonuria		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Alkaptonuria– Albinism		3	
	Pedigree Analysis, Eugenics		3	
	Euthenics, Genetic Counselling		3	
	Inbreeding and Out breeding		3	
			15	
V	Concept of Gene: Cistron – split gene – promoter – repetitive DNA – Transposons.		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Bacterial genome- Transformation – Conjugation		4	
	F factor -Sexduction – Transduction		3	
	Generalised & Specialized – Plasmids		2	
	Operon concept- Lac & trp operons (outlines)		2	
			15	

Course Learning Outcomes:

On successful completion of the course, the student will be able to:

	CLO Statements	Knowledge level
CLO 1	Understand the basic principles of inheritance at the molecular, cellular and organism levels.	Up to K2
CLO 2	Describe the significance of linkage, crossing over and chromosomal abnormalities.	Up to K3
CLO 3	Examine the types of mutagens and DNA repair mechanism	Up to K3
CLO 4	Analyze the hereditary disorders and the importance of genetic counseling	Up to K4
CLO 5	Evaluate the role of gene, plasmid, operon concept and significance of modern genetics	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	1	1	2	1	2	2	2	2
CLO 2	2	2	3	2	3	3	3	2
CLO 3	1	1	2	2	3	2	2	2
CLO 4	2	1	3	3	3	2	2	2
CLO 5	3	2	3	2	2	3	3	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	2	3	2	2	3
CLO 2	2	3	2	3	3
CLO 3	2	2	2	3	2
CLO 4	2	3	2	3	3
CLO 5	2	2	2	2	3

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT – I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	2 (K2/K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core	20U5ZMC8	Animal Physiology	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

By the end of the course, students will be able to:

1. Make awareness about the facts of Animal Physiology.
2. Provide an idea about molecular cellular functions in a whole animal model.
3. Make awareness about regulation of physiological activities.
4. Provide an adequate explanation regarding the co-ordination of system, structure, functions and molecular signals.

Unit	Description	Hours	K-Level	CLO
I	Nutrition and Respiration Digestion and absorption of Carbohydrates, Proteins and Lipids. Hormonal control of digestion. Minerals and Vitamins their deficiency diseases. Respiratory pigments-structure and functions. Transportation of gases-Bohr effect, Regulation of respiration-bronchitis, asthma, smoking and its impacts.	15	Up to K2	1
II	Circulation and Excretion Composition and functions of blood. Mechanism of blood clotting, Types of heart - comparative study, Heart beat and pacemaker-Cardiac cycle-ECG –pulse and blood pressure. Excretory products, Structure of nephron, mechanism of urine formation, Osmoregulation in fishes.	15	Up to K3	2
III	Muscle and Nerve Physiology. Types of muscles, Contraction and properties of muscle. Neurons-Structure and types, Transmission of nerve impulse-Synaptic transmission, neuro transmitters and Reflex action. Nerve disorders-Epilepsy, Alzheimers and Parkinsons disease.	15	Up to K3	3
IV	Sense Organs Structure of eye, physiology and chemistry of vision. Eye defects –Myopia, hyperopia, presbyopia, astigmatism and cataract. Structure of ear and mechanism of hearing, Hearing impairments-deafness, labyrinthine disease.	15	Up to K4	4
V	Reproductive Physiology Endocrine glands in man - Hormones action, disorders and feed-back mechanism. Puberty, adolescence, pregnancy, parturition lactation and birth control.	15	Up to K4	5

Book for study

1. Arumugam, N. & Mariakuttikan, A. 2014. *Animal Physiology*, Saras Publications, Nagercoil.
2. Rastogi, S.C. 2019. *Essentials of Animal Physiology*, New Age International.
3. Verma, P.S., Tyagi, B.S. & Agarwal, V.K. 2000. *Animal Physiology*, S. Chand Publishers, New Delhi.

Book for References

1. Bhagavan, N.V. 2001. *Medical biochemistry*, 4th Edition, Elsevier.
2. Jain, A.K. 2017. *Textbook of Physiology*. Avichal Publishing Company.
3. Hall, J. & Hall, M. 2020. *Guyton and Hall Text Book of Medical Physiology*, 14th Edition, Elsevier.
4. Nelson, D.L. & Cox, M.M. 2021. *Lehninger Principles of Biochemisry* 8th Edition, Macmillan.

Web resources

1. <https://www.pmfias.com/vitamins-minerals-deficiency-diseases-food-sources-of-vitamins-minerals/>
2. <https://healthinfo.healthengine.com.au/blood-function-and-composition>
3. <https://my.clevelandclinic.org/health/body/21887-muscle>
4. <https://www.msmanuals.com/en-in/home/eye-disorders/biology-of-the-eyes/structure-and-function-of-the-eyes>
5. <https://www.youtube.com/watch?v=T6mPS53Jb1M>

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Rationale for Nature of the course

This course will enable the students to grasp the theories, concepts and basics of Physiological activities, homeostasis, complications, deficiencies, disorders and treatments.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquiring of knowledge on basic and advanced concepts of Physiology enriches students overall understanding of biology, which may boost their research temperament in metabolism.

Course designer:

Dr. B. Latha

Lecture Schedule (Total hours: 75)

Unit	Description	Staff Name	Hrs	Mode
I	Basic concepts of Physiology in Digestion and Absorption.		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Carbohydrate, protein and Lipid metabolism.		3	
	Vitamins and their deficiency diseases.		2	
	Hormonal control in digestion		2	
	Transportation of Gases.		2	
	Bohr effect-Regulation of Respiration Respiratory diseases		3	
	Physiological effect of Smoking.		1	
			15	
II	Circulation and excretion-Blood composition and functions, Mechanism of clotting,		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Types of hearts, heart beat rate.		2	
	Pace maker, cardiac cycle, ECG		3	
	Pulse and blood pressure		1	
	Structure and function of Nephrons		2	
	Mechanism of Urine formation		2	
	Excretory products, Osmoregulation in fishes.		2	
			15	
III	Types of muscles		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Ultra structure of striated muscle		2	
	Muscle contraction and properties		2	
	Transmission of impulses, synaptic transmission		3	
	Neurotransmission and transmitters, reflex action, Nerve disorders.		4	
			15	
IV	Structure of eye, visual pigments and photochemistry of vision.		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Eye defects		2	
	Mechanism of Hearing		2	
	Hearing impairments		3	
	Deafness and symptoms		2	
	Labyrinthine disease		2	
			15	
V	Endocrine glands in man		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Hormone action and disorders		2	
	Outline mechanism of Hormonal activity		3	
	Puberty, adolescence, pregnancy		3	
	Parturition and Lactation		2	
	Birth control methods		2	
			15	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the basic concepts, structures and mechanism of digestion of biomolecules.	Up to K2
CLO 2	Describe the process of clotting mechanism and the proteins involved.	Up to K3
CLO 3	Apply the knowledge to learn about the origin and conduction of heart beat and its regulation.	Up to K3
CLO 4	Analyse the importance of vision and hearing.	Up to K4
CLO 5	Examine the clinical implications of Reproductive Physiology.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	3	1	2	1	2	1	3	1
CLO 2	3	1	3	1	2	1	3	1
CLO 3	2	1	2	1	2	1	3	1
CLO 4	3	1	3	1	3	1	3	3
CLO 5	3	1	3	1	3	1	3	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	1	3	1	1	1
CLO 2	1	3	2	2	2
CLO 3	1	3	2	2	2
CLO 4	1	2	2	2	1
CLO 5	2	2	1	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT - I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	SectionD (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core	20U6ZMC9	Evolution	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

By the end of the course, students will be able to:

1. Understand the adaptations and its significance in relation to evolution.
2. Create the aware of the historical periods during the evolution of earth and status of fauna during the particular age.
3. Make awareness about the distribution of the various faunal components.
4. Develop an idea regarding the evolution of various vertebrate forms.
5. Appraise the how organic evolution occurred and how the various life forms come into existence.

Unit	Description	Hours	K-level	CLO
I	Evidences of Evolution Origin of life: Abiogenesis, Biogenesis, Cosmic theory, Biochemical origin of life, Urey-Miller experiment. Evidences of evolution: Morphological & Anatomical, Embryological, Physiological & Biochemical and paleontological.	15	Up to K2	1
II	Theories of Organic Evolution Lamarckism, Neo Lamarckism, Darwinism, Neo Darwinism, Mutation theory & New version of mutation theory. Modern Synthetic theory of evolution. Natural selection. Convergent & Divergent evolution.	15	Up to K3	2
III	Adaptation & Isolation Adaptation – Colouration and Mimicry (types and significance) – Non adaptive traits – Neotony & Significance. Isolation – Mechanism & Speciation. Hardy Weinberg Equilibrium - Genetic drift. Basic outlines of Molecular evolution.	15	Up to K3	3
IV	Animal Distribution Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities. Wallace line, Discontinuous distribution - Continental Drift. Geological time scale (Up to periods for Palaeozoic & Mesozoic era; up to epoch for Coenozoic era).	15	Up to K4	4
V	Evolution of Higher forms Evolutionary significance of Dipnoi – Origin of Amphibia – Golden age of Reptiles - Major types of Dinosaurs and reason for extinction, Affinities of Archaeopteryx, Outlines of evolution of Man and Horse.	15	Up to K4	5

Books for Study

1. Arumugam, N. 2019. *Organic Evolution*, Saras Publication, Nagercoil.
2. Gupta, P.K. 2018. *Cytology, Genetics & Evolution*, Rastogi Publications, Meerut.
3. Stebbins, G.L. 1966. *Process of Organic Evolution*. Prentice Hall, New Delhi.
4. Verma, P.S. & Agarwal, V.K. 2004. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*, S Chand Publishers, New Delhi.
5. Rastogi, V.B. 2021. *Organic Evolution (Evolutionary Biology)*. Medtech, India

Books for References

1. Barton, N.H., Briggs, D.E.G., Eisen, J.A., Goldstein, D.B. & Patel, N.H. 2007. *Evolution*. Cold Spring, Harbour Laboratory Press.
2. Hall, B.K. & Hallgrímsson, B. 2008. *Evolution*, Jones and Bartlett Publishers.
3. Darwin, RC 1859. *On the Origin of Species by the means of Natural Selection*. John Murrey, Abemarel Street London.
4. Dobzansky, T. 1976. *Genetics and the origin of species*. Oxford and TBH Publishing Co., New Delhi.
5. Dodson, E.O. 1960. *Evolution: process and product*. Affiliated East- West Press, New Delhi.

Web resources

1. <https://www.khanacademy.org/science/biology/her/evolution-and-natural-selection/a/lines-of-evidence-for-evolution>
2. <https://byjus.com/neet/organic-evolution/>
3. <https://www.biologydiscussion.com/biology/protective-colouration-and-mimicry-zoology/34366>
4. <https://www.youtube.com/watch?v=SYryvCHVljs>
5. <https://www.britannica.com/animal/horse/Origin-of-horse-domestication>

Rationale for Nature of the course

This course will enable the students to comprehend the knowledge on evidences of evolution, theories of organic evolution, adaptation and isolation, Hardy Weinberg Equilibrium, Basic outlines of Molecular evolution, zoogeographical region, geological time scale, evolution of higher forms, evolution of man and horse.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquiring of knowledge on origin of life, evidences of evolution, theories of organic evolution, animal distribution and evolution of higher animals. It would help their overall understanding on true affinities existing between animals that enrich their research career.

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Course Designer:

Dr. S. Dinakaran

Lecture Schedule (Total hours: 75)

Unit	Description	Staff Name	Hrs	Mode
I	Origin of life: Abiogenesis, Biogenesis, Cosmic theory.		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Biochemical origin of life		2	
	Urey-Miller experiment.		2	
	Evidences of evolution: Morphological & Anatomical evidences.		3	
	Embryological, Physiological evidences.		2	
	Biochemical and paleontological evidences.		3	
			15	
II	Lamarkism, Neo Lamarkism		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Darwinism, Neo Darwinism		2	
	Mutation theory & New version of mutation theory		3	
	Modern Synthetic theory of evolution		2	
	Natural selection		2	
	Convergent & Divergent evolution		3	
			15	
III	Adaptation – Colouration and Mimicry (types and significance)		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Non adaptive traits.		2	
	Neotony & Significance		2	
	Isolation – Mechanism & Speciation		3	
	Hardy Weinberg Equilibrium, Genetic drift.		2	
	Basic outlines of Molecular evolution.		2	
			15	
IV	Evolutionary significance of Dipnoi		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Origin of Amphibia		2	
	Golden age of Reptiles		2	
	Major types of Dinosaurs and reason for extinction		3	
	Affinities of Archaeopteryx		2	
	Outlines of evolution of Man and Horse.		4	
			15	
V	Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities.		5	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Wallace line		2	
	Discontinuous distribution		2	
	Continental Drift		2	
	Geological time scale (Up to periods for Palaeozoic & Mesozoic era; up to epoch for Coenozoic era)		4	
			15	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the origin of life and evidences of evolution.	Up to K2
CLO 2	Describe the theories of organic evolution.	Up to K3
CLO 3	Apply the knowledge to identify the adaptation and isolation of animals.	Up to K3
CLO 4	Analyze the evolution of higher animals.	Up to K4
CLO 5	Examine the zoogeographical regions and animal distribution.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	3	1	2	2	1	1	2	2
CLO 2	3	1	2	2	1	1	2	1
CLO 3	3	2	2	2	1	1	2	1
CLO 4	3	1	2	2	1	1	2	2
CLO 5	3	1	2	3	1	1	2	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	3	1	1	2	1
CLO 2	3	1	1	2	1
CLO 3	3	1	1	2	1
CLO 4	3	1	1	2	1
CLO 5	3	1	1	2	2

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT - I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT – II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K 4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without Choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	SBE	20U5ZSM3	Ornamental fish culture	2	2	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented			Entrepreneurship oriented	✓

Course Objectives

By the end of the course, students will be able to:

1. Learn the basic principles and techniques of Ornamental fish culture.
2. Study the features of common ornamental fishes and maintenance of aquarium.
3. Learn the culture techniques of Aquarium fishes.
4. Provide adequate exposure about the nutritional requirements for fish.
5. Give an knowledge about Transportation methods and packing methods.

Unit	Description	Hours	K-level	CLO
I	Introduction to Aquarium Introduction: Indian and world scenario- advantages of ornamental fish culture - Setting up home aquarium – Aquarium tank: Types (Glasses tank, acrylic tank) materials required for the construction of tanks - Features Aquaponics.	6	Up to K2	1
II	Limnology of Aquarium Water quality management: Heating lighting, Aeration – Filtering - Aquarium equipment's, Aquarium plants- Hydroponics. Precautions in purchasing for ornamental fishes.	6	Up to K3	2
III	Ornamental fish and fish breeding Salient features of ornamental fishes - Egg layers (Gold fish, Koi Carp, Zebrafish, Tiger barb and Fighter fish. Live bearers (Molly, Platy & Guppy) and Significance Breeding techniques of Gold fish, fighter fish, Guppy and Molly.	6	Up to K3	3
IV	Food & Feeding: Nutritional requirements for fish, live feed, artificial feed, Composition of ideal fish feed. Parasites & Diseases: Fish louse, ligula, Fin rot disease, Carp pox and velvet disease.	6	Up to K4	4
V	Fish Trades: Ornamental Fish transportation and packing: Methods (open and closed packing) starvation and sedation, factors to be considered for packaging (Density, temperature, dissolved gases, salinity, anesthetics).	6	Up to K4	5

Books for Study

1. Tharadevi, C.S. & Jayashree, K. V. 2009. *Home Aquarium*, Saras Publication, Nagercoil.
2. Arumugam, N. 2010. *Aquaculture*, Saras publication, Nagercoil.

Books for References

1. Shukla, J.P. 2012. *Fish and Fisheries*, Rastogi Publications. New Delhi.
2. Zade, S.B., Khune, C.J., Sitre, S.R. & Tijare, R.V. 2011. *Principles of Aquaculture*. Himalaya publishing House. Mumbai.
3. Srivastava, C.B.L. 2006. *Aquarium – Fish keeping*. Kitab Mahal, Allahabad.

Web resources

1. <https://www.youtube.com/watch?v=Aal2W8sDOPA>
2. <https://www.youtube.com/watch?v=yhcAOE2JOVs>
3. <https://www.youtube.com/watch?v=V0BrgBF9IQM>
4. <https://www.youtube.com/watch?v=IUUbINZzURo>
5. <https://www.youtube.com/watch?v=aVIdhqEP-jw>
6. <https://www.youtube.com/watch?v=G9fqWkd3QkQ>
7. <https://www.youtube.com/watch?v=uFvkZVWn2pE>

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Rationale for Nature of the course

This course will enable the students to grasp the theoretical knowledge and basics techniques of Ornamental Fish Culture, Aquarium setting, breeding, life history, Food and feeding, Diseases, transportation and packing.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquiring of knowledge on basic and breeding techniques of Ornamental fish culture enriches students' overall understanding of breeding techniques which may boost their research temperament and Entrepreneurship

**Course
designer:**

Dr. P. Sivakumar

Lecture Schedule (Total hours: 30)

Unit	Description	Staff Name	Hrs	Mode
I	Introduction to Ornamental fish Culture- Indian and world scenario- advantages.		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Setting up home aquarium and requirements		2	
	Aquarium tank: Types and Features Aquaponics		2	
			6	
II	Water quality management: Heating lighting, Aeration – Filtering		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Aquarium equipment's		1	
	Aquarium plants- Hydroponics		1	
	Precautions in purchasing for ornamental fishes		2	
			6	
III	Salient features of ornamental fishes (Oviparous and Ovoviviparous)		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Breeding techniques of Gold fish, fighter fish, Guppy and Molly.		2	
	Breeding of bubble Nest builders		1	
	Breeding of live bearers		2	
			6	
IV	Food and Feeding: Nutritional requirements for ornamental fish		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Composition of ideal fish feed		2	
	Parasites & Diseases- ornamental fish		2	
			6	
V	Ornamental Fish transportation packing: Methods (open and closed packing)		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Starvation and sedation,		2	
	Factors to be considered for packaging		2	
			6	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the basic principles and techniques of Ornamental fish culture.	Up to K2
CLO 2	Analyses the water quality of the Aquarium	Up to K3
CLO 3	Apply the knowledge on Breeding techniques of ornamental fishes and fish feed formulation	Up to K3
CLO 4	Explain the causative organism of various diseases on aquarium fishes	Up to K4
CLO 5	Examine the transportation methods and packing methods of ornamental fishes.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	1							
CLO 2	2	1	2	2		2	2	
CLO 3	2	2	2	2		2	2	2
CLO 4	2		2		2			
CLO 5	1		2					1

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	1				
CLO 2	1	2	2	1	2
CLO 3	1	2	2	2	2
CLO 4	1	1	1		1
CLO 5	1				2

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT – I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	SectionD (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Inter disciplinary	20U5ZIDC	Biodiversity & Conservation Biology	3	4	25	75	100

Nature of Course			
Knowledge and skill	✓		Employability oriented
Skill oriented	✓		Entrepreneurship oriented

Course Objectives:

1. To understand the biodiversity of India and status of endangered and endemic species.
2. To identify the methods of sampling for animal population
3. To appraise the techniques for biodiversity sampling
4. To demonstrate the physiological and health status of wild animals.
5. To describe the methods of biodiversity conservation.

Unit	Description	Hours	K-Level	CLO
I	Biodiversity: Definitions, Levels of biodiversity, Values and significance of biodiversity, Biogeographical zones of India, biological diversity at National level, Hotspots of biodiversity, Ecosystem diversity in India, Threats to biodiversity, Endemic and endangered species in India.	12	Up to K2	1
II	Techniques for Biodiversity studies: Sampling techniques for Invertebrates (light traps, pitfall traps, sweep netting, bait traps (aerial attractant traps), Birds (point counts, line transects), Mammals (trapping, dung counting, signs of feeding and foot prints). Remote sensing.	12	Up to K2	2
III	Age and sex criteria of Wild animals: <i>Mammals:</i> Ageing of foetus, Annuli technique, tooth replacement & wear, Eye lens, other methods. <i>Birds:</i> Embryonic development, juvenile birds, Juvenile/adult classification.	12	Up to K2	3
IV	Health condition evaluation of wild animals: Chemical immobilization of wild animals, Physical examination of animal in hand, examination of dead animals. Foot and mouth disease. Case studies for human dimensions in wildlife management and development: Tribes in Periyar Tiger Reserve and Gujar at Chilla Wildlife Sanctuary (Problem, analysis, solutions and results).	12	Up to K2	4
V	Conservation of Biodiversity: <i>in situ</i> conservation – National parks, wildlife sanctuaries and biosphere reserves. <i>ex situ</i> conservation – Gene banks, cryopreservation and captive breeding. Legal aspects: Wildlife (protection) Act, 1972; Biological Diversity Act, 2002, CITES, Red Data Book. Organizations associated with Biodiversity and conservation: IUCN, MoEF&CC, ZSI, ICFRE	12	Up to K2	5

Books for Study

1. Krishnamurthy, K.V. 2003, An advanced Textbook on Biodiversity Principles and Practice, Oxford & IBH publishing Co. Pvt. Ltd, New Delhi.
2. Kumar, V. and M.J. Asija. 2005, Biodiversity Principles and Conservation, Student Edition, Jodhpur.
3. Berwick, S.H. and V.B. Saharaia. 1995, Wildlife Research and Management, Oxford University Press, New Delhi.
4. Sutherland, W.J. 1997, Ecology Census Techniques A Hand book, Cambridge University Press, New Delhi.

Books for References

1. Rodgers, W.A. 1991, Techniques for Wildlife census in India A Field Manual, Wildlife Institute of India, Dehradun.
2. Odum, E.P. 1971, Ecology, Amerind Publishing Co. Pvt. Ltd, New Delhi.
3. Benton, A.H. and W.E. Werner. 1980, Field Biology and Ecology, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.
4. Seshadri, B. 1969, The twilight of India's Wildlife, John Baker Publishers. London.

Web Resources

1. <https://en.wikipedia.org/wiki/Biodiversity>
2. <http://casfosddn.nic.in/document/wildlife-census.pdf>
3. https://en.wikipedia.org/wiki/Wildlife_conservation
4. <https://moef.gov.in/en/>
5. <https://cites.org/eng>

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Rationale for Nature of the course

This course will enable the students to comprehend the knowledge on concepts and methods used in the biodiversity studies and conservation of animals. Students will learn the methods used for the estimation of age and sex of wild animals, evaluate health status of the wild animals. Students will also acquire knowledge on conservation methods and get enlightened on role on government and organizations on the biodiversity conservation

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on the principles and methods used in the biodiversity conservation will help the students for developing their skills in wildlife studies and conservation biology, which further paves the way for their employability.

Course designers:

1. Dr. R. Eswaran (Department of Zoology)
2. Dr. S. Saravanan (Department of Botany)

Course Learning Outcomes:

	CLO Statement	Knowledge level
CLO-1	Understand the biodiversity and important areas of biodiversity in India	Up to K2
CLO-2	Describe the techniques for the sampling of wild animals.	Up to K2
CLO-3	Demonstrate the age and sex criteria of wild animals	Up to K2
CLO-4	Examine the physiological and health status of wild animals	Up to K2
CLO-5	Discuss the methods of wildlife conservation and role of people and organisations on biodiversity conservation.	Up to K2

Mapping with Programme Specific Outcomes:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
CLO-1	1	1	1	2	1		1	
CLO-2	2	3	2	3	2		2	2
CLO-3	2	3	3	3	2		3	2
CLO-4	1	2	3	3	2		2	2
CLO-5	1	2	3	3	2		3	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	1	1	2	2	
CLO-2	2	2	2	2	2
CLO-3	2	2	2	3	2
CLO-4	2	3	1	3	3
CLO-5	2	3	2	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

Learning Outcome Based Education & Assessment (LOBE)
Blue Print –(CIA-I & II)
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
CLO x	Up to K2	1	K1	1	K2/K2	1	K2
CLO y	Up to K2	2	K1	1	K2/K2	2	K2
No. of Questions to be asked		3		2		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		6		14		20	

Distribution of Section-wise Marks with K Levels (CIA I & II)

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Total Marks	% of Marks without choice	Consolidated %
K1	6	-		6	9.38	100
K2	-	28	30	58	90.62	
K3	-	-	-	-	-	-
K4	-	-	-	-	-	-
Total Marks	6	28	30	64	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)
Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K-Level	Section – A		Section – B		Section – C	
			Short Answers		(Either / or Choice)		(Open Choice)	
			No. of Questions	K-Level	No. of Questions	K-Level	No. of Questions	K-Level
1	CLO 1	Up to K2	1	K1	1	K2/K2	1	K2
2	CLO 2	Up to K2	1	K1	1	K2/K2	1	K2
3	CLO 3	Up to K2	1	K1	1	K2/K2	1	K2
4	CLO 4	Up to K2	1	K1	1	K2/K2	1	K2
5	CLO 5	Up to K2	1	K1	1	K2/K2	1	K2
No. of Questions to be asked			5		5		5	
No. of Questions to be answered			5		5		3	
Marks for each question			2		7		10	
Total Marks for each section			10		35		30	

Distribution of Section-Wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	10	-		10	7.69	100
K2	-	70	50	120	92.31	
K3	-	-	-	-	-	-
K4	-	-	-	-	-	-
Total Marks	10	35	50	130	100.00	100

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

LESSON PLAN (Total hours: 60)

Unit	Description	Staff Name	Hours	Mode
I	Biodiversity: Definitions, Levels of biodiversity		2	Lecture
	Values and significance of biodiversity		1	Interaction
	Biogeographical zones of India, biological diversity at National level,		3	Chalk and Talk
	Hotspots of biodiversity, Ecosystem diversity in India,		3	Group Discussion
	Threats to biodiversity, Endemic and endangered species in India.		3	PPT
II	Techniques for Biodiversity studies: Sampling techniques for Invertebrates (light traps, pitfall traps, sweep netting, bait traps (aerial attractant traps),		5	Lecture Group Discussion
	Birds (point counts, line transects), Mammals (trapping, dung counting, signs of feeding and foot prints).		5	Interaction
	Remote sensing.		2	Chalk and Talk
III	Age and sex criteria of Wild animals : <i>Mammals</i> : Ageing of foetus, Annuli technique,		3	Group Discussion
	tooth replacement & wear, Eye lens, other methods		3	Interaction
	<i>Birds</i> : Embryonic development, juvenile birds,		3	Chalk and Talk
	Juvenile/adult classification.		3	PPT
IV	Health condition evaluation of wild animals: Chemical immobilization of wild animals,		3	Group Discussion
	Physical examination of animal in hand, examination of dead animals.		2	Interaction
	Foot and mouth disease		2	Lecture
	Case studies for human dimensions in wildlife management and development : Tribes in Periyar Tiger Reserve and Gujar at Chilla Wildlife Sanctuary (Problem, analysis, solutions and results).		5	Chalk and Talk
V	Conservation of Biodiversity: <i>in situ</i> and <i>ex situ</i> conservation methods.		4	Group Discussion
	Legal aspects: Wildlife (protection) Act, 1972; Biological Diversity Act, 2002, CITES, Red Data Book.		4	Interaction
	Organizations associated with Biodiversity and conservation: IUCN, MoEF&CC, ZSI, ICFRE		4	Chalk and Talk

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Elective	20U5ZME1	Forensic Science	2	3	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives

By the end of the course, students will be able to:

1. Understand the basic principles of forensic science and the importance of forensic laboratories.
2. Create awareness among the students about the crime, crime scene and the functions of cyber crime.
3. Gain knowledge on various types of crime and the role of cyber crime in investigation.
4. Apply efficiently and execute various techniques employed in crime investigation
5. Appraise the role of insects in Forensic investigation.

Unit	Description	Hours	K-Level	CLO
I	Forensic Science Introduction, Definition, Historical perspectives. Divisions of Forensic Science laboratories and its functions: Ballistics, Biology, Chemical, Document, Lie-detector, Physics, Serology, Toxicology.	9	Up to K2	1
II	Crime and Crime scene Definition, classification, preservation, recording of crime scene and methodic search for evidence- strip, spiral, zone and wheel method. Cyber crime-Definition, classification-Physical, Data related and software related crime, computer crime preventive measures.	9	Up to K3	2
III	Physical Evidences Definition, Importance, Sources, Types of physical evidences, Collection of evidences, Handling, Packing and Labeling evidences. Instructions for special type of exhibits-Fingerprints, Foot prints, Weapons and tools, Hairs and fibres, Soil and dust, Blood and blood stains, Semen and saliva, Tool marks, Liquid and volatile materials.	9	Up to K3	3
IV	Investigation techniques Fingerprints: Friction ridges and fingerprints, Individuality of fingerprints- uniqueness, permanence, universality, simplicity and simplicity of classification. Pattern classification- Arches, Loops, Whorls and Composites. Method of recording fingerprint and identification. DNA profiling-Principle, sources, technique and application. Narco Analysis-Spot test, Microcrystal Test and Confirmatory test.	9	Up to K4	4
V	Forensic Entomology Principle, Scope, Stages of decomposition, duration and associated arthropod fauna, Circumferential Environmental Factors, Forensic Entomological Investigation Methodology-Scanning Electron Microscopy, Potassium Permanganate Staining, Mitochondrial DNA and Mock Crime Scenes.	9	Up to K4	5

Books for Study

1. Singh, N. 2015. *Forensic Science: Principles & Concepts*, Ancient Publishing House.
2. Siegel, J. 2016. *Forensic Science: A Beginner's Guide*, One world Publications.

Books for References

1. Nabar, B.S. 2015. *Forensic Science in Crime Investigation*, Asia Law House, Hyderabad.
2. Narayan Reddy, K.S. 2015. *The Essentials of Forensic Medicine And Toxicology*, Jaypee Brothers Medical Publishers.

Web Resources

1. <http://cfslhyd.gov.in/>
2. <http://www.forensicsciencesimplified.org/dna/how.html>
3. <https://www.sfu.ca/~ganderso/forensicentomology.htm>
4. <https://legaldesire.com/role-of-terrestrial-and-aquatic-insects-in-forensic-investigation/>
5. <http://www.forensicsciencesimplified.org/prints/how.html>

Rationale for Nature of the course

This course creates awareness and imparts knowledge on various disciplines in the field of Forensic science such as crime scene, investigation techniques, significance of DNA profiling and narco analysis. It also highlights the use of insects in forensic investigations.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on forensic entomology will help them to get through their employability in forensic department.

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Course designer:

Dr. L. D. Devasree

Lecture Schedule (Total hours: 45)

Unit	Description	Staff Name	Hrs	Mode
I	Introduction and Definition.		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Historical perspectives.		2	
	Divisions of Forensic Science laboratories and its functions: Ballistics, Biology		3	
	Chemical, Document, Lie-detector, Physics, Serology, Toxicology		3	
			9	
II	Definition and classification		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Preservation, recording of crime scene		3	
	Methodic search for evidence- strip, spiral, zone and wheel method.		2	
	Cyber crime-Definition, classification-Physical, Data related and software related crime, computer crime preventive measures		3	
			9	
III	Definition, Importance, Sources, Types of physical evidences.		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Collection of evidences, Handling, Packing and Labeling evidences.		2	
	Instructions for special type of exhibits- Fingerprints, Foot prints, Weapons and tools, Hairs and fibres, Soil and dust,		3	
	Blood and blood stains, Semen and saliva, Tool marks, Liquid and volatile materials.		2	
			9	
IV	Fingerprints: Friction ridges and fingerprints, Individuality of fingerprints- uniqueness, permanence, universality, simplicity and simplicity of classification.		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Pattern classification- Arches, Loops, Whorls and Composites. Method of recording fingerprint and identification.		3	
	DNA profiling-Principle, sources, technique and application		2	
	Narco Analysis-Spot test, Microcrystal Test and Confirmatory test.		2	
			9	
V	Principle, Scope, Stages of decomposition, duration and associated arthropod fauna.		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Circumferential Environmental Factors		2	
	Forensic Entomological Investigation Methodology-Scanning Electron Microscopy,		2	
	Potassium Permanganate Staining, Mitochondrial DNA and Mock Crime Scenes		2	
			9	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

	CLO Statements	Knowledge level
CLO 1	Describe the significance of forensic science, its types and functions	Up to K2
CLO 2	Examine various evidences in crime scene and utilize cyber crime for preventive measures.	Up to K3
CLO 3	Investigate documents, ballistics and fingerprints by applying different techniques.	Up to K3
CLO 4	Analyse the DNA derived from various sources and identify the type of narcotics.	Up to K4
CLO 5	Investigate the role of insects in Forensic Science	Up to K4

Mapping with Programme Specific Outcomes of Chemistry

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	2	2	1	2	2	3	2	2
CLO 2	2		3	1	2	3	3	1
CLO 3	2	1	2	3	3	3	2	2
CLO 4	2		3	2	3	3	3	3
CLO 5	2	2	3	3	3	3	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	2	3	2	3	3
CLO 2	2	3	1	3	3
CLO 3	2	2	2	3	3
CLO 4	2	3	2	3	3
CLO 5	2	3	1	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT – I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1 (K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2 (K2/3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT – II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K 4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	10	30	40	33.33	33%
K4	-	-	20	10	30	25	25%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Elective	20U5ZME1	Animal Behaviour	2	3	25	75	100
Nature of Course								
Knowledge and skill			✓	Employability oriented				
Skill oriented			✓	Entrepreneurship oriented				

Course Objectives:

By the end of the course, students will be able to:

1. Understand the basic principles, history, mechanism and significance of animal behaviour.
2. Describe the significance of different behavioural patterns in animals.
3. Appraise the advantages of social organization and reproductive behaviour in animals.
4. Analyse the role of pheromones in animal behaviour.
5. Acquire knowledge on various types of biorhythms and its effect in animal behaviour.

Unit	Description	Hours	K-Level	CLO
I	Introduction to Animal Behaviour Definition, History, Brief on contributions of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behaviour, mechanism of behaviour significance of animal behaviour.	9	Up to K2	1
II	Patterns of Behaviour Stereotyped Behaviour: Orientation, Reflexes; Individual Behaviour: Instinct and Learnt Behaviour; Non-associative learning-Imprinting and habituation; Associative learning-classical conditioning, operant conditioning and latent learning.	9	Up to K3	2
III	Social and Reproductive Behaviour Social organization: Structure, advantages, vital qualities. Social dominance, Territoriality-characteristics and functions. Reproductive Behaviour: Sexual selection, Mating system, Mechanism of Courtship, Courtship in fishes (three- spined stickleback), Parental care in birds.	9	Up to K3	3
IV	Pheromones Definition, Insect pheromones - Orthoptera, Lepidopterans), functions of insect pheromones. Pheromones in Vertebrates-mammals (Male hippopotamus, Tiger), Functions of Pheromones in Vertebrates.	9	Up to K4	4
V	Chronobiology Biological clock-definition, Types: Circadian rhythm, Circatidal rhythm, Lunar rhythm, Semilunar rhythm and Circannual rhythm.	9	Up to K4	5

Books for Study

1. Agarwal, V.K. 2013. *Animal Behaviour*, S. Chand Publishers, New Delhi.
2. Kumar, V. 2002. *Biological Rhythms*. Narosa Publishing House, New Delhi.
3. Mandal, F. 2010. *A Text Book of Animal Behaviour*. Pentice Hall India.
4. Mathur, R. 2005. *Animal Behaviour*. Rastogi Pub. Meerut.

Books for References

1. Alcock, J. 2001. *Animal Behaviour: An Evolutionary Approach*, Sinauer Associate Inc., USA.
2. Chattopadhyay, S. 2012. *Life: Evolution, Adaptation, Ethology*. 3rd Edn. Books and Allied, Kolkata.
3. Dujatkin, L.A. 2014. *Principles of Animal Behaviour*. 3rd Edn. W.W. Norton and Co.
4. Dunlap, J.C., Loros, J.J. & De Coursey, J.P. 2004. *Chronobiology: Biological Time keeping*. Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
5. Refinetti, R. 2000. *Circadian Physiology*. CRC Press, Boca Raton

Web resources

1. <https://www.notesonzooology.com/ethology/ethology-definition-and-approaches-zoology/4400>
2. <https://www.notesonzooology.com/animal-behaviour/behavioural-pattern-of-animals-zoology/4508>
3. <https://biologyboom.com/social-behavior/>
4. <https://www.depts.ttu.edu/animalwelfare/research/pheromones/index.php>
5. <https://www.webmd.com/a-to-z-guides/what-are-biological-rhythms>

Rationale for Nature of the course

This course will enable the students to comprehend the knowledge on concepts of animal behaviour, patterns of behaviour, social behaviour, reproductive behaviour, role of pheromones and significance of biological rhythm in animals.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on animal behaviour will help the students to analyse the total repertoire of the innate and learned behaviours that animals employ to solve the problems of survival and reproduction. The knowledge gained in animal behaviour will help them to undertake research activities in the field of chronobiology, human ethology, pheromones etc.

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Course Designer:

1. Dr. L. D. Devasree

Lecture Schedule (Total hours: 45)

Unit	Description	Staff Name	Hrs	Mode
I	Definition, History: Brief on contributions of Karl Von Frish.		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Contribution of Ivan Pavlov, Konrad Lorenz, Niko Tinbergen.		2	
	Proximate and ultimate causes of behavior.		2	
	Mechanism of behaviour and significance of animal behaviour.		3	
			9	
II	Stereotyped Behaviour: Orientation and Reflexes.		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Individual Behaviour: Instinct and Learnt Behaviour		2	
	Non-associative learning-Imprinting and habituation.		2	
	Associative learning-classical conditioning, operant conditioning and latent learning.		3	
			9	
III	Social organization: Structure, advantages and Vital qualities		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Social dominance, Territoriality-characteristics and functions.		2	
	Reproductive Behaviour: Sexual selection, Mating system		2	
	Mechanism of Courtship, Courtship in fishes (three- spined stickleback)		2	
	Parental care in birds.		2	
			9	
IV	Definition, Insect pheromones- Orthoptera, Lepidopterans), functions of insect pheromones.		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Pheromones in Vertebrates-mammals (Male hippopotamus, Tiger)		3	
	Functions of Pheromones in Vertebrates.		3	
			9	
V	Biological Rhythm: Definition and a brief introduction.		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Types:Circadian rhythm and Circatidal rhythm.		3	
	Lunar rhythm and Semilunar rhythm		2	
	Circannual rhythm.		2	
			9	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

	CLO Statements	Knowledge level
CLO 1	Understand the basic principles and history of ethology, mechanism and its significance.	Up to K2
CLO 2	Describe the patterns of animal behaviour.	Up to K3
CLO 3	Examine the social behaviour and reproductive behaviour in animals.	Up to K3
CLO 4	Analyze the role of pheromones in insects and vertebrates.	Up to K4
CLO 5	Evaluate the types and characteristics of biological rhythms in animals.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	1	1	2	1	2	2	2	2
CLO 2	2	2	3	2	3	3	3	2
CLO 3	1	1	2	2	3	2	2	2
CLO 4	2	1	3	3	3	2	2	2
CLO 5	3	2	3	2	2	3	3	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	2	3	2	2	3
CLO 2	2	3	2	3	3
CLO 3	2	2	2	3	2
CLO 4	2	3	2	3	3
CLO 5	2	2	2	2	3

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT – I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	2 (K2/K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core	20U5ZMP5	Major Practical – V	2	3	40	60	100
Nature of Course								
Knowledge and skill			✓	Employability oriented				
Skill oriented				Entrepreneurship oriented				

Major Practical 3 (Genetics, Biodiversity & Conservation Biology and Forensic Science)

Course Objectives

By the end of the course, students will be able to:

1. Understand the concepts of Genetics, Biodiversity & conservation biology and forensic science.
2. Operate the techniques used in Genetics, Biodiversity & conservation biology and forensic science.
3. Apply the knowledge learned in Forensic science to draw conclusion in forensic investigation.

S.No.	Experiments
1	Mounting of polytene chromosomes.
2	Mendelian monohybrid experiment using beads.
3	Estimation of salinity in water sample
4	Estimation of dissolved oxygen in water sample
5	Estimation of dissolved carbon dioxide in water sample
6	Observation of Finger prints in human population.
	VISIT
	Visit to Pond/Forest/Agri ecosystem
	Visit to forensic laboratory
	SPOTTERS
	Twins, Replication model, Mendelian traits in Man, Sickle cell anaemia, Klinefelter's, Turner and Down's Syndromes, Ecological pyramids, Pitfall trap, Light trap, Red Data Book, National Parks. DNA profiling, Insects in Forensic science, Cyber crime

Books for References

1. Sinha, J., Chatterjee, A.K. & Chattopadhyay, P. 2011. *Advanced Practical Zoology*, Books and Allied (P) Ltd.

Web Resources

1. <https://www.youtube.com/watch?v=sm3X6HThJNQ>
2. <https://www.youtube.com/watch?v=dzS59W0eemk>
3. <https://www.youtube.com/watch?v=frtln5ZoeNQ>
4. <https://www.youtube.com/watch?v=Bgg6hQMIBck>
5. <https://www.youtube.com/watch?v=SjUNl6sUvig>

Rationale for Nature of the course

The students can develop skills to validate genetic laws through experiments. They could develop their skills to study polytene chromosome and forensic finger print study. Also develop skills to quantitatively estimate of dissolved oxygen, carbon dioxide and salinity in water.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

Acquiring of skills on validating a law through experiments, quantitative analysis of quality of a water, and knowledge on forensic investigation through learned knowledge in biology will ensure their career in higher studies, research institutes and industries.

Pedagogy

PPT, group discussion, interaction, tutorial and virtual labs.

Course designers

1. Dr. R. Eswaran
2. Dr. L.D. Devasree

Lecture Schedule (Total hours: 45)

Cycle	Description	Staff Name	Hrs	Mode
Experiments				
1	Mounting of polytene chromosomes.		3	Live demo with experiments
2	Mendelian monohybrid experiment using beads.		3	Learning through experiments
3	Estimation of salinity in water sample		3	Live demo with experiments
4	Estimation of dissolved oxygen in water sample		3	Live demo with experiments
5	Visit to ecosystem/Forensic laboratory		3	Live demonstration
6	Estimation of dissolved carbon dioxide in water sample		3	Live demo with experiments
7	Observation of Finger prints in human population.		3	Live demonstration
Spotters				
8	Twins, Replication model,		3	Comments with Image
9	Mendelian traits in Man, Sickle cell anaemia,		3	
10	Klinefelter's, Turner and Down's Syndromes,		3	
11	Ecological pyramids, Pitfall trap, Light trap,		3	
12	Red Data Book, National Parks. DNA profiling,		3	
13	Insects in Forensic science, Cyber crime		3	
14	Internal Practical Test			
15	Summative Practical Examination			

Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Learn the methods to validate the genetic laws	Up to K2
CLO 2	Understand the techniques used in genetics, biodiversity & conservation biology	Up to K3
CLO 3	Apply the knowledge to enquire forensic investigation	Up to K3
CLO 4	Analyse the methods of biodiversity conservation	Up to K4
CLO 5	Verify the theoretical knowledge through experiments and field visits	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	2	1	3		1		2	
CLO 2	2	2	3			2	2	
CLO 3	2	3	3		2		2	
CLO 4	2	1	3				2	
CLO 5	2	1	3	2	2	3	3	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	3	2	3	2	2
CLO 2	2	1	1	1	3
CLO 3	3	2	2	2	1
CLO 4	1	1	1	3	2
CLO 5	3	2	2	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

EPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core	20U5ZMP6	Major Practical – VI	2	3	40	60	100

Nature of Course			
Knowledge and skill			Employability oriented
Skill oriented	✓		Entrepreneurship oriented

Course Objectives

By the end of the course, students will be able to:

1. Understand the physiology of animal and evolution of life.
2. Estimate the oxygen consumption of fish with reference to body weight and temperature.
3. Analyze the nitrogenous waste products in fish tank water, bird excreta and mammalian urine.
4. Demonstrate the instruments using in physiology and biochemistry.

	Experiments
1.	Estimation of oxygen consumption of fish with reference to body weight.
2.	Estimation of oxygen consumption of fish with reference to temperature.
3.	Qualitative analysis of nitrogenous waste products in fish tank water
4.	Qualitative analysis of nitrogenous waste products in bird excreta and mammalian urine.
5.	Study on types of fossils.
6.	Observation of vestigial organs of man from pictures
7.	Examples of Evolutionary Importance: <i>Peripatus</i> and <i>Limulus</i>
8.	Problems on Hardy-Weinberg Law
	Spotters
	Sphygmomanometer, Haemoglobinometer, Kymograph, Warburg Respirometer, ECG, Simple muscle curve, Darwin finches, <i>Archeopteryx</i> , Homologous and Analogous Organs

Books for References

1. Arumugam, N. & Mariakuttikan, 2014. A. *Animal Physiology*. Saras Publications, Nagercoil.
2. Ridley, M. 2004. *Evolution* 3rd Edition. Blackwell publishing
3. Hall, B.K. & Hallgrimson, B. 2008. *Evolution* 4th Edition. Jones and Barlett Publishers.
4. Campbell, N.A. & Reece J.B. 2011. *Biology* IX Edition. Pearson, Benjamin, Cummings.
5. Futuyma, D.J. 1997. *Evolutionary Biology*. Sinauer Associates.
6. Hall, J. & Hall, M. 2020. *Guyton and Hall Text Book of Medical Physiology* 14th Edition, Elsevier.
7. Jain, A.K. 2017. *Textbook of Physiology*. Avichal Publishing Company.

Web Resources

1. <https://www.youtube.com/watch?v=FKdzbgHaQQM>
2. <https://www.youtube.com/watch?v=7vKQuWWgULw>
3. <https://study.com/learn/lesson/fossil-types-characteristics-examples.html>
4. <https://www.vedantu.com/biology/vestigial-organs>
5. <https://www.youtube.com/watch?v=xPkOAnK20kw>

Rationale for Nature of the course

The students can develop their skills in instruments using in physiology and evidence of evolution. They could develop their skills to estimate the oxygen consumption of fish with reference to body weight and temperature, analyze the nitrogenous waste of fish tank water, bird excreta and mammalian urine, identification of fossils, vestigial organs of man and problems on Hardy-Weinberg Law in evolution can be learned.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

Acquiring of skills on estimate the oxygen consumption of fish and qualitative analysis of nitrogenous waste and knowledge on types of fossils, vestigial organs of man, evolutionary important animals will ensure their career in higher studies, research institutes and industries.

Pedagogy

PPT, group discussion, interaction, tutorial and virtual labs.

Course designers

1. Dr. C. Selvakumar
2. Dr. B. Latha

LESSON PLAN (Total hours: 45)

Cycle	Description	Staff Name	Hrs	Mode
Experiments				
1	Estimation of oxygen consumption of fish with reference to body weight.		3	Live Demonstration
2	Estimation of oxygen consumption of fish with reference to temperature.		3	Live Demonstration
3	Qualitative analysis of nitrogenous waste products in fish tank water		3	Live Demonstration
4	Qualitative analysis of nitrogenous waste products in bird excreta and mammalian urine.		3	Live Demonstration
5	Study on types of fossils.		3	Live Demonstration
6	Observation of vestigial organs of man from pictures		3	Live Demonstration
7	Examples of Evolutionary Importance: <i>Peripatus</i> and <i>Limulus</i>		3	Live Demonstration with specimens
8	Problems on Hardy-Weinberg Law		3	Live Demonstration
Spotters				
9	Sphygmomanometer, Haemoglobinometer		3	Demonstration with Instruments
10	Kymograph, Warburg Respirometer		3	Demonstration with Pictures
11	ECG, Simple muscle curve		3	Demonstration with Pictures
12	Darwin finches, <i>Archeopteryx</i>		3	Demonstration with Pictures
13	Homologous and Analogous Organs		3	Demonstration with Pictures
14	Internal Practical Test		3	
15	Summative Practical Examination			

Course Learning Outcomes:

On successful completion of the course, the student will be able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Recall the operational methods and uses of instruments using in physiology.	Up to K2
CLO 2	Understand the physiology of animal and evolution of life.	Up to K3
CLO 3	Apply the knowledge to oxygen consumption of fish with reference to body weight and temperature.	Up to K3
CLO 4	Analyse the nitrogenous waste products in fish tank water, bird excreta and mammalian urine.	Up to K4
CLO 5	Examine the type of fossils, vestigial organs of man and evolutionary important animals.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	2	1	2	1	1	1	2	1
CLO 2	2	2	3	2	1	1	2	2
CLO 3	2	1	3	1	1	1	2	1
CLO 4	1	1	3	3	1	1	2	2
CLO 5	1	2	3	2	1	1	3	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	1	2	2	2	2
CLO 2	2	2	1	2	2
CLO 3	1	2	2	2	1
CLO 4	1	2	1	2	2
CLO 5	2	2	1	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

Semester V: Mapping of Courses with Programme Specific Outcomes

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
Genetics (20U5ZMC7)	3	1	2	2	2	2	3	2
Animal Physiology (20U5ZMC8)	3	1	2	2	3	3	3	2
Evolution (20U5ZMC9)	3	1	3	3	2	2	2	3
Ornamental fish culture (20U5ZSM3)	3	2	2	1	3	3	2	3
Biodiversity & Conservation Biology (20U5ZIDC)	3	2	2	1	2	2	2	3
Forensic Science (20U5ZME1)	3	2	2	2	3	3	2	3
Animal Behaviour (20U5ZME1)	2	2	3	2	3	3	3	2
Major Practical-V (20U5ZMP5)	2	1	1	2	2	1	1	2
Major Practical-VI (20U5ZMP6)	2	1	1	2	2	1	1	2

3- Advance application; 2- Intermediate level; 1- Basic level

Semester V: Mapping of Course Outcomes with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
20U5ZMC7	1	1	2	1	2	2	2	2
	2	2	3	2	3	3	3	2
	1	1	2	2	3	2	2	2
	2	1	3	3	3	2	2	2
	3	2	3	2	2	3	3	2
20U5ZMC8	3	1	2	1	2	3	3	1
	3	1	2	1	2	3	3	1
	2	1	2	1	2	3	3	1
	3	1	2	1	3	3	3	3
	3	1	2	1	3	3	3	2
20U5ZMC9	3	1	2	2	1	1	2	2
	3	1	2	2	1	1	2	1
	3	2	2	2	1	1	2	1
	3	1	2	2	1	1	2	2
	3	1	2	3	1	1	2	2
20U5ZSM3	1							
	2	1	2	2		2	2	

	2	2	2	2		2	2	2
	2		2		2			
	1		2					1
20U5ZIDC	1	1	1	2	1		1	
	2	3	2	3	2		2	2
	2	3	3	3	2		3	2
	1	2	3	3	2		2	2
	1	2	3	3	2		3	2
20U5ZME1	2	2	1	2	2	3	2	2
	2		3	1	2	3	3	1
	2	1	2	3	3	3	2	2
	2		3	2	3	3	3	3
	2	2	3	3	3	3	3	3
20U5ZME1	1	1	2	1	2	2	2	2
	2	2	3	2	3	3	3	2
	1	1	2	2	3	2	2	2
	2	1	3	3	3	2	2	2
	3	2	3	2	2	3	3	2
20U5ZMP5	2	1	3		1		2	
	2	2	3			2	2	
	2	3	3		2		2	
	2	1	3				2	
	2	1	3	2	2	3	3	2
20U5ZMP6	2	1	2	1	1	1	2	1
	2	2	3	2	1	1	2	2
	2	1	3	1	1	1	2	1
	1	1	3	3	1	1	2	2
	1	2	3	2	1	1	3	2

3- Advance application; 2- Intermediate level; 1- Basic level

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core	20U6ZMC10	Microbiology and Immunology	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

By the end of the course, students will be able to:

1. Make awareness about the classification, diversity, application and pathogenicity of the microorganisms existing the ecosystem.
2. Learn about the various microbial culture techniques and its handling.
3. Acquire an idea that how microbes are used in various industries for generation of various products related to day to day life.
4. Insight to the cellular components involved in the immunity.
5. Gain an awareness of the mechanism, types and concepts regarding immune response.

Unit	Description	Hours	K-level	CLO
I	Introductory Microbiology Scope of Microbiology, Classification of kingdom Monera and Fungi. Systematic position of Virus - Classification. Bacteriophages – Lamda phage, M13 Bacteriophage. Ultra structure of <i>E. coli</i> , General characters and structure of Fungi.	15	Up to K2	1
II	Bacterial Culture Sterilization methods – Types and preparation of Culture medium- Culture of Bacteria- Bacterial growth and plotting growth curve – factors influencing bacterial growth and maintenance of colonies. Bacterial staining, Biofermentors and its significance in mass culture.	15	Up to K3	2
III	Applied Microbiology Preservation of milk - Microbes in food spoilage and control measures - Culture of yeast and economic importance, fermentation process, Basic concepts of Probiotics. Bacterial (Cholera, Typhoid), Viral (Rabies, HIV) & Fungal (Candidiasis, Dandruff) diseases - pathogenicity, mode of transmission, symptoms and treatment.	15	Up to K3	3
IV	Immunity and Immunogens Immunoglobulins and its types - Epitopes, paratopes, Haptens and Adjuvants. Lymphoid organs - T& B cells in Immune system, Cell mediated and Humoral Immunity, Antigen and Antibody reactions – Monoclonal antibodies. Interferons - cytokines and complimentary proteins.	15	Up to K4	4
V	Immunodeficiency and Vaccination Major Histocompatibility complex and hypersensitivity reactions. Autoimmunity and immunodeficiency. Preparation and types of vaccines - Live and attenuated. Immunization Schedule.	15	Up to K4	5

Books for study

1. Dubey, R.C. & Maheswari, D.K. 2013. *A Textbook of Microbiology*, S. Chand Publishers, New Delhi.
2. Arumugam, N., Mani, A., Narayanan, L.M., Fatima, D. & Selvaraj, A.M. 2015. *Immunology and Microbiology*, Saras Publication, Nagercoil.
3. Fatima, D. & Arumugam, N. 2014. *Immunology*, Saras Publication, Nagercoil.
4. Ramesh, S.R. 2017, *Immunology*, McGraw Hill Education India Private Limited.

Books for reference

1. Abbas, A.K., Lichtman, A.H. & Pillai, S. 2019. *Basic Immunology*, Elsevier.
2. Pelczar, M.J., Chan, E.C. & Pelczar, M.F. 1981. *Elements of Microbiology*. McGraw-Hill International Book Company.
3. Delves, P.J., Martin, S.J., Burton, D.R. & Roitt, I.M. 2017. *Roitt's Essential Immunology*, Wiley- Blackwell.
4. Ryan, K.J. & Ray, C.G. (Editors), 2004. *Sherris Medical Microbiology*. McGraw-Hill Education.
5. Willey, J.M., Sherwood, L.M. & Woolverton, J.C. 2017. *Prescott's Microbiology*, McGraw Hill Education, New York.

Web resources

1. <https://www.youtube.com/watch?v=hiQCCN5oisw>
2. <https://www.biologydiscussion.com/microorganisms/culture-media-types-preparation-and-requirements/64852>
3. <https://teachmephysiology.com/immune-system/immune-responses/types-of-immunity/>
4. <https://www.britannica.com/science/lymphatic-system>
5. <https://www.youtube.com/watch?v=psJQtVtg0sM>
6. <https://www.cloudninecare.com/other-services/immunization-schedule>

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Rationale for Nature of the course

This course will enable the students to grasp the theories, concepts of Microbiology, significance of microbe, Synthesis of drugs, impart knowledge in food preservation. Gain knowledge about Natural Immunity, Immunogens, Vaccination and Preparation of vaccines.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

Acquiring knowledge on basic and advanced concepts of Microbiology and Immunology adorns the students' overall understanding of Microbiology and Immunology, which may raise their research temperament in this field and provide job opportunities.

Course designer: Dr. B. Latha

Lecture Schedule (Total hours: 75)

Unit	Description	Staff Name	Hrs	Mode
I	Scope of Microbiology		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Classification and characters of kingdom Monera		2	
	Classification and Characters of kingdom Fungi		2	
	Lamda phage, M13 bacteriophage		2	
	Ultrastructure of <i>E. coli</i>		2	
	General characters and structure of fungi		2	
	Systematic position of virus and classification		2	
			15	
II	Sterilization methods		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Types and preparation of culture medium		2	
	Bacterial culture, Bacterial growth		4	
	Bacterial growth curve		2	
	Factors affecting bacterial growth		2	
	Maintenance of colonies		2	
	Biofermentors			
			15	
III	Preservation of milk		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Microbes in food spoilage and control measures		2	
	Culture of yeast and Economic importance		2	
	Fermentation process		3	
	Basic concepts of Probiotics		4	
	Bacterial diseases, Viral and fungal diseases			
			15	
IV	Immunoglobulins and its types		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Antigen antibody reactions		2	
	Cell mediated & Humoral Immunity		4	
	Lymphoidal organs		2	
	T cells and B cells		2	
	Monoclonal antibodies		1	
			15	
V	Major Histocompatibility complex		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Hypersensitivity reactions		2	
	Autoimmunity		3	
	Immunodeficiency diseases		2	
	Preparation of vaccines		2	
	Types of Vaccines		2	
	Vaccination		1	
			15	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the basic concepts, classification, characters and systematic position of microbes.	Up to K2
CLO 2	Describe the process of sterilization and preservation	Up to K3
CLO 3	Apply the knowledge in preparing and maintaining the cultures.	Up to K3
CLO 4	Analyze the significance of microbes in the field.	Up to K4
CLO 5	Examine the importance of Immunogens and Immunization.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	1		2					
CLO 2	2		2		1			
CLO 3	2	2	2	2	2		2	
CLO 4	2		2		2	2		
CLO 5	1		2		2	2	2	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	1		1		
CLO 2	1		2		
CLO 3	1		2		
CLO 4	1	2	2	2	1
CLO 5	2	2	1	2	3

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT - I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	SectionD (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core	20U6ZMC11	Biotechnology	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

By the end of the course, students will be able to:

1. Understand the basic concepts and techniques of Biotechnology.
2. Make awareness about applications of biotechnology.
3. Describe recombinant DNA technology and molecular techniques.
4. Appraise the animal tissue culture and its application.
5. Gain an idea about the techniques involved in biotechnology.

Unit	Description	Hours	K-level	CLO
I	Recombinant DNA technology Scope of Biotechnology, Restriction endonuclease – sequence recognition. DNA Ligase. Identification & isolation of gene - Cloning vectors and recombination -. Screening of recombinant DNA. Application of recombinant DNA technology. Commercial production of Insulin. Human Genome Project	15	Up to K2	1
II	Molecular Techniques Methods to isolate DNA – PCR types, Principle & applications. Electrophoresis – types and Principle. Blotting – types & applications. DNA finger printing and its applications – RAPD – FISH- RFLP. DNA probes & diagnosis – Super bugs (Oil pollution).	15	Up to K3	2
III	Animal tissue culture Applications – Primary culture. Steps involved in mammalian cell culture- <i>He la</i> & <i>WI38</i> cell lines – Maintenance of cell lines – Techniques and Application of organ culture. Animal cloning – Dolly.	15	Up to K3	3
IV	Applications Genetically modified Animals - Single cell Protein from microbes – Biofuels – Solid waste management – Liquid Waste Management – Biogas production - Biopesticides. Transgenic Animals (Fish, Mice, Sheep & Cow) & its significance – Mushroom Culture.	15	Up to K4	4
V	Enzyme Biotechnology Microbial production & application of enzymes – Ribozymes- Artificial enzymes - Immobilization of enzymes methods and its application. Biosensors - Cryobiology – Methods of cryo-preservation.	15	Up to K4	5

Books for Study

1. Dubey, R.C. 2009. *A text book of Biotechnology*. S.Chand & Company, New Delhi.
2. Gupta, P.K. 2010. *Elements of Biotechnology*, 2nd Edison, Rastogi publications, New Delhi.
3. Kumaresan, V. 2015. *Biotechnology*. Saras Publication, Nagercoil.
4. Mitra, S. 1996. *Genetic Engineering Principles and Practice*. Macmillan India Ltd., India.
5. Verma, P.S. & Agarwal, V.K. 2009. *Genetic Engineering*, S. Chand Publishers, New Delhi.

Books for References

1. Brown, T.A. 1995. *Gene cloning*. London: Chapman & Hall;
2. Primrose, S.B. & Twyman, R. 2013. *Principles of gene manipulation and genomics*. John Wiley & Sons.
3. Robertis, D. 2017. *Cell and Molecular biology*. Lea & Febiger, U.S
4. Chawla, H.S. 2000. *Introduction to Biotechnology*, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Crueger, W. & Crueger, A. 2000. *Biotechnology: A Test Book of Industrial Microbiology*, Panima Publishing Corporation, New Delhi.

Web resources

1. https://web.ornl.gov/sci/techresources/Human_Genome/index.shtml
2. <https://microbeonline.com/polymerase-chain-reaction-pcr-steps-types-applications/>
3. <https://microbenotes.com/animal-cell-culture/>
4. <https://www.britannica.com/science/genetically-modified-organism>
5. <https://www.youtube.com/watch?v=5x5giF7URK0>

Rationale for Nature of the course

This course will enable the students to grasp the theories concepts, basics and scope of Biotechnology, recombinant DNA technology, human genome project, DNA isolation, types of PCR, electrophoresis and blotting techniques, applications of DNA finger printing, animal cloning, genetically modified animal, biofuels, biopesticides, mushroom culture, applications of enzymes, biosensors and cryopreservation methods.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquiring of knowledge on basic and advanced concepts of Biotechnology enriches students' overall understanding of techniques, which may boost their research temperament. Web resources

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Course Designer:

Dr. S. Dinakaran

Lecture Schedule (Total hours: 75)

Unit	Description	Staff Name	Hrs	Mode
I	Scope of Biotechnology		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Restriction endonuclease – sequence recognition. DNA Ligase		3	
	Identification & isolation of gene		2	
	Cloning vectors and recombination		2	
	Screening of recombinant DNA		2	
	Application of recombinant DNA technology		1	
	Commercial production of Insulin, Human Genome Project		3	
			15	
II	Methods to isolate DNA		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	PCR types, Principle & applications		2	
	Electrophoresis – types and Principle		3	
	Blotting – types & applications		2	
	DNA finger printing and its applications		2	
	RAPD – FISH- RFLP		2	
	DNA probes & diagnosis, Super bugs (Oil pollution)		2	
			15	
III	Applications – Primary culture		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Steps involved in mammalian cell culture - <i>He la</i> & <i>WI38</i> cell lines		3	
	Maintenance of cell lines		2	
	Techniques and Application of organ culture.		4	
	Animal cloning – Dolly.		4	
			15	
IV	Genetically modified Animals.		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Single cell Protein from microbes		2	
	Biofuels – Solid waste management		2	
	Liquid Waste Management		2	
	Biogas production, Biopesticides		2	
	Transgenic Animals (Fish, Mice, Sheep & Cow) & its significance.		3	
	Mushroom Culture		2	
			15	
V	Microbial production & application of enzymes		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Ribozymes - Artificial enzymes		2	
	Immobilization of enzymes methods and its application.		3	
	Biosensors		3	
	Cryobiology – Methods of cryo-preservation.		3	
			15	

Course Learning Outcomes:

On successful completion of the course, the student will be able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the basic concepts, types of restriction, endonuclease and process of recombinant DNA technology.	Up to K2
CLO 2	Describe the methods of DNA Isolation, PCR, electrophoresis, blotting techniques and DNA finger printing.	Up to K3
CLO 3	Apply the knowledge to culture the animal cells.	Up to K3
CLO 4	Analyze the importance of genetically modified organisms and its significance.	Up to K4
CLO 5	Assess the importance of enzymes, artificial enzymes, biosensors and the methods involved in cryopreservation.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	3	1	2	1	2	3	3	1
CLO 2	3	1	2	1	2	3	3	1
CLO 3	2	1	2	1	2	3	3	1
CLO 4	3	1	2	1	3	3	3	3
CLO 5	3	1	2	1	3	3	3	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	3	2	1	1	3
CLO 2	3	3	1	1	2
CLO 3	3	2	1	1	3
CLO 4	3	3	1	3	2
CLO 5	3	3	1	1	3

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT - I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K 4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core	20U6ZMC12	Ecology	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

By the end of the course, students will be able to:

1. Understand the environment and the interaction of various components.
2. Describe nutrient cycles and their interactions.
3. Appraise the various ecosystems and its importance.
4. Make awareness about various effects of pollution and its management.
5. Gain an idea about the natural resources and its importance.

Unit	Description	Hours	K-level	CLO
I	Ecological concepts Concept of Ecosystem structure & function. Abiotic factors and its ecological role – Soil, Light, Temperature, Water. Limiting factors. Concept of Species, Population dynamics and Growth curves - Population Ecology – Community Ecology.	15	Up to K2	1
II	Nutrient cycles & Interactions Biogeochemical cycles: Carbon, Sulphur, Nitrogen and Phosphorous. Food chain & web, Pyramids & Trophic levels - Energy flow. Animal relationships: - Mutualism, commensalism, parasitism, competition, predation.	15	Up to K3	2
III	Habitat Ecology Ecosystem: characteristic features, types and faunal adaptations in Freshwater (Lotic & lentic), Marine, estuarine, mangrove, tundra, Savanna, cave, forest and desert ecosystems. Ecotone & edge effect. Significance & Conservation of wetlands. Ecological succession, Ecological effects of dams, hydroelectric projects & Aquaculture.	15	Up to K3	3
IV	Pollution Types, causes, effects (with examples) & management of Land, Water, Air, Thermal & Pesticide pollution. Nuclear Hazards – Management of Solid waste, Plastic waste, Medical waste and e-waste.	15	Up to K4	4
V	Natural Resources Types of Resources: Renewable and non-renewable resources. Forest, Water and Energy and its types. Mineral, Marine and Land resources, Deforestation, Desertification.	15	Up to K4	5

Books for Study

1. Arumugam, N. 2014. *Concepts of Ecology*, Saras Publication, Nagercoil.
2. Dash, M.C. 2004. *Fundamentals of Ecology*, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Sharma, P.D. 2019. *Fundamentals of Ecology*, Rastogi Publications, Meerut.
4. Verma, P.S. & Agarwal, V.K. 2015. *Environmental Biology: Principles of Ecology*, S Chand Publishers, New Delhi.

Books for References

1. Fryxell, J.M., Sinclair, A.R & Caughley, G. 2014. *Wildlife ecology and management*. Wiley-Blackwell.
2. Divan, S. & Rosencranz, A. 2002. *Environmental law and policy in India: Cases, materials and statutes*. Oxford University Press, New Delhi.
3. Chapman, J.L. & Reiss, M.J. 1998. *Ecology: Principles and Applications*, Cambridge University Press, New Delhi.
4. Odum, E.P. 1971. *Fundamentals of Ecology*, W.B Saunders College Publishing, Philadelphia.

Web resources

1. <http://www.biodiversitybc.org/EN/main/where/131.html>
2. <https://byjus.com/biology/biogeochemical-cycles/>
3. <https://www.youtube.com/watch?v=C6YrPt1ygX8>
4. <https://www.livescience.com/22728-pollution-facts.html>
5. <https://www.toppr.com/guides/evs/what-if-it-finishes/materials-resources-and-its-classification/>

Rationale for Nature of the course

This course will enable the students to comprehend the knowledge on ecological concepts, Nutrient cycles and Interactions, Habitat Ecology, types, causes and effects of Pollution and natural resources and its importance.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on the ecosystem, biogeochemical cycles, habitat ecology, pollution and natural resources will help the students for developing their skills in mitigation of pollution, importance and conservation of ecosystem, which further paves the way for their future studies.

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Course Designer:

Dr. C. Selvakumar

Lecture Schedule (Total hours: 75)

Unit	Description	Staff Name	Hrs	Mode
I	Concept of Ecosystem structure & function.		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Abiotic factors and its ecological role – Soil, Light, Temperature, Water.		4	
	Limiting factors.		2	
	Concept of Species, Population dynamics and Growth curves.		3	
	Population Ecology & Community Ecology.		3	
			15	
II	Biogeochemical cycles: Carbon, Sulphur, Nitrogen and Phosphorous.		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Food chain & web.		2	
	Trophic levels - Energy flow, Pyramids		3	
	Animal relationships: Mutualism, commensalism		3	
	Animal relationships: parasitism, competition and predation.		3	
			15	
III	Ecosystem: characteristic features, types and faunal adaptations in Freshwater (Lotic & lentic), Marine, estuarine, mangrove, tundra, Savanna, cave, forest and desert ecosystems.		8	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Ecotone & edge effect.		2	
	Significance & Conservation of wetlands.		2	
	Ecological succession.		1	
	Ecological effects of dams, hydroelectric projects & Aquaculture.		2	
			15	
IV	Types, causes, effects (with examples) & management of Land, Water & Air pollution.		6	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Types, causes, effects (with examples) & management of Thermal & Pesticide pollution.		4	
	Nuclear Hazards		1	
	Management of Solid and Plastic waste		2	
	Management of Medical and e-waste.		2	
			15	
V	Types of Resources: Renewable and non-renewable resources		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Forest resources and its types		3	
	Water resources and its types		2	
	Energy resources and its types		4	
	Mineral, Marine and Land resources		3	
	Deforestation and Desertification.		2	
			15	

Course Learning Outcomes:

On successful completion of the course, the student will be able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Describe the concepts of ecology and species, population dynamics and growth curves, ecology of population and community.	Up to K2
CLO 2	Discuss the biogeochemical cycles, food chain and web, pyramids and trophic levels, energy flow and animal relationships.	Up to K3
CLO 3	Examine the characteristic features, types and faunal adaptations in various ecosystems and ecological effects of dams, hydroelectric projects and Aquaculture.	Up to K3
CLO 4	Investigate the types, causes, effects and management of pollution and wastes.	Up to K4
CLO 5	Analyze the natural resources and their importance and conservation.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	3	1	3	2	1	1	3	3
CLO 2	3	1	3	3	1	1	3	2
CLO 3	3	1	3	3	1	1	2	3
CLO 4	2	1	2	3	1	1	2	3
CLO 5	1	1	2	3	1	1	1	3

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	3	2	1	1	1
CLO 2	3	1	2	1	1
CLO 3	2	1	1	2	1
CLO 4	3	1	1	2	1
CLO 5	2	1	1	1	2

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT - I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K 4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	SBE	20U6ZSM4	Vermiculture	2	2	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented			Entrepreneurship oriented	✓

Course Objectives

By the end of the course, students will be able to:

1. Learn the basic concepts of Vermiculture.
2. Understand the role of earthworms in Vermiculture.
3. Gain knowledge and develop skill in vermicomposting technology.
4. Provide adequate exposure about the Compost harvesting and Storage of vermicompost.
5. Appraise the significance of vermicompost and vermiwash.

Unit	Description	Hours	K-level	CLO
I	Earthworm Biology Introduction, role of earthworms in vermiculture, Characteristics of earthworms - colour, habitat, morphology, locomotion, food ingestion, reproduction.	6	Up to K2	1
II	Classification of Earthworm Categories of earthworm - Anecic, Endogeic, Epigeic. Importance of earthworm. Vermiculture process, Earthworm's food, Potential organic resources for vermiculture, Monoculture and Polyculture.	6	Up to K3	2
III	Parameters of Vermicompost Definition, Selection of species, characteristics of materials for vermicomposting, selection of materials for vermicomposting, parameters of vermicomposting.	6	Up to K3	3
IV	Harvesting and Storage Vermicomposting of wastes in field pits, ground heaps and in tank, Compost harvesting, Storage of vermicompost, Advantages of vermicompost.	6	Up to K4	4
V	Organic farming Vermiwash preparation, Applications of vermiwash. Applications- Organic farming. Role of intestinal microbes of earthworms on the decomposition of organic wastes.	6	Up to K4	5

Books for Study

1. Mary Violet Christy, A. 2008. *Vermitechnology*, MJP Publishers, Chennai.

Books for References

1. Ismail, S.A. 1997. *The Biology of Earthworms*, New Delhi, Orient Longman Ltd, Chennai.
2. Ranganathan, L.S. 2006. *Vermibiotechnology*, Jodhpur, Agrobios, India.

Web Resources

1. <https://www.youtube.com/watch?v=jKkl4EYPn9Y>
2. <https://www.youtube.com/watch?v=2cwnceaQsUw>
3. <https://www.youtube.com/watch?v=Efb1eib08js>
4. <https://www.youtube.com/watch?v=Rh1CyyHh47w>
5. <https://www.youtube.com/watch?v=ycUIouq0thw>
6. <https://www.youtube.com/watch?v=ov8pslndm6g>
7. <https://www.youtube.com/watch?v=tpYJrXQ1dxM>

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Rationale for Nature of the course

This course will enlighten the students about the nature of earthworm, categories of earthworm, vermiculture, vermicomposting technology and significance vermiwash. This course augments their knowledge on organic farming.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquiring of knowledge on vermiculture could inculcate awareness on organic farming in the young minds. Moreover, this knowledge will enable the students to get through their employment in Agriculture dept. and make employability through own organic farming.

Course designer:

Dr. P. Sivakumar

LESSON PLAN (Total hours: 30)

Unit	Description	Staff Name	Hrs	Mode
I	Basic concepts and role of earthworms in vermiculture		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Characteristics of earthworms- Habitat, Colour etc.		1	
	Morphology, locomotion, food ingestion		2	
	Reproduction		2	
			6	
II	Categories and importance of earthworm		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Vermiculture process, Earthworm's food,		1	
	Potential organic resources for vermiculture,		1	
	Monoculture and Polyculture.		2	
			6	
III	Selection of species, characteristics of materials for vermicomposting		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	selection of materials for vermicomposting,		2	
	parameters of vermicomposting.		2	
			6	
IV	Vermicomposting of wastes in field pits, ground heaps and in tank,		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Compost harvesting		2	
	Storage of vermicompost,		1	
	Advantages of vermicompost.		1	
			6	
V	Vermiwash preparation		1	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Applications of Vermiwash,		1	
	Applications- Organic farming.		2	
	Role of intestinal microbes of earthworms on the decomposition of organic wastes.		2	
			6	

Course Learning Outcomes:

On successful completion of the course, the student will be able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the basic concepts, characters and role of earthworms in vermiculture.	Up to K2
CLO 2	Describe the vermiculture process, different categories, Monoculture, polyculture.	Up to K3
CLO 3	Examine the parameters of vermicomposting and selection of materials for vermicomposting,	Up to K3
CLO 4	Investigate the vermicomposting of wastes in field pits, ground heaps and in tank	Up to K4
CLO 5	Assess the role of intestinal microbes of earthworms on the decomposition of organic wastes, vermiwash and organic farming	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	1		1					
CLO 2	2	2	2					
CLO 3	2	2	2			3	2	2
CLO 4	2			2	2	3	2	2
CLO 5	2			2	2	3	2	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	1	1	1	1	1
CLO 2	1	2	2	1	2
CLO 3	1	2	2	1	2
CLO 4	1	2	2	1	2
CLO 5	2	2	2	1	2

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT - I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	SectionD (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Elective	20U6ZME2	Biophysics, Biostatistics & Bioinformatics	3	4	25	75	100
Nature of Course								
Knowledge and skill			✓	Employability oriented				
Skill oriented				Entrepreneurship oriented				

Course Objectives:

By the end of the course, students will be able to:

1. Understand the basic principle and applications of biophysics,
2. Study the biophysical mechanism of Bioenergetics and bioluminescence.
3. Appraise the methods of biological data collection, organization and presentation of data.
4. Understand the statistical methods for the interpretation and conclusion of data.
5. Analyze the concepts and applications of bioinformatics.

Unit	Description	Hours	K-Level	CLO
I	Biophysics: Definition, scope, Colloids - Description, properties and types. membrane conductivity -Diffusion, active transport, osmosis. entropy, enthalpy, Free energy – Endergonic and exergonic reactions. Coupling chemical reactions-redox reactions, redox potential.	12	Up to K2	1
II	Bioenergetics: ATP-structure, ATP formation and breakdown in living system-NADP/NADPH redox couple bioenergetics. Mitochondrial bioenergetics. Bioluminescence: Types of bioluminescence, mechanism of bioluminescence in bacteria and firefly.	12	Up to K3	2
III	Biostatistics: definition, Types of data (Primary and secondary data), Methods of collection of Primary and secondary data, Tabulation, Diagrammatic and graphical presentation of Data: Histogram, frequency curve, bar diagram, pie diagram.	12	Upto K3	3
IV	Biostatistics: Measurement of Central tendency (mean, median, mode for individual, discrete and frequency series), Measures of dispersion (Range, standard deviation), Chi-square test, students t test, Pearson Correlation coefficient.	12	Up to K4	4
V	Bioinformatics: Definitions, Applications of Bioinformatics, Features of biological Databases, PDB, SWISS-PROT, PROSITE, ExPASy, Gen Bank, DDBJ, EMBL. BOLD (Barcode of Life Data systems). Sequence alignment: BLAST, FASTA.	12	Up to K4	5

Books for Study

1. Subramanian, M.A. 2005. *Biophysics, Principles and Techniques*, M.J.P. Publishers, Chennai.
2. Ramakrishnan, P. 1996. *Biostatistics*, Saras Publications, Nagercoil.
3. Gurumani, N. 2004. *An introduction to Biostatistics*. MJP publishers. Chennai
4. Banerjee, P. 2014. *Introduction to Bioinformatics*, S. Chand and Company Pvt. Limited, New Delhi.
5. Lesk, A.M. 2007. *Introduction to Bioinformatics*, Oxford University Press, New Delhi.
6. Hepsyba, S.G.H. & Hemalatha, C.R. 2009. *Basic Bioinformatics*, MJP Publishers. Chennai.

Books for References

1. Daniel, M. 1992. *Biophysics Biologist*, Wiley International, New Delhi.
2. Das, D. 1996. *Biophysical and Biological Chemistry*, Academic Publishers, Kolkata.
3. Sokal, R.J. and Rohlf, S.J. 1981, *Introduction to Biostatistics*, W.H. Freeman, London.
4. Mittal, C. 2003, *Fundamentals of Information Technology*, Pragathi Prakasam, Meerut.
5. Piramal, V. 2006. *Biophysics*, Dominant publishers and distributors. New Delhi.
6. Zar, J.H. 2011. *Biostatistical Analysis*, Pearson Education Inc. New Delhi.
7. Murthy, C.S.V. 2004, *Bioinformatics*, Himalaya Publishing House, New Delhi.

Web Resources

1. <http://www.mednotes.net/notes/biophysics/>
2. <https://www.easybiologyclass.com/biophysics-free-online-classes-lecture-notes-references-study-materials/>
3. https://cdn1.sph.harvard.edu/wp-content/uploads/sites/565/2019/09/HST190_Lecture_1.pdf
4. <https://www.aminotes.com/2017/10/biostatistics-study-materials.html>
5. <https://microbenotes.com/category/bioinformatics/>
6. <https://www.biologydiscussion.com/biodiversity/bioinformatics/notes-on-bioinformatics-genetics/38224>

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Rationale for Nature of the course

This course will enable the students to understand the methodology used in the biophysics, biostatistics and bioinformatics. Students will learn the biophysical principles involved in cell physiology. Students will also acquire knowledge on the data collection methods, basic and inferential statistical methods used for the biological research. They also get enlightened on the advanced knowledge on the bioinformatics and biological databases.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on the principles and methods used in the biophysics, biostatistics and bioinformatics will help the students to improve their skills, which further paves the way for their employability.

Course designer:

Dr. R. Eswaran

Lecture Schedule (Total hours: 60)

Unit	Description	Staff Name	Hours	Mode
I	Biophysics: Definition, scope, Colloids - Description, properties and types.		3	Group Discussion, Lecture, Interaction, Chalk and Talk, PPT
	Membrane conductivity -Diffusion, active transport, osmosis.		3	
	Entropy, enthalpy, Free energy – Endergonic and exergonic reactions.		3	
	Coupling chemical reactions-redox reactions, redox potential.		3	
			12	
II	Bioenergetics: ATP-structure, ATP formation and breakdown in living system-		3	Group Discussion, Lecture, Interaction, Chalk and Talk, PPT
	NADP/NADPH redox couple bioenergetics. Mitochondrial bioenergetics.		3	
	Bioluminescence :Types of bioluminescence,		2	
	Mechanism of bioluminescence in bacteria and firefly.		4	
			12	
III	Biostatistics: definition, Types of data (Primary and secondary data),		2	Group Discussion, Lecture, Interaction, Chalk and Talk, PPT
	Methods of collection of Primary and secondary data,		4	
	Tabulation,		2	
	Diagrammatic and graphical presentation of Data: Histogram, frequency curve,		2	
	Bar diagram, pie diagram.		2	
			12	
IV	Measurement of Central tendency (mean, median, mode for individual, discrete and frequency series)		4	Group Discussion, Lecture, Interaction, Chalk and Talk, PPT
	Measures of dispersion (Range, standard deviation)		2	
	Chi-square test.		2	
	students t test		2	
	Pearson Correlation coefficient		2	
			12	
V	Bioinformatics: Definitions, Applications of Bioinformatics		2	Group Discussion, Lecture, Interaction, Chalk and Talk, PPT
	Features of biological Databases PDB, SWISS-PROT, PROSITE, ExPASy,		4	
	Gen Bank, DDBJ, EMBL. BOLD (Barcode of Life Data systems).		4	
	Sequence alignment: BLAST, FASTA.		2	
			12	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

	CLO Statement	Knowledge level
CLO 1	Understand the basic concepts of biophysics and biophysical principles of cell membrane conductivity and biochemical reactions	Up to K2
CLO 2	Recall the concepts and mechanism of bioenergetics and bioluminescence.	Up to K3
CLO 3	Apply the statistical knowledge to for data collection and presentation	Up to K3
CLO 4	Analyse the inferential statistical tests to draw conclusion for the biological study and experiments	Up to K4
CLO 5	Evaluate the role of role of biophysics, biostatistics and bioinformatics to the modern biological research	Up to K4

Mapping with Programme Specific Outcomes:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	1	1	1	1		1	1	
CLO 2	1	2	2	2			2	
CLO 3	1	3	3				2	
CLO 4	1	3	3	2		2	2	1
CLO 5	1	3	3	2		2	2	1

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	2	1	1		2
CLO 2	2	2	1		2
CLO 3	2	2	3	1	1
CLO 4	2	3	3	1	3
CLO 5	3	2	2	2	3

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT – I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Question s	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Elective	20U6ZME2	Entomology	3	4	25	75	100
Nature of Course								
Knowledge and skill			✓	Employability oriented				
Skill oriented			✓	Entrepreneurship oriented				

Course Objectives:

By the end of the course, students will be able to:

1. Understand the general characteristics of important groups of insects.
2. Describe the external morphology of insects.
3. Appraise the structure and physiology of internal structure of insects.
4. Evaluate the relationship between the structure of excretory and nervous system on modes of insect life.
5. Analyze the role of hormones in insects life.

Unit	Description	Hours	K-Level	CLO
I	Entomology Definition, General characters of Insects- Salient features (up to order) and examples of Thysanura, Ephemeroptera, Plecoptera, Orthoptera, Hemiptera, Coleoptera, Diptera, Lepidoptera, Hymenoptera.	12	Up to K2	1
II	External morphology of Insects The integument, dermal glands, structure of head (segmentation of the head, appendages, mouthparts). Thorax (tergum, sternum, legs, wings, wing coupling mechanism) and abdomen (abdominal segments, external genitalia).	12	Up to K3	2
III	Insect Internal Morphology Structure of Digestive system, physiology of digestion. Fat body. Tracheal system: general structure, types of tracheal system, Respiration in aquatic insects. Respiration in parasites. Structure of Circulatory system, haemocytes.	12	Up to K3	3
IV	Excretory & Nervous system Excretory system - Malpighian tubule, labial kidneys. Water and salt regulation. Nervous system –general structure, mechanoreceptors, auditory organs, chemoreceptors, ommatidia.	12	Up to K4	4
V	Reproductive & Endocrine systems Reproductive systems: Male and female reproductive system, determination of sex. Metamorphosis and its types. Endocrine system: Neurosecretory cells, Corpora cardiaca, corpora allata, thoracic glands, endocrine control of metamorphosis. Endocrine influence on reproduction. Pheromones.	12	Up to K4	5

Books for Study

1. Chapman, R.F. 2013. *The Insects: Structure and Function*. Cambridge University Press, UK.
2. Imms, A.D., Richards, O.W. & Davies, R.G. 2014. *IMMS' General Textbook of Entomology* (Volume I & II). Springer, Netherlands.
3. Nayar, K.K., Ananthakrishnan, T.N. & David, B.V. 1976. *General and Applied Entomology*. Tata McGraw-Hill Publishing Company Limited, New Delhi.

Books for References

1. Gullan, P.J. & Cranston, P. 2004. *The Insects. Outline of Entomology*. Wiley-Blackwell.
2. Richards, O.W. & Davies, R.G. 1984. *A General Text Book of Entomology* Vol. I & II, 10th Edition, Chapman Hall, Lane London.
3. Tembhare, D.B. 2012. *Modern Entomology*, Himalaya Publishing House, Mumbai.
4. Wigglesworth, V.B. 2012. *The Principles of Insect Physiology*. Springer, Netherlands.

Web Resources

1. <https://www.royensoc.co.uk/understanding-insects/classification-of-insects/>
2. <https://archive.org/details/principlesofinse033321mbp/page/n425/mode/2up>
3. <https://www.youtube.com/watch?v=NCUJQrRkQZY>
4. https://www.mlsu.ac.in/econtents/1208_Insect%20Anatomy%20and%20Physiology%20%E2%80%93%20I,II,III&IV.pdf
5. https://www.youtube.com/watch?v=QL906_79HJM
6. <https://www.e-libraryme.com/2021/02/the-principles-of-insect-physiology-7th-edition-pdf.html>

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Rationale for Nature of the course

This course will enable the students to grasp the knowledge on the largest group in the animal kingdom, the insects. Students will acquire the in-depth knowledge on the classification, structure and physiology of insects that will shed light on the finer adaptations acquired by insects during evolution for their successful dominance on earth. This course will kindle the young minds to observe nature to verify their acquired knowledge on insects, since insects are high abundant in nature and easily seen in all the habitats when compared to other groups of animals. All these erudition will be very much helpful for their higher studies and research.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on the principles of classification, structure and physiology of insects will help the students for developing their skills in entomology, which further paves the way for their employability.

Course designer:

Dr. R. Eswaran

Lecture Schedule (Total hours: 60)

Unit	Description	Staff Name	Hrs	Mode
I	Entomology-definition. General characters of Insects		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Salient features (up to order) and examples of Thysanura, Ephemeroptera, Plecoptera, Orthoptera, Hemiptera		5	
	Salient features (up to order) and examples of Coleoptera, Diptera, Lepidoptera, Hymenoptera		5	
			12	
II	External morphology of Insects: The integument, dermal glands.		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Structure of head (segmentation of the head, appendages, mouthparts).		3	
	Thorax (tergum, sternum, legs, wings, wing coupling mechanism)		3	
	Abdomen (abdominal segments, external genitalia)		3	
			12	
III	Insect Internal Morphology: structure of Digestive system, physiology of digestion. Fat body.		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Tracheal system: general structure, types of tracheal system.		3	
	Respiration in aquatic insects. Respiration in parasites.		3	
	Structure of Circulatory system, haemocytes.		3	
			12	
IV	Excretory system – Malpighian tubule, labial kidneys.		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Water and salt regulation.		2	
	Nervous system – general structure,		2	
	Mechanoreceptors, auditory organs, chemoreceptors, ommatidia.		5	
			12	
V	Reproductive systems: Male and female reproductive system, determination of sex.		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Metamorphosis and its types. Endocrine control of metamorphosis.		3	
	Endocrine system: Neurosecretory cells, Corpora cardiaca, corpora allata, thoracic glands		4	
	Endocrine influence on reproduction. Pheromones.		2	
			12	

Course Learning Outcomes:

On successful completion of the course, the student will be able to:

	CLO Statement	Knowledge level
CLO 1	Understand the general characters and classification of insects	Up to K2
CLO 2	Describe the external morphology of insects.	Up to K3
CLO 3	Apply the knowledge on internal morphology of insects to understand their mode of life	Up to K3
CLO 4	Analyse the role of excretory system and sensory biology of insects on their survival	Up to K4
CLO 5	Examine the role played by hormones on the reproduction and development of insects	Up to K4

Mapping with Programme Specific Outcomes:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	2	3	1	1	2	2	2	
CLO 2	3	3	3	2	2	1	2	1
CLO 3	2	2	3	3	2		1	1
CLO 4	2	2	3	3	2		1	
CLO 5	1	2	3	3	2		2	

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	3	2	2	1	3
CLO 2	2	2	2	1	2
CLO 3	2	2	1	1	2
CLO 4	2	3	1	1	3
CLO 5	2	3	1	2	3

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT – I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	2 (K2/K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Elective	20U6ZME2	Preventive and Social Medicine	3	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

By the end of the course, students will be able to:

1. Understand the basic principles of preventive and the importance of Social medicine.
2. Create awareness among the students about the present scenario about prevailing health aspects of India
3. Gain knowledge on various types of diseases and the role of societal contribution among the citizens of India.
4. Apply efficiently and execute diagnostic tools in the investigation health status
5. Appraise the role of health workers and PHC across the nation.

Unit	Description	Hours	K-Level	CLO
I	History of Social medicine Brief history of Social medicine and community health - Indicators of health and well being - Natural history of disease and levels of prevention – Responsibilities of communities and private sectors in health	12	Up toK2	1
II	Amenities for Health Health infrastructure in India – Health Legislation in India – Civil society and social movements in health – Health Policies	12	Up toK3	2
III	Epidemiology Types and uses of Epidemiology; Diagnosis – Significance of Social, economical, and behavioural factors on health and diseases – Social health approach in Health care	12	Up toK3	3
IV	Diseases Common health problems in India – Communicable and non-communicable diseases – Accidents, injuries, and disasters – National Health Mission	12	Up toK4	4
V	Environment and Public health Environment and Health – Nutrition – Family planning – Gender issues and women health – Child health – Adolescent health program	12	Up to K4	5

Books for Study

1. Park, K. 2015. *Park's textbook of preventive and social medicine*, Bhanot Publishers, India.
2. Lal, S., Adarsh & Pankaj. 2021. *Textbook of Community Medicine Preventive and Social Medicine*, CBS Publishers and distributors Pvt Ltd.

Books for References

1. Bhalwar, R. 2021. *Community Medicine: Prep Manual for Undergraduates*, Elsevier India.
2. Hiremath, L.D., & Hiremath, D.A. 2012. *Essentials of Community Medicine: A Practical Approach* 2nd Edition, Jaypee, India.
3. Lal, S. & Vikas. 2016. *Public Health Management: Principles and Practice*, CBS Publishers and distributors Pvt Ltd.

Web resources

1. <https://nhm.gov.in/index1.php?lang=1&level=2&sublinkid=1220&lid=190>
2. <https://www.bajajfinserv.in/insights/health-problems-in-india>
3. <https://www.bmj.com/about-bmj/resources-readers/publications/epidemiology-uninitiated/1-what-epidemiology>
4. <http://www.gmcoge.tn.gov.in/comm.html>
5. <https://www.eea.europa.eu/themes/human/intro>

Rationale for Nature of the course

This course creates awareness and imparts knowledge on natural history of disease, levels of prevention, amenities for health, prevailing health aspects of India, various types of diseases and the role of societal contribution among the citizens of India and Environment and Public health.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on preventive and social medicine will help the students to identify responsibilities of communities and private sectors in health, amenities for health, types of diseases and gender issues and child, women and adolescent health program. The knowledge gained in preventive and social medicine will help them to understand the social, economical, and behavioural factors on health and diseases.

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Course Designer:

1. Dr. S. Dinakaran

Lecture Schedule (Total hours: 60)

Unit	Description	Staff Name	Hrs	Mode
I	Brief history of Social medicine and community health		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Indicators of health and well being		3	
	Natural history of disease and levels of prevention		3	
	Responsibilities of communities and private sectors in health		3	
			12	
II	Health infrastructure in India		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Health Legislation in India		3	
	Civil society and social movements in health		3	
	Health Policies		3	
			12	
III	Epidemiology – types and uses		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Diagnosis		2	
	Significance of Social, economical, and behavioural factors on health and diseases		4	
	Social health approach in Health care		2	
			12	
IV	Common health problems in India		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Communicable diseases		3	
	Non-communicable diseases		3	
	Accidents, injuries, and disasters		2	
	National Health Mission		2	
			12	
V	Environment and Health		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Nutrition		2	
	Family planning		2	
	Gender issues and women health		2	
	Child health		2	
	Adolescent health program		2	
			12	

Course Learning Outcomes:

On successful completion of the course, the student will be able to:

	CLO Statements	Knowledge level
CLO 1	Understand the social medicine, natural history of disease and responsibilities of communities and private sectors in health.	Up to K2
CLO 2	Describe the significance of infrastructure and legislation of health in India.	Up to K3
CLO 3	Examine the types and uses of Epidemiology and significance of social, economical, and behavioural factors on health and diseases.	Up to K3
CLO 4	Analyze the health problems in India, diseases and National Health Mission.	Up to K4
CLO 5	Evaluate the environment, public health, gender issues and women health.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	3	1	2	1	2		1	1
CLO 2	3	2	3	1	1		1	2
CLO 3	3	1	3	2	3		1	1
CLO 4	3	1	3	3	3		1	3
CLO 5	3	2	2	3	2		1	3

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	3	3	1	2	1
CLO 2	3	3	2	3	1
CLO 3	2	3	1	3	2
CLO 4	2	3	1	2	3
CLO 5	3	3	2	3	3

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT – I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	2 (K2/K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Elective	20U6ZME3	Animal Farming	2	3	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented			Entrepreneurship oriented	✓

Course Objectives

By the end of the course, students will be able to:

1. Aware about the applied aspects of Zoology.
2. Understand the economic importance of animals.
3. Gain knowledge on various techniques employed in culture of organisms.
4. Learn the farming and culture practice of animals.
5. Apply efficiently and execute the methodology for field practice.

Unit	Description	Hours	K-level	CLO
I	Poultry Breeds of poultry (Aseel, Ghagus, Rhode Island Reds, Brahma, Sussex and Leghorn), Types of poultry house, Principles for construction of poultry house, Diseases, Nutritive value of eggs.	9	Up to K2	1
II	Dairy farming Breeds of Cattles (Draft, Dairy, Dual purpose and Exotic breeds), Nutritive value of milk, Livestock diseases: Mastitis, Foot and mouth diseases and Rinder pest.	9	Up to K3	2
III	Pisciculture Types of culturable fishes: fin fishes and shell fishes, Polyculture of carps, Integrated fish farming: Paddy cum fish culture, Poultry cum fish culture.	9	Up to K3	3
IV	Prawn culture Culture of marine prawn (<i>Penaeus monodon</i>): seed collection, culture method, harvesting and preservation. Culture of freshwater prawn (<i>Macrobrachium rosenbergii</i>): seed collection, culture method, harvesting and preservation.	9	Up to K4	4
V	Edible & Pearl Oyster farming Edible Oyster farming: biology, spat collection, culture methods, harvesting, cleaning and preservation. Pearl Oyster farming: biology, pearl formation and culture of pearls.	9	Up to K4	5

Books for Study

1. Arumugam N, 2000. *Aquaculture*, Saras publication, Nagercoil.
2. Arumugam, N., Murugan, S., Johnson Rajeshwar, J. & Ramprabha, R. 2005. *Applied Zoology*, Saras publication, Nagercoil.
3. Tomer, B.S. 2011. *Economic Zoology*, Emkay Publications, Delhi.
4. Shukla, G.S. & Upahyay, V.B. 2011. *Economic Zoology*, Rastogi Publications, Meerut.

Books for References

1. Ravindranathan, K.R. 2005. *A text book of economic zoology*, Dominant publishers and distributors, New Delhi.
2. Singh, H. and Moore, E.N. 1982. *Livestock and Poultry production*, Prentice Hall of India, Pvt. Ltd. New Delhi.
3. Gnanamani, R. 1978. *Modern aspects of commercial Poultry keeping*, Hytone Publications, Madurai
4. Vasantharaj David, B. & Kumaraswamy, T. 1996. *Elements of Economic Entomology*, Popular Book depot, Chennai.

Web Resources

1. http://agritech.tnau.ac.in/animal_husbandry/animhus_cattle%20_index_page.html
2. http://agritech.tnau.ac.in/fishery/fish_index.html
3. http://agritech.tnau.ac.in/farm_enterprises/fe_apiculture_home.html
4. http://www.agritech.tnau.ac.in/expert_system/poultry/index.html
5. http://agritech.tnau.ac.in/animal_husbandry/animhus_cattle%20_index_page.html
6. http://agritech.tnau.ac.in/fishery/fish_index.html

Rationale for Nature of the course

This course represents an attractive means of combining state-of-the-art transition on various techniques employed in rearing of economically important animals.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on animal farming will help the students to develop their entrepreneurial skills that enable the students to become a successful entrepreneur.

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Course designer:

Dr. C.
Selvakumar

Lecture Schedule (Total hours: 45)

Unit	Description	Staff Name	Hrs	Mode
I	Breeds of poultry (Aseel, Ghagus Rhode Island Reds, Brahma, Sussex and Leghorn)		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Types of poultry house		1	
	Principles for construction of poultry house		2	
	Diseases of poultry		2	
	Nutritive value of eggs		1	
			9	
II	Breeds of Cattles (Draft, Dairy, Dual purpose and Exotic breeds)		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Nutritive value of milk		1	
	Livestock diseases: Mastitis, Foot and mouth diseases		3	
	Livestock disease: Rinder pest		1	
			9	
III	Types of culturable fishes (fin fishes and shell fishes)		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Seed collection and culture practices of Indian major carps		3	
	Feeding, weed and predator control, harvesting and preservation of Indian major carps		2	
	Integrated fish farming: Paddy cum fish culture, Poultry cum fish culture.		2	
			9	
IV	Seed collection and culture method of marine prawn (<i>Penaeus monodon</i>)		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Harvesting and preservation of marine prawn (<i>Penaeus monodon</i>)		2	
	Seed collection and culture method of freshwater prawn (<i>Macrobrachium rosenbergii</i>)		2	
	Harvesting and preservation of freshwater prawn (<i>Macrobrachium rosenbergii</i>)		3	
			9	
V	Biology, spat collection and culture methods of Edible Oyster		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Harvesting, cleaning and preservation of Edible Oyster.		2	
	Biology and pearl formation of Pearl Oyster		2	
	Culture methods of Pearl Oyster		2	
			9	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the animal types, rearing techniques and it uses.	Up to K2
CLO 2	Describe the economically important of animals and its culture methods.	Up to K3
CLO 3	Apply the knowledge to execute the methodology for field practice.	Up to K3
CLO 4	Analyse the problem in culture practices and to rectify the same.	Up to K4
CLO 5	Infer the biological importance of Poultry farming, Dairy farming, Pisciculture, Prawn culture, Edible oyster and Perl oyster culture.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	2	2	1	1	2	3	2	1
CLO 2	2	1	3	1	2	3	2	1
CLO 3	2	1	1	3	1	3	3	2
CLO 4	2	1	2	1	2	3	1	1
CLO 5	3	1	2	2	3	3	2	2

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	1	1	1	1	2
CLO 2	2	2	1	1	3
CLO 3	2	2	1	1	3
CLO 4	2	3	1	1	3
CLO 5	2	3	1	2	2

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT - I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Question S	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl.No	CLOs	K- Level	Section A		Section B		Section C (Either/ or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without Choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Elective	20U6ZME3	Fisheries Science	2	3	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	✓

Course Objectives

By the end of the course, students will be able to:

1. Learn the basic principles, prospects and problems of Fisheries.
2. Study the Life history features of common marine and freshwater fisheries.
3. Learn the Inland fisheries and their economics.
4. Gain the induced breeding techniques of food fishes.
5. Provide adequate exposure about the Processing, Preservation and pathology of fishes.

Unit	Description	Hours	K-level	CLO
I	Introduction to Fisheries and fish gears Introduction: World and Indian Fisheries – Prospects and Problems. Plans, Policies and Current Status of Indian Fisheries. Fish Gears and Crafts used in South Indian Fisheries.	9	Up to K2	1
II	Life history of marine and freshwater fisheries Marine fisheries: Sardines, Mackerels, Ribbonfish, Silver bellies, Pomfrets and Prawns. Freshwater fisheries: Indian major carps (Catla, Rohu and Mrigal)	9	Up to K3	2
III	Inland fisheries Freshwater – riverine, reservoir, pond and cold water fisheries – Spawning and breeding habits of fishes. Estuarine and brackish water fisheries and their economics.	9	Up to K3	3
IV	Age and Growth, Population & Induced breeding Age and Growth: Scale method, otolith method, length – weight relationship and condition factor. Population studies: estimation of population size, marking, tagging. Induced breeding – techniques – examples.	9	Up to K4	4
V	Trades and Pathology Fish Processing and Preservation, fish by-products – brief account on transport and marketing. Fish Pathology: White-spot disease (Protozoa), Saprolegniasis (Fungi) and fin and tail rot diseases (Bacteria).	9	Up to K4	5

Books for Study

1. Biswas, S.P. 1993. *Manual of Methods in Fish Biology*, International Book Co., Absecon Highlands, New Jersey.
2. Jhingran, V.G. 1991. *Fish and Fisheries of India*, Hindustan Publishing Corporation, New Delhi.
3. Pillai, T.V.R. 1993. *Aquaculture: Principles and Practices*, Fishing News Agency, London.

Books for References

1. Bose, A.N., Yang, C.T. & Misra, A. 1991. *Coastal Aquaculture Engineering*, Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.
2. Chakrabarti, N.M. 1994. *Diseases of Cultivable Freshwater Fishes and Their Control*, International Books and Periodicals Supply service, New Delhi.
3. Day, F. 1986. *The Fishes of India*, Vols. I & II. Today and Tomorrow's Book Agency, New Delhi.
4. Govindan, T.K. 1992). *Fish processing Technology*, Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.
5. MPEDA, 1992. *Hand book of Aquafarming*, Freshwater Fishes, Marine Products Export Development Agency, Kochi.
6. Santhanam, R. 1990. *Fisheries Science*, Daya Publishing House, New Delhi.

Web resources

1. <https://www.youtube.com/watch?v=l-Bhvvfbo9o>
2. <https://www.youtube.com/watch?v=YezRRnbgHyQ>
3. <https://www.youtube.com/watch?v=gGzZO19eorE>
4. <https://www.youtube.com/watch?v=-cz1MSSqGQA>
5. <https://www.youtube.com/watch?v=tbOXqcT-rvk>
6. <https://www.youtube.com/watch?v=tOrli85OW8Y>
7. <https://www.youtube.com/watch?v=At4dDZQbnoA>
8. <https://www.youtube.com/watch?v=2rXIZUWb6hM>

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Rationale for Nature of the course

This course will enable the students to grasp the theoretical knowledge and basics techniques of Fisheries Science, Induce Breeding, life history, Processing and Preservation Pathology, Age and growth studies, Population studies, transportation and packing.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquiring of knowledge on basic and induced breeding techniques of food fish culture enriches students' overall understanding the biology of fishes and breeding techniques which may boost their farming interest, research temperament and Entrepreneurship.

Course designer:

Dr. P. Sivakumar

Lecture schedule (Total hours: 45)

Unit	Description	Staff Name	Hrs	Mode
I	World and Indian Fisheries		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Prospects and Problems – Plans, Policies		2	
	Current Status of Indian Fisheries.		2	
	Fish Gears and Crafts used in South Indian Fisheries.		3	
			9	
II	Marine fisheries: Sardines, Mackerels and Ribbonfish		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Marine fisheries: Silver bellies, Pomfrets and Prawns		3	
	Freshwater fisheries: Indian major carps (Catla, Rohu and Mrigal)		3	
			9	
III	Freshwater – riverine, reservoir, pond and cold water fisheries		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Spawning and breeding habits of fishes.		2	
	Estuarine and brackish water fisheries and their economics.		3	
			9	
IV	Age and Growth: Scale method, otolith method		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Length – weight relationship and condition factor.		2	
	Estimation of population size, marking, tagging,		2	
	Techniques of Induced breeding – examples.		2	
			9	
V	Fish Processing and Preservation		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	fish by-products		2	
	Brief account on transport and marketing.		2	
	White-spot disease (Protozoa), Saprolegniasis (Fungi) and fin and tail rot diseases (Bacteria).		3	
			9	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the basic principles, prospects, problems and current status of Fisheries.	Up to K2
CLO 2	Describe the biology of marine and freshwater fisheries	Up to K3
CLO 3	Analyses the freshwater, Estuarine and brackish water fisheries and their economics.	Up to K3
CLO 4	Apply the knowledge on Induced Breeding techniques of food fishes estimation of the Age and Growth.	Up to K4
CLO 5	Explain the protozoan, fungal and bacterial parasites of fishes	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	1		1	1			1	1
CLO 2	2	2		2			1	2
CLO 3	2		2	2		2	1	2
CLO 4	2		2		2	2	1	2
CLO 5	1				2	2	1	

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	1				
CLO 2	1				
CLO 3	1	2	2	2	
CLO 4	1	2	2	2	2
CLO 5	1	2		2	2

3- Advance application; 2- Intermediate level; 1- Basic level

BLUE PRINT FOR FORMATIVE ASSESSMENT – I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.6	07%
K2	2	2	2	2	36	60	60%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	-	-	-	0%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR FORMATIVE ASSESSMENT – II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	SectionD (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be Asked			4		3		4	3	14
No. of Questions to be Answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each Section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general

answers K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	1	-	-	4	06.7	07%
K2	2	2	2	1	26	43.3	43%
K3	-	-	2	1	20	33.3	33%
K4	-	-	-	1	10	16.7	17%
Total Marks	4	6	20	30	60	100.00	100%

BLUE PRINT FOR SUMMATIVE

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K 4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K 4	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core	20U6ZMP7	Major Practical – VII	2	3	40	60	100

Nature of Course			
Knowledge and skill			Employability oriented
Skill oriented	✓		Entrepreneurship oriented

(Ecology, Biophysics, Biostatistics & Bioinformatics, Animal farming)

Course Objectives

By the end of the course, students will be able to:

1. Learn the techniques used in Ecology, Biostatistics and Bioinformatics.
2. Understand the analysis of water quality.
3. Learn the statistical methods, bioinformatics and biological databases.

S. No.	Experiments
1.	Quantitative measurement of Alkalinity
2.	Quantitative measurement of Hardness
3.	Measurement of water transparency using Sacchis' Disc
4.	Mounting of freshwater planktons
5.	Tabulation for a given biological data
6.	Calculation of Arithmetic Mean, Median, Mode, Range and Standard Deviation for any biological data.
7.	Correlation analysis for a biological data.
8.	Download and study at least two samples of Genome sequences from NCBI.
	Spotters
	GPS, Hygrometer, Rain gauge, Ecological pyramids, Osmosis, Ramachandran plot, BOLD, BLAST, Foot and mouth diseases, Pearl Oyster.

Books for References

1. Adoni, A.D. 1985. *Workbook on Limnology*, Pratibha Publication.
2. Gurumani, N. 2004. *An introduction to Biostatistics*, MJP publishers. Chennai
3. Rao, K.S. 2003. *Practical Ecology*, Anmol Publications Pvt. Ltd.
4. Wheater, C.P., Bell, J.R. & Cook, P.A. 2020. *Practical Field Ecology: A Project Guide*, Wiley-Blackwell.
5. Zar, J.H. 2011. *Biostatistical Analysis*, Pearson Education Inc. New Delhi.

Web Resources

1. <https://wrrc.umass.edu/research/projects/acid-rain-monitoring-project/analysis-method-ph-and-alkalinity>
2. <https://www.youtube.com/watch?v=zXvEmlFqicw>
3. <https://www.youtube.com/watch?v=Sa0WfA9UGG0>
4. <https://www.youtube.com/watch?v=Q3il2j1jG7k>
5. <https://www.ncbi.nlm.nih.gov/>
6. <https://www.boldsystems.org/>

Pedagogy

PPT, group discussion, interaction, tutorial and virtual labs.

Rationale for Nature of the course

The students will acquire skills on water quality analysis. Students will also acquire knowledge on the data collection methods, basic and inferential statistical methods used for the biological research. They also get enlightened on the knowledge on the bioinformatics and biological databases.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

Students could learn the skills on ecology and methods used in the biophysics, biostatistics and bioinformatics will help the students to improve their skills, which further paves the way for their employability.

Course designers:

1. Dr. L. D. Devasree
2. Dr. R. Eswaran

LESSON PLAN (Total hours: 45)

Cycle	Description	Staff Name	Hrs	Mode
Experiments				
1	Quantitative measurement of Alkalinity		3	Live demonstration
2	Quantitative measurement of Hardness		3	Live demonstration
3	Measurement of water transparency using Sacchis' Disc		3	Live demonstration
4	Mounting of freshwater planktons		3	Live demonstration
5	Tabulation for a given biological data		3	Live demonstration
6	Calculation of Arithmetic Mean, Median, Mode, Range and Standard Deviation for any biological data.		3	Live demonstration
7	Correlation analysis for a biological data.		3	Live demonstration
8	Download and study at least two samples of Genome sequences from NCBI.		3	Live demonstration
Spotters				
9	GPS, Hygrometer		3	Explanation with instrument
10	Rain gauge, Ecological pyramids		3	Explanation with picture
11	Osmosis, Ramachandran plot,		3	Explanation with picture
12	BOLD, BLAST		3	Live demonstration
13	Foot and mouth diseases, Pearl Oyster		3	Explanation with picture
14	Internal Practical Test		3	
15	Summative Practical Examination			

Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the various techniques involving in Ecology, Biophysics, Biostatistics and Bioinformatics.	Up to K2
CLO 2	Describe the different water quality parameters.	Up to K3
CLO 3	Apply the knowledge to calculate the biological data.	Up to K3
CLO 4	Analyze the database of Bioinformatics.	Up to K4
CLO 5	Examine the economic important animals and their diseases.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	1	1	1	1			1	
CLO 2	1	2	3	3			3	
CLO 3	1	3	3	3			3	
CLO 4	1	3	3	3			3	
CLO 5	1	2	2	1	2	2	2	

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	2	2		2	
CLO 2	2	2		2	
CLO 3	2	2	1	3	2
CLO 4	2	2	2	2	1
CLO 5	2	2		3	3

3- Advance application; 2- Intermediate level; 1- Basic level

DEPARTMENT OF ZOOLOGY				CLASS: III B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core	20U6ZMP8	Major Practical – VIII	2	3	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

(Microbiology, Immunology and Biotechnology)

Course Objectives

By the end of the course, students will be able to:

1. Learn the techniques used in Microbiology, Immunology and Biotechnology.
2. Understand the different staining methods and identification of human blood groups.
3. Learn the isolation and separation of DNA.

S. No.	Experiments
1.	Simple staining of bacteria.
2.	Gram staining of bacteria.
3.	Hanging drop method.
4.	Blood grouping - Man.
5.	Lymphoid organs in chick
6.	Isolation of DNA
7.	Isolation of RNA
8.	Electrophoretic separation of DNA
	Spotters
	Whittaker's Five Kingdom, Bacterial growth curve Antibody structure, Double Immunodiffusion pBR 322, Gene cloning, PCR, RFLP, Dolly, Spirulina.

Books for References

1. Talwar, C.P. & Gupta, S.K. 2017. *Hand book of practical and clinical Immunology*. CBS Publishers & Distributors, New Delhi.
2. Dubey, R.C. & Maheshwari, D.K. 2010. *Practical Microbiology*, S. Chand Publishers, New Delhi.
3. Janarthanan, S. & Vincent, S. 2007. *Practical Biotechnology: Methods & Protocols*. Universities Press (India) P. Ltd. Hyderabad.

Web Resources

1. <https://www.youtube.com/watch?v=--OvDvS-Pec>
2. <https://www.youtube.com/watch?v=-jKzLLHjRfs>
3. <https://www.youtube.com/watch?v=5DbialnMSO4>
4. <https://www.youtube.com/watch?v=aS-LwdUAk4Q>
5. <https://www.youtube.com/watch?v=jFl6HmcGw9Q>

Pedagogy

PPT, group discussion, interaction, tutorial and virtual labs.

Rationale for Nature of the course

The students will acquire skills on identifying the microorganisms and blood group and the techniques used in biotechnology.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

Students could learn the skills namely, staining the bacteria, identification of blood group, extraction of DNA and RNA and electrophoretic separation of DNA. It would help their overall understanding on techniques of Microbiology, Immunology and Biotechnology that enriches their research career.

Course designers:

3. Dr. B. Latha
4. Dr. C. Selvakumar

Lecture Schedule (Total hours: 45)

Cycle	Description	Staff Name	Hrs	Mode
Experiments				
1	Simple staining of bacteria.		3	Live demonstration
2	Gram staining of bacteria.		3	Live demonstration
3	Hanging drop method.		3	Live demonstration
4	Blood grouping - Man.		3	Live demonstration
5	Lymphoid organs in chick		3	Demonstration with Picture
6	Isolation of DNA		3	Live demonstration
7	Isolation of RNA		3	Live demonstration
8	Electrophoretic separation of DNA		3	Live demonstration
Spotters				
9	Whittaker's Five Kingdom & Bacterial growth curve		3	Explanation with picture
10	Antibody structure & Double Immunodiffusion		3	Explanation with picture
11	pBR 322 & Gene cloning		3	Explanation with picture
12	PCR & RFLP		3	Explanation with instrument
13	Dolly & Spirulina		3	Explanation with picture
14	Internal Practical Test		3	
15	Summative Practical Examination			

Course Learning Outcomes:

On successful completion of the course, the student will be able to:

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the various techniques involving in Microbiology, Immunology and Biotechnology.	Up to K2
CLO 2	Describe the different staining techniques of microorganisms.	Up to K3
CLO 3	Apply the knowledge to extract the DNA and RNA from the animal tissue.	Up to K3
CLO 4	Analyze the blood group in man and lymphoid organs in chick.	Up to K4
CLO 5	Examine the electrophoretic separation of DNA and amplification of DNA using PCR.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO 1	1	1	1	1			1	
CLO 2	1	2	3	3			3	
CLO 3	1	3	3	3			3	
CLO 4	1	3	3	3			3	
CLO 5	1	2	2	1	2	2	2	

3- Advance application; 2- Intermediate level; 1- Basic level

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO 1	2	2		2	
CLO 2	2	2		2	
CLO 3	2	2	1	3	2
CLO 4	2	2	2	2	1
CLO 5	2	2		3	3

3- Advance application; 2- Intermediate level; 1- Basic level

Semester VI: Mapping of Courses with Programme Specific Outcomes

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
Microbiology & Immunology (20U6ZMC10)	3	1	2	2	2	2	3	2
Biotechnology (20U6ZMC11)	3	1	2	2	3	3	3	2
Ecology (20U6ZMC12)	3	1	3	3	2	2	2	3
Major Practical-VII	2	1	1	2	2	1	1	2
Major Practical-VIII	2	1	1	2	2	1	1	2
Vermiculture (20U6ZSM4)	3	2	2	1	3	3	2	3
Biophysics, Biostatistics & Bioinformatics (20U6ZME2)	3	2	2	1	2	2	2	3
Entomology (20U6ZME2)	2	2	3	3	2	1	1	1
Preventive and Social Medicine (20U6ZME2)	3	1	3	2	3	1	1	1
Animal Farming (20U6ZME3)	3	2	2	2	3	3	2	3
Fisheries Science (20U6ZME3)	2	1	2	2	1	2	1	2

3- Advance application; 2- Intermediate level; 1- Basic level

Semester VI: Mapping of Course Outcomes with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
20U6ZMC10	1		2					
	2		2		1			
	2	2	2	2	2		2	
	2		2		2	2		
	1		2		2	2	2	2
20U6ZMC11	3	1	2	1	2	3	3	1
	3	1	2	1	2	3	3	1
	2	1	2	1	2	3	3	1
	3	1	2	1	3	3	3	3
	3	1	2	1	3	3	3	2
20U6ZMC12	3	1	3	2	1	1	3	3
	3	1	3	3	1	1	3	2
	3	1	3	3	1	1	2	3
	2	1	2	3	1	1	2	3

	1	1	2	3	1	1	1	3
20U6ZSM4	1		1					
	2	2	2					
	2	2	2			3	2	2
	2			2	2	3	2	2
	2			2	2	3	2	2
20U6ZME2	1	1	1	1		1	1	
	1	2	2	2			2	
	1	3	3				2	
	1	3	3	2		2	2	1
	1	3	3	2		2	2	1
20U6ZME2	2	3	1	1	2	2	2	
	3	3	3	2	2	1	2	1
	2	2	3	3	2		1	1
	2	2	3	3	2		1	
	1	2	3	3	2		2	
20U6ZME2	3	1	2	1	2		1	1
	3	2	3	1	1		1	2
	3	1	3	2	3		1	1
	3	1	3	3	3		1	3
	3	2	2	3	2		1	3
20U6ZME3	2	2	1	1	2	3	2	1
	2	1	3	1	2	3	2	1
	2	1	1	3	1	3	3	2
	2	1	2	1	2	3	1	1
	3	1	2	2	3	3	2	2
20U6ZME3	1		1	1			1	1
	2	2		2			1	2
	2		2	2		2	1	2
	2		2		2	2	1	2
	1				2	2	1	
20U6ZMP7	1	1	1	1			1	
	1	2	3	3			3	
	1	3	3	3			3	
	1	3	3	3			3	
	1	2	2	1	2	2	2	
20U6ZMP8	3	2	3	1	3	2	3	1
	2	2	3	3	2	2	3	2
	3	3	3	3	1	2	3	1
	1	3	3	3	1	2	3	2
	3	2	2	1	2	2	2	3

3- Advance application; 2- Intermediate level; 1- Basic level

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Department of Zoology

Programme : B.Sc. (Zoology)

Metric and weight calculation

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U1TLA1/20U1HLA1/20U1SLA1	CLO1	0.000	0.051	0.051	0.103	0.103	1.643
	CLO2	0.000	0.103	0.103	0.154	0.103	
	CLO3	0.000	0.154	0.051	0.000	0.103	
	CLO4	0.154	0.000	0.051	0.000	0.103	
	CLO5	0.000	0.000	0.154	0.000	0.103	
	Total	0.154	0.308	0.411	0.257	0.513	
20U1NEN1	CLO1	0.000	0.103	0.154	0.103	0.000	1.797
	CLO2	0.000	0.103	0.154	0.154	0.000	
	CLO3	0.000	0.103	0.103	0.103	0.000	
	CLO4	0.000	0.103	0.103	0.103	0.000	
	CLO5	0.000	0.103	0.154	0.154	0.000	
	Total	0.000	0.513	0.668	0.616	0.000	
20U1VEN1	CLO1	0.154	0.000	0.103	0.154	0.154	2.876
	CLO2	0.154	0.000	0.103	0.154	0.154	
	CLO3	0.154	0.000	0.103	0.154	0.154	
	CLO4	0.103	0.000	0.103	0.154	0.154	
	CLO5	0.154	0.103	0.103	0.154	0.154	
	Total	0.719	0.103	0.513	0.770	0.770	
20U1ZMC1	CLO1	0.051	0.000	0.000	0.103	0.000	1.849
	CLO2	0.103	0.103	0.000	0.103	0.000	
	CLO3	0.051	0.103	0.103	0.103	0.103	
	CLO4	0.051	0.103	0.051	0.103	0.051	
	CLO5	0.103	0.103	0.051	0.154	0.154	
	Total	0.359	0.411	0.205	0.565	0.308	
20U1ZMC2	CLO1	0.051	0.000	0.000	0.000	0.000	1.797
	CLO2	0.103	0.103	0.051	0.103	0.000	
	CLO3	0.103	0.103	0.051	0.103	0.051	
	CLO4	0.103	0.103	0.103	0.103	0.000	
	CLO5	0.103	0.103	0.103	0.103	0.154	
	Total	0.462	0.411	0.308	0.411	0.205	
20U1ZMP1	CLO1	0.103	0.103	0.000	0.103	0.103	2.362
	CLO2	0.103	0.103	0.051	0.103	0.103	
	CLO3	0.103	0.154	0.103	0.154	0.103	
	CLO4	0.103	0.103	0.000	0.103	0.000	
	CLO5	0.103	0.103	0.051	0.154	0.154	
	Total	0.513	0.565	0.205	0.616	0.462	
20U1CAC1	CLO1	0.154	0.103	0.000	0.000	0.000	1.284
	CLO2	0.154	0.103	0.000	0.000	0.000	
	CLO3	0.154	0.103	0.000	0.000	0.000	
	CLO4	0.154	0.103	0.000	0.000	0.000	
	CLO5	0.154	0.103	0.000	0.000	0.000	
	Total	0.770	0.513	0.000	0.000	0.000	
20U1CAP1	CLO1	0.154	0.103	0.000	0.000	0.000	1.489
	CLO2	0.154	0.103	0.000	0.000	0.000	

	CLO3	0.154	0.103	0.000	0.000	0.000	
	CLO4	0.154	0.103	0.000	0.000	0.000	
	CLO5	0.154	0.103	0.103	0.103	0.000	
	Total	0.770	0.513	0.103	0.103	0.000	
20U2TLA2/20U2HLA2/20U2SLA2	CLO1	0.051	0.000	0.154	0.000	0.103	1.695
	CLO2	0.000	0.000	0.103	0.000	0.154	
	CLO3	0.051	0.000	0.154	0.051	0.103	
	CLO4	0.103	0.051	0.154	0.051	0.154	
	CLO5	0.000	0.000	0.154	0.051	0.051	
	Total	0.205	0.051	0.719	0.154	0.565	
20U2NENG2	CLO1	0.000	0.103	0.154	0.103	0.000	1.797
	CLO2	0.000	0.103	0.154	0.154	0.000	
	CLO3	0.000	0.103	0.103	0.103	0.000	
	CLO4	0.000	0.103	0.103	0.103	0.000	
	CLO5	0.000	0.103	0.154	0.154	0.000	
	Total	0.000	0.513	0.668	0.616	0.000	
20U2EVS1	CLO1	0.103	0.000	0.000	0.051	0.154	2.157
	CLO2	0.103	0.000	0.103	0.051	0.154	
	CLO3	0.103	0.154	0.000	0.051	0.154	
	CLO4	0.103	0.000	0.000	0.154	0.154	
	CLO5	0.103	0.154	0.000	0.154	0.154	
	Total	0.513	0.308	0.103	0.462	0.770	
20U2ZMC3	CLO1	0.103	0.103	0.051	0.103	0.000	2.413
	CLO2	0.103	0.103	0.103	0.103	0.051	
	CLO3	0.103	0.103	0.103	0.103	0.051	
	CLO4	0.103	0.103	0.103	0.103	0.154	
	CLO5	0.103	0.103	0.103	0.103	0.154	
	Total	0.513	0.513	0.462	0.513	0.411	
20U2ZMC4	CLO1	0.051	0.103	0.051	0.103	0.000	2.619
	CLO2	0.103	0.103	0.103	0.154	0.051	
	CLO3	0.051	0.154	0.103	0.154	0.103	
	CLO4	0.103	0.154	0.103	0.154	0.103	
	CLO5	0.103	0.103	0.103	0.154	0.154	
	Total	0.411	0.616	0.462	0.719	0.411	
20U2ZMP2	CLO1	0.103	0.103	0.000	0.103	0.103	2.362
	CLO2	0.103	0.103	0.051	0.103	0.103	
	CLO3	0.103	0.154	0.103	0.154	0.103	
	CLO4	0.103	0.103	0.000	0.103	0.000	
	CLO5	0.103	0.103	0.051	0.154	0.154	
	Total	0.513	0.565	0.205	0.616	0.462	
20U2CAC1	CLO1	0.154	0.103	0.000	0.000	0.000	1.284
	CLO2	0.154	0.103	0.000	0.000	0.000	
	CLO3	0.154	0.103	0.000	0.000	0.000	
	CLO4	0.154	0.103	0.000	0.000	0.000	
	CLO5	0.154	0.103	0.000	0.000	0.000	
	Total	0.770	0.513	0.000	0.000	0.000	
20U2CAP2	CLO1	0.154	0.103	0.000	0.000	0.000	1.540
	CLO2	0.154	0.103	0.000	0.000	0.000	
	CLO3	0.154	0.103	0.000	0.000	0.000	
	CLO4	0.154	0.103	0.000	0.000	0.000	
	CLO5	0.154	0.103	0.103	0.103	0.051	
	Total	0.770	0.513	0.103	0.103	0.051	
20U3TLA3/17U3HLA3/20U3SLA3	CLO1	0.000	0.051	0.051	0.103	0.103	1.643
	CLO2	0.000	0.103	0.103	0.154	0.103	
	CLO3	0.000	0.154	0.051	0.000	0.103	
	CLO4	0.154	0.000	0.051	0.000	0.103	
	CLO5	0.000	0.000	0.154	0.000	0.103	
	Total	0.154	0.308	0.411	0.257	0.513	

20U3NENG3	CLO1	0.000	0.103	0.154	0.103	0.000	1.797
	CLO2	0.000	0.103	0.154	0.154	0.000	
	CLO3	0.000	0.103	0.103	0.103	0.000	
	CLO4	0.000	0.103	0.103	0.103	0.000	
	CLO5	0.000	0.103	0.154	0.154	0.000	
	Total	0.000	0.513	0.668	0.616	0.000	
20U3ZMC5	CLO1	0.051	0.051	0.103	0.103	0.154	2.259
	CLO2	0.103	0.051	0.103	0.051	0.103	
	CLO3	0.103	0.051	0.103	0.051	0.103	
	CLO4	0.103	0.103	0.051	0.103	0.103	
	CLO5	0.051	0.051	0.154	0.103	0.154	
	Total	0.411	0.308	0.513	0.411	0.616	
20U3ZSM1	CLO1	0.051	0.051	0.051	0.051	0.103	2.259
	CLO2	0.103	0.103	0.051	0.051	0.154	
	CLO3	0.103	0.103	0.051	0.051	0.154	
	CLO4	0.103	0.154	0.051	0.051	0.154	
	CLO5	0.103	0.154	0.051	0.103	0.103	
	Total	0.462	0.565	0.257	0.308	0.668	
20U3ZMP3	CLO1	0.051	0.103	0.103	0.103	0.103	2.311
	CLO2	0.103	0.103	0.051	0.103	0.103	
	CLO3	0.051	0.103	0.103	0.103	0.051	
	CLO4	0.051	0.103	0.051	0.103	0.103	
	CLO5	0.103	0.103	0.051	0.154	0.154	
	Total	0.359	0.513	0.359	0.565	0.513	
20U3BAC1	CLO1	0.154	0.103	0.154	0.103	0.154	2.362
	CLO2	0.154	0.051	0.103	0.154	0.103	
	CLO3	0.103	0.103	0.154	0.051	0.154	
	CLO4	0.051	0.051	0.051	0.051	0.103	
	CLO5	0.051	0.051	0.051	0.051	0.051	
	Total	0.513	0.359	0.513	0.411	0.565	
20U3BAP1	CLO1	0.154	0.154	0.154	0.103	0.154	2.208
	CLO2	0.154	0.051	0.051	0.154	0.103	
	CLO3	0.051	0.103	0.103	0.051	0.103	
	CLO4	0.051	0.051	0.103	0.051	0.051	
	CLO5	0.051	0.051	0.051	0.051	0.051	
	Total	0.462	0.411	0.462	0.411	0.462	
20U4TLA4/17U4HLA4/20U4SLA4	CLO1	0.000	0.051	0.051	0.103	0.103	1.643
	CLO2	0.000	0.103	0.103	0.154	0.103	
	CLO3	0.000	0.154	0.051	0.000	0.103	
	CLO4	0.154	0.000	0.051	0.000	0.103	
	CLO5	0.000	0.000	0.154	0.000	0.103	
	Total	0.154	0.308	0.411	0.257	0.513	
20U4NEN4	CLO1	0.000	0.103	0.154	0.103	0.000	1.797
	CLO2	0.000	0.103	0.154	0.154	0.000	
	CLO3	0.000	0.103	0.103	0.103	0.000	
	CLO4	0.000	0.103	0.103	0.103	0.000	
	CLO5	0.000	0.103	0.154	0.154	0.000	
	Total	0.000	0.513	0.668	0.616	0.000	
20U4ZMC6	CLO1	0.051	0.000	0.051	0.000	0.000	1.335
	CLO2	0.051	0.000	0.103	0.000	0.000	
	CLO3	0.051	0.000	0.103	0.000	0.000	
	CLO4	0.051	0.103	0.103	0.103	0.051	
	CLO5	0.103	0.103	0.051	0.103	0.154	
	Total	0.308	0.205	0.411	0.205	0.205	
20U4ZMP4	CLO1	0.103	0.103	0.000	0.103	0.000	2.105
	CLO2	0.103	0.103	0.000	0.103	0.000	
	CLO3	0.103	0.103	0.051	0.154	0.103	
	CLO4	0.103	0.103	0.103	0.103	0.051	

	CLO5	0.103	0.103	0.000	0.154	0.154	
	Total	0.513	0.513	0.154	0.616	0.308	
20U4ZSM2	CLO1	0.103	0.103	0.051	0.154	0.103	3.286
	CLO2	0.103	0.154	0.103	0.154	0.103	
	CLO3	0.103	0.154	0.154	0.154	0.154	
	CLO4	0.103	0.154	0.154	0.154	0.154	
	CLO5	0.103	0.154	0.154	0.154	0.154	
	Total	0.513	0.719	0.616	0.770	0.668	
20U4BAC2	CLO1	0.154	0.154	0.154	0.103	0.154	2.413
	CLO2	0.154	0.051	0.051	0.154	0.154	
	CLO3	0.103	0.103	0.051	0.051	0.103	
	CLO4	0.051	0.103	0.103	0.103	0.103	
	CLO5	0.051	0.051	0.051	0.051	0.051	
	Total	0.513	0.462	0.411	0.462	0.565	
20U4BAP2	CLO1	0.154	0.154	0.154	0.103	0.154	2.208
	CLO2	0.154	0.051	0.051	0.154	0.103	
	CLO3	0.051	0.103	0.103	0.051	0.103	
	CLO4	0.051	0.051	0.103	0.051	0.051	
	CLO5	0.051	0.051	0.051	0.051	0.051	
	Total	0.462	0.411	0.462	0.411	0.462	
20U5ZMC7	CLO1	0.103	0.154	0.103	0.103	0.154	3.081
	CLO2	0.103	0.154	0.103	0.154	0.154	
	CLO3	0.103	0.103	0.103	0.154	0.103	
	CLO4	0.103	0.154	0.103	0.154	0.154	
	CLO5	0.103	0.103	0.103	0.103	0.154	
	Total	0.513	0.668	0.513	0.668	0.719	
20U5ZMC8	CLO1	0.051	0.154	0.051	0.051	0.051	2.362
	CLO2	0.051	0.154	0.103	0.103	0.103	
	CLO3	0.051	0.154	0.103	0.103	0.103	
	CLO4	0.051	0.103	0.103	0.103	0.051	
	CLO5	0.103	0.103	0.051	0.154	0.154	
	Total	0.308	0.668	0.411	0.513	0.462	
20U5ZMC9	CLO1	0.154	0.051	0.051	0.103	0.051	2.105
	CLO2	0.154	0.051	0.051	0.103	0.051	
	CLO3	0.154	0.051	0.051	0.103	0.051	
	CLO4	0.154	0.051	0.051	0.103	0.051	
	CLO5	0.154	0.051	0.051	0.103	0.103	
	Total	0.770	0.257	0.257	0.513	0.308	
20U5ZMP5	CLO1	0.154	0.103	0.154	0.103	0.103	2.619
	CLO2	0.103	0.051	0.051	0.051	0.154	
	CLO3	0.154	0.103	0.103	0.103	0.051	
	CLO4	0.051	0.051	0.051	0.154	0.103	
	CLO5	0.154	0.103	0.103	0.154	0.154	
	Total	0.616	0.411	0.462	0.565	0.565	
20U5ZMP6	CLO1	0.051	0.103	0.103	0.103	0.103	2.311
	CLO2	0.103	0.103	0.051	0.103	0.103	
	CLO3	0.051	0.103	0.103	0.103	0.051	
	CLO4	0.051	0.103	0.051	0.103	0.103	
	CLO5	0.103	0.103	0.051	0.154	0.154	
	Total	0.359	0.513	0.359	0.565	0.513	

20U5ZSM3	CLO1	0.051	0.000	0.000	0.000	0.000	1.284
	CLO2	0.051	0.103	0.103	0.051	0.103	
	CLO3	0.051	0.103	0.103	0.103	0.103	
	CLO4	0.051	0.051	0.051	0.000	0.051	
	CLO5	0.051	0.000	0.000	0.000	0.103	
	Total	0.257	0.257	0.257	0.154	0.359	
20U5ZIDC	CLO1	0.051	0.051	0.103	0.103	0.000	2.670
	CLO2	0.103	0.103	0.103	0.103	0.103	
	CLO3	0.103	0.103	0.103	0.154	0.103	
	CLO4	0.103	0.154	0.051	0.154	0.154	
	CLO5	0.103	0.154	0.103	0.154	0.154	
	Total	0.462	0.565	0.462	0.668	0.513	
20U5ZME2	CLO1	0.103	0.154	0.103	0.154	0.154	3.184
	CLO2	0.103	0.154	0.051	0.154	0.154	
	CLO3	0.103	0.103	0.103	0.154	0.154	
	CLO4	0.103	0.154	0.103	0.154	0.154	
	CLO5	0.103	0.154	0.051	0.154	0.154	
	Total	0.513	0.719	0.411	0.770	0.770	
20U6ZMC10	CLO1	0.051	0.000	0.051	0.000	0.000	1.335
	CLO2	0.051	0.000	0.103	0.000	0.000	
	CLO3	0.051	0.000	0.103	0.000	0.000	
	CLO4	0.051	0.103	0.103	0.103	0.051	
	CLO5	0.103	0.103	0.051	0.103	0.154	
	Total	0.308	0.205	0.411	0.205	0.205	
20U6ZMC11	CLO1	0.154	0.103	0.051	0.051	0.154	2.722
	CLO2	0.154	0.154	0.051	0.051	0.103	
	CLO3	0.154	0.103	0.051	0.051	0.154	
	CLO4	0.154	0.154	0.051	0.154	0.103	
	CLO5	0.154	0.154	0.051	0.051	0.154	
	Total	0.770	0.668	0.257	0.359	0.668	
20U6ZMC12	CLO1	0.154	0.103	0.051	0.051	0.051	1.951
	CLO2	0.154	0.051	0.103	0.051	0.051	
	CLO3	0.103	0.051	0.051	0.103	0.051	
	CLO4	0.154	0.051	0.051	0.103	0.051	
	CLO5	0.103	0.051	0.051	0.051	0.103	
	Total	0.668	0.308	0.308	0.359	0.308	
20U6ZMP7	CLO1	0.103	0.103	0.000	0.103	0.000	2.105
	CLO2	0.103	0.103	0.000	0.103	0.000	
	CLO3	0.103	0.103	0.051	0.154	0.103	
	CLO4	0.103	0.103	0.103	0.103	0.051	
	CLO5	0.103	0.103	0.000	0.154	0.154	
	Total	0.513	0.513	0.154	0.616	0.308	
20U6ZMP8	CLO1	0.103	0.103	0.000	0.103	0.000	2.105
	CLO2	0.103	0.103	0.000	0.103	0.000	
	CLO3	0.103	0.103	0.051	0.154	0.103	
	CLO4	0.103	0.103	0.103	0.103	0.051	
	CLO5	0.103	0.103	0.000	0.154	0.154	
	Total	0.513	0.513	0.154	0.616	0.308	
20U6ZSM4	CLO1	0.051	0.051	0.051	0.051	0.051	1.951
	CLO2	0.051	0.103	0.103	0.051	0.103	
	CLO3	0.051	0.103	0.103	0.051	0.103	
	CLO4	0.051	0.103	0.103	0.051	0.103	
	CLO5	0.103	0.103	0.103	0.051	0.103	
	Total	0.308	0.462	0.462	0.257	0.462	

20U6ZME3	CLO1	0.103	0.051	0.051	0.000	0.103	2.362
	CLO2	0.103	0.103	0.051	0.000	0.103	
	CLO3	0.103	0.103	0.154	0.051	0.051	
	CLO4	0.103	0.154	0.154	0.051	0.154	
	CLO5	0.154	0.103	0.103	0.103	0.154	
	Total	0.565	0.513	0.513	0.205	0.565	
20U6ZME4	CLO1	0.051	0.051	0.051	0.051	0.103	2.259
	CLO2	0.103	0.103	0.051	0.051	0.154	
	CLO3	0.103	0.103	0.051	0.051	0.154	
	CLO4	0.103	0.154	0.051	0.051	0.154	
	CLO5	0.103	0.154	0.051	0.103	0.103	
	Total	0.462	0.565	0.257	0.308	0.668	
	Total	20.181	20.848	17.100	20.181	18.691	97

NME COURSES

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U3ZNM1	CLO1	0.036	0.036	0.018	0.055	0.036	
	CLO2	0.036	0.036	0.018	0.036	0.018	
	CLO3	0.036	0.055	0.036	0.036	0.036	
	CLO4	0.036	0.055	0.036	0.055	0.036	
	CLO5	0.055	0.055	0.036	0.055	0.055	
	Total	0.200	0.236	0.145	0.236	0.182	1
20U4ZNM2	CLO1	0.033	0.033	0.033	0.050	0.050	
	CLO2	0.017	0.033	0.033	0.050	0.033	
	CLO3	0.033	0.033	0.033	0.050	0.050	
	CLO4	0.033	0.050	0.033	0.050	0.050	
	CLO5	0.033	0.050	0.033	0.050	0.050	
	Total	0.150	0.200	0.167	0.250	0.233	1

All the course outcomes are adequately mapped against the programme outcomes and all the programme outcomes carry adequate weight against the cumulative outcome of the programme.



DEPARTMENT OF COMPUTER SCIENCE

Revised Curriculum
(Choice Based Credit system with Outcome Based Education)
Academic Year 2020-2021 onwards

V and VI semesters (B.Sc. Computer science)
(Aided & SF stream)

Department of Computer science

(Course Structure under CBCS & OBE Pattern with effect from the Academic Year 2020-21 Onwards.)

SEMESTER-I

Part	category	Sub. code	Title of the paper	No of hours	credits	Int. marks	Ext. marks	Total marks
I	Language-1	20U1TLA1/ 20U1HLA1/ 20U1SLA1	Tamil / Hindi / Sanskrit	6	3	25	75	100
II	English-1	20U1NEN1	English-1	6	3	25	75	100
III	core-1	20U1DMC1	Programming in C	3	2	25	75	100
III	core-2	20U1DMC2	Digital computer fundamentals	3	2	25	75	100
III	Allied-1	20U1DAT1	Discrete mathematics	6	5	25	75	100
III	Practical-1	20U1DMCP1	C programming lab.	3	2	40	60	100
IV	VE & PE	20U1DVE1	Value education	3	3	25	75	100
			TOTAL	30	20			

SEMESTER - II

Part	category	Sub. code	Title of the paper	No of hours	credits	Int. marks	Ext. marks	Total marks
I	Language-2	20U2TLA2/ 20U2HLA2/ 20U2SLA2	Tamil/Hindi/Sanskrit	6	3	25	75	100
II	English2	20U2NEN2	English-1	6	3	25	75	100
III	core-3	20U2DMC3	Data structures and algorithms	3	2	25	75	100
III	core-4	20U2DMC4	Computer organization and architecture	3	2	25	75	100
III	Allied-2	20U2DAT2	Microprocessors 8086/88	6	5	25	25	100
III	Practical2	20U2DMCP2	Data structures lab using c	3	2	40	60	100
IV	EVS	20U2DES1	Environmental studies	3	3	25	75	100
			TOTAL	30	20			

SEMESTER - III

Part	category	Sub. code	Title of the paper	No of hours	credits	Int. marks	Ext. marks	Total marks
I	Language-3	20U3TLA3/ 20U3HLA3/ 20U3SLA3	Tamil /Hindi /Sanskrit	6	3	25	75	100
II	English-3	20U3NEN3	English-3	6	3	25	75	100
III	Core-5	20U3DMC5	Operating systems	5	5	25	75	100
III	SBE-1	20U3DSE1	Visual programming	2	2	25	75	100
III	Allied-3	20U3DAT3	Numerical methods	6	5	25	75	100
III	NME-1	20U3DNM1	Computer fundamentals	2	2	25	75	100
III	Core Practical-3	20U3DMCP3	Visual programming lab	3	2	40	60	100
III	Add-on course	20U3DAD1	Statistics with R Programming	--	2	50	50	100
	Self-study paper		Aptitude and Reasoning	--	2		100	100
			TOTAL	30	26			

SEMESTER - IV

Part	category	Sub. code	Title of the paper	No of hours.	credits	Int. marks	Ext. marks	Total marks
I	Language-4	20U4TLA4/ 20U4HLA4/ 20U4SLA4	Tamil/Hindi/Sanskrit	6	3	25	75	100
II	English-4	20U4NEN4	English-4 (SS)	6	3	25	75	100
III	Core-6	20U4DMC6	Linux & shell programming	5	5	25	75	100
III	SBE-2	20U4DSE2	Office automation	2	2	25	75	100
III	Allied- 4	20U4DAT4	Resource management techniques	6	5	25	75	100
III	NME-2	20U4DNM2	Introduction to Internet	2	2	25	75	100
III	Major Practical-4	20U4DMCP4	LINUX lab	3	2	40	60	100
III	Add-on course		Database Design using Microsoft Access	---	2	50	50	100
			Extension activity	---	1			
			TOTAL	30	25			

SEMESTER - V

Part	Category	Sub. code	Title of the paper	No of hours	Credits	Int. marks	Ext. marks	Total marks
III	Core-7	20U5DMC7	Programming in JAVA	5	5	25	75	100
III	Core-8	20U5DMC8	Relational Database Management systems	5	5	25	75	100
III	Core-9	20U5DMC9	Computer networks	5	5	25	75	100
III	Multi-disciplinary	20U5DMDC	E-Commerce Applications & Management	4	3	25	75	100
III	Core Elective-1	20U5DME1	Data mining and data warehouse /Programming in ASP / client server computing	3	2	25	75	100
III	SBE-3	20U5DSE3	Android programming	2	2	25	75	100
III	Practical5	20U5DMCP5	Programming in JAVA lab	3	2	40	60	100
III	Practical6	20U5DMCP6	SQL & PL/SQL lab	3	2	40	60	100
			TOTAL	30	26			

SEMESTER-VI

Part	category	Sub. Code	Title of the paper	No of hours	Credits	Int. marks	Ext. marks	Total marks
III	Core-10	20U6DMC10	Web technology	5	5	25	75	100
III	Core-11	20U6DMC11	Software engineering	5	5	25	75	100
III	Core-12	20U6DMC12	Open source technology	5	5	25	75	100
III	Core Elective-2	20U6DME2	Multimedia systems /programming in PHP /Information security	4	3	25	75	100
III	Core Elective-3	20U6DME3	Programming in python/ software testing / Internet programming	3	2	25	75	100
III	SBE-4	20U6DSE4	Distributed Programming	2	2	25	75	100
III	Practical-7	20U6DMP7	Web technology lab	3	2	40	60	100
III	Practical8	20U6DMP8	Open source technology lab	3	2	40	60	100
III	Add-on course	20U6DMPRO	Project & viva-voce		2	50	50	100
			TOTAL	30	28	26		
			GRAND TOTAL	180	141			

List of Core Elective Papers:

<u>Elective-1:</u>	<u>Elective-2 :</u>	<u>Elective -3:</u>
A. Data mining and data warehouse B. Programming in ASP C. client server computing	D. Multimedia systems E. Programming in PHP F. Information security	G. Programming in python H. Software testing I. Internet programming

Semester	Course Code	Title of the Course	Hours	Credits	Nature of Course(Employability/ Entrepreneurship/ Skill Development)				Scope of Focus (Local / National / Global developmental needs)		Percentage of Syllabus Revision /New
					Empl	Ent	Skill	Local	National	Global	
I	20U1DMC1	Programming in C	4	4			Yes			Yes	42%
	20U1DMC2	Digital computer fundamentals	4	4			Yes			Yes	38%
	20U1DAT1	Discrete mathematics	4	3			Yes			Yes	62%
	20U1DMCP1	C programming lab.	3	2			Yes			Yes	89%
II	20U2DMC3	Data structures and algorithms	4	4			Yes			Yes	68%
	20U2DMC4	Computer organisation and	4	4	Yes					Yes	32%
	20U2DAT2	Microprocessors 8086/88	4	3	Yes					Yes	0%
	20U2DMCP2	Data structures lab using c	3	2			Yes			Yes	New
III	20U3DMC5	Operating systems	5	5			Yes			Yes	New
	20U3DSM1	Visual programming	2	2	Yes					Yes	0%
	20U3DNM1	Computer Fundamentals	2	2			Yes			Yes	0%
	20U3DAT3	Numerical Methods	6	5			Yes			Yes	New
	20U3DMCP3	Visual programming lab.	3	2			Yes			Yes	0%
IV	20U4DMC6	Linux & shell programming	5				Yes			Yes	New
	20U4DSM2	Office automation	2		Yes					Yes	New
	20U4DNM2	Introduction to Internet	2				Yes			Yes	0%
	20U4DAT4	Resource management	6				Yes			Yes	0%
	20U4DMCP4	LINUX lab	3		Yes					Yes	New
V	20U5DMC7	Programming in JAVA	5	5			Yes			Yes	61%
	20U5DMC8	Relational database	5	5	Yes					Yes	53%
	20U5DMC9	Computer networks	5	5	Yes					Yes	32%
	20U5DSM3	Android programming	2	2			Yes			Yes	81%
	20U5DMCP5	JAVA programming Lab	3	2			Yes			Yes	100%
	20U5DMCP6	SQL & PL/SQL lab	3	2			Yes			Yes	33%
	20U5DMDC	E-Commerce Applications &	4	3		Yes	Yes			Yes	New
	20U5DME2	Programming in ASP	3	2			Yes			Yes	0%
		Client server computing			Yes					Yes	0%
		Data Mining & Data			Yes					Yes	4

VI	20U6DMC1	Web technology	5	5			Yes			Yes	86%
	20U6DMC1	Software Engineering	5	5	Yes					Yes	86%
	20U6DMC1	Open Source Technology	5	5			Yes			Yes	New
	20U6DME3	Multimedia systems	4	3	Yes					Yes	0%
		Programming in PHP					Yes			Yes	50%
		Information security			Yes					Yes	0%
	20U6DME4	Programming in python	3	2			Yes			Yes	New
		Software testing			Yes					Yes	New
		Internet programming					Yes			Yes	New
	20U6DSM4	Distributed programming	2	2			Yes			Yes	New
	20U6DMP7	Web technology lab	3	2			Yes			Yes	New
	20U6DMP8	Open Source Technology	3	2			Yes			Yes	New

Multi-disciplinary Course:

Multi-disciplinary approach has been introduced in the revised modern curriculum with OBE pattern as it is considered an important challenging technique. Computer science department faculty members collaborate with mathematics and commerce and will handle the curriculum which is framed as an integrated one with the components of Computer related , commerce and mathematics. Computer related contents is a prime area and remaining things will be the integrated components of both maths and commerce. The integrated contents can be very beneficial to student learners .This scheme will be offered during the Pre-final year (Vth semester) of B.Sc. Computer science degree.

Evaluation Pattern Theory subjects:

	Components	Marks	Total Marks
Internal [Formative]	Test	10	25
	Assignment	5	
	Attendance/Quiz	5	
	Quiz / Documentation / Case lets / ICT based assignments / Mini Projects	5	
External [Summative]		75	75
Total Marks			100

Question Paper pattern for External examination - Theory (75 marks)

Section		Marks
A	Multiple Choice Questions (10 X 1 mark)	10
B	Short Answer questions (5 X 2 marks)	10
C	Either or Choice questions (5 X 5 marks)	25
D	Open Choice questions – 3 out of 5 (3 X 10 Marks)	30
	Total	75

Practical Subjects:

A candidate has to prepare an Algorithm / Procedure for the questions given during the external practical examination. The following list of parameters is taken into account for the evaluation.

Total Marks: 100 (Internal: 40 marks, External: 60 Marks)

Parameters:**For Internal Marks:**

- i. Average of two tests: ----- 25
- ii. Record Note Work: ----- 10
- iii. Seminar / Quiz: ----- 5
- Total: 40 marks**

For External Marks:

- i. Aim, Procedure / Algorithm& Program: ----- 15
- ii. Coding & Compilation :----- 10
- iii. Debugging :----- 15

iv. Results : -----	10
v. Viva: -----	10
Total:	60 marks

Add-on courses

Evaluation pattern for Add-on courses:

Internal evaluation	: 50 % marks
External evaluation	: 50 %marks

Continuous Internal Assessment components	Marks
Assignment (3nos) / mini project)	20 %
Paper presentation/seminar	15 %
Quiz	15 %
Total	50%

External examination duration: 2 hours

Question paper pattern

Part-A	Multiple choice type	10 x 1 = 10 marks
Part- B	Descriptive type [4 out of 7]	4 x 10 = 40 marks

Self-study paper :

This paper can be offered by all students of second year (III semester& IV semester) identified as an advanced learners on the basis of the marks obtained in the entrance test conducted during admission in the first year. The maximum marks for this course is 100 marks.

The various parameters is taken into account for the evaluation of this self study paper are:

*Assignment -25%,	* project (or) innovative experiment -25%
*Viva-voce , paper presentation – 25%	*Internal Test – 25 %

Courses of Study with Credit Distribution

Part	Category	No. of Courses	No. of Credits
I	Language (Tamil)	4	12
II	English	3	9
III	Allied	4	20
	Core	12	48
	Core-Practical	8	16
	Elective	3	7
	Multi-disciplinary	1	3
	Skill Based Elective	4	8
IV	Non-Major Elective	2	4
Common	Value Education	1	3
	Environmental Studies	1	3
	Soft Skills (English)	1	3
V	Extension Activity	1	1
	Total	45	140

Percentage of Total Courses offered by Department to TANSCHHE Mandatory Papers

Particulars	B.Sc. (CS)
Common Courses – Other than Computer Science	5
Computer science Subjects as per TANSCHHE (25 Mandatory Papers)	26
Additional Courses offered by Department	4
Total Courses	44
Percentage of Total Courses offered by Department to TANSCHHE Mandatory Papers	74%
Department offered	26%

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core-7	20U3DMC7	Programming in JAVA	5	5	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To understand the basic programming constructs of Java Language.
- To explore the features of Java by coding.

Units	CONTENTS	Total Hours: 75	K-Level	CLO
I	Genesis of Java: Creation of Java – why java is important to internet – The Java Buzz words – An overview of Java Object Oriented Programming. Data types – Variables – Type conversion and casting – Automatic type promotion in Expressions – Strings. Arrays: One Dimensional Array – Multi Dimensional Array – Operators – Control statements.	15 hrs	Up to K2	1
II	Class Fundamentals – Declaring objects – Assigning object Reference variables – Introducing Methods – Constructors – Garbage collection – Finalize () Method – Stack class. A Closer Look at Methods and classes: Overloading Methods – Argument passing – Nested and Inner classes – String class – Using command line arguments. Inheritance Basics & Types - Method overriding – Dynamic Method Dispatch – Using Abstract class – Using final with inheritance.	15 hrs	Up to K3	2
III	Packages & Interface - Exception Handling - Creating your own Exception subclasses. Multithreaded Programming: Java Thread Model – Main Thread – Creating a Thread - Creating Multiple Threads–Using is Alive () and join () – Thread priorities – Synchronization – Inter thread Communication.	15 hrs	Up to K3	3
IV	I/O & Applets : I/O Basics Reading console Input – writing console output – The Print Writer class – Reading and Writing Files. The Applet class: - Applet Architecture – Applet Skeleton – Applet Display method – Requesting Repainting – HTML APPLET tag- Passing Parameters to Applet – Audio Clip Interface. Event Handling Mechanisms – Delegation Event Model – Event classes – Sources of Events – Event Listener Interfaces – Adapter Classes.	15 hrs	Up to K3	4

V	AWT Classes – Window fundamentals – working with Frame Windows - working with Graphic Using AWT controls: Controls fundamentals – Labels – using Buttons – Applying check Boxes – Check Box group – Choice controls – Using a Text field – Using a Text Area – Understanding Layout Managers (Flow Layout only) – Menu Bars and Menus.	15 hrs	Up to K4	5

Books for Study:

1. Herbert Schildt, “Java - The Complete Reference”, Ninth Edition, McGrawHill Education, 2014

Books for Reference :

1. E. Balagurusamy, “Programming with Java”, Tata McGraw-Hill Education India, 2014
2. Sachin Malhotra & Saurabh Choudhary, “Programming in JAVA”, 2nd Ed, Oxford Press
3. Sagayaraj, Denis, Karthik and Gajalakshmi, “JAVA Programming for Core and Advanced Learners”, 2018

Web resources:

1. <https://beginnersbook.com/java-tutorial-for-beginners-with-examples>
2. <https://www.tutorialspoint.com/java/index.htm>
3. <https://www.programiz.com/java-programming>

Rationale for Nature of the course:

JAVA programming includes concepts such as class, object and inheritance etc. It enhances the coding structure and thus it making it more reliable. Nowadays, java is the best choice for scientific and other processing.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools □ Live- demonstrations with program sample segments.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Creation of Java – why java is important to internet – The Java Buzz words – An overview of Java Object Oriented Programming. Data types	3	Chalk and talk and assignment
	– Variables – Type conversion and casting – Automatic type promotion in Expressions	4	
	Strings. Arrays: One Dimensional Array – Multi Dimensional Array	4	
	Operators – Control statements.	4	
II	Class Fundamentals – Declaring objects – Assigning object Reference variables – Introducing Methods – Constructors – Garbage collection – Finalize () Method – Stack class	4	Chalk and talk, Group discussion
	A Closer Look at Methods and classes: Overloading Methods – Argument passing – Nested and Inner classes	4	

	String class – Using command line arguments. Inheritance Basics & Types - Method overriding	4	
	Dynamic Method Dispatch – Using Abstract class – Using final with inheritance.	3	
III	Packages & Interface - Exception Handling - Creating your own Exception subclasses. Multithreaded Programming:	5	Chalk and talk, Quiz and assignment
	Java Thread Model – Main Thread – Creating a Thread	5	
	Using is Alive () and join () – Thread priorities –	5	
IV	I/O & Applets : I/O Basics Reading console Input – writing console output – The Print Writer class – Reading and Writing Files. The Applet class: - Applet Architecture	5	PPT, Chalk and talk, Quiz and assignment
	Applet Skeleton – Applet Display method – Requesting Repainting – HTML APPLET tag- Passing Parameters to Applet – Audio Clip Interface.	5	
	Event Handling Mechanisms – Delegation Event Model – Event classes – Sources of Events – Event Listener Interfaces – Adapter Classes.	5	
V	AWT Classes – Window fundamentals – working with Frame Windows - working with Graphic Using AWT controls	5	PPT, Chalk and talk, Quiz and assignment
	Controls fundamentals – Labels – using Buttons – Applying check Boxes – Check Box group – Choice controls	5	
	Using a Text field – Using a Text Area – Understanding Layout Managers (Flow Layout only) – Menu Bars and Menus.	5	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – JAVA Programming

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 4	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – JAVA Programming

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Demonstrate the principles of object oriented programming and Use simple data structures like arrays in a Java program.	Up to K2
CLO-2	Understand the concepts of Class, objects and constructors.	Up to K3
CLO-3	Acquire the knowledge of overloading and nesting of classes.	Up to K3
CLO-4	Demonstrate the design of interfacing ,exception handling and multithreading.	Up to K4
CLO-5	Understand the AWT classes and the process about working with AWT controls.	Up to K3

MAPPING OF CLOs WITH POs:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO1	S				
CLO2		M	S		
CLO3	M				
CLO4	M			S	
CLO5	M	M	M	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	1	2	3	1	1	1
CLO-3	2	1	1	1	1	2
CLO-4	2	1	1	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Dr.T.Sree Ram kumar

Prof.J.,Mayajothi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core-8	20U3DMC8	Relational Database Management systems	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To understand the basic knowledge of data models, Need of normalization and various database architecture.
- To explore the features of Relations and relational operations.

Units	CONTENTS	Total Hours: 75	K-Level	CLO
I	Introduction: Database System Applications-DBMS Vs. File System - View of Data-Data Model Database Languages - Database users and Administrators -Transaction Management - Database System Structure - Application Architecture. Data Models: Basic Concepts - Constraint- Keys- ER Diagram -Weak Entity - Extended ER Features - UML; Relational Model: Structure of Relational Databases - Relational Algebra - Views.	15 hrs	Up to K2	1
II	SQL: Background-Basic Structure-Set Operation-Aggregate Function-Null Values-Nested Sub Queries - Views - Modification of the Database - Data Definition Language - Embedded SQL - Dynamic SQL.	15 hrs	Up to K3	2
III	Advance SQL : Integrity and Security: Domain - Constraint - Referential Integrity - assertions - Triggers - Security and Authorization -Authorization in SQL - Encryption and Authentication.	15 hrs	Up to K3	3
IV	Relational Database Design: First Normal Form - Pitfalls in Relational Database Design-Functional Dependencies (Second Normal Form) - Boyce-Codd Normal form - Third Normal Form - Fourth Normal Form - Overall Database Design Process.	15 hrs	Up to K3	4
V	Transaction Management: Transaction concepts - States - Serializability. Lock based concurrency control: Locks - Granting - Two-Phase Locking protocol. Time stamp based protocol: Timestamps - Timestamp ordering protocol - Dead lock handling.	15 hrs	Up to K4	5

Books for Study:

1. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", 5th Edition McGraw-Hill, 2005.

Books for Reference :

1. Alexis Leon & Mathews Leon, "Essential of DBMS", 2nd reprint, Vijay Nicole Publications, 2009.
2. Alexis Leon & Mathews Leon, "Fundamentals of DBMS", 2nd Edition, Vijay Nicole Publications, 2014

Web resources:

1. <https://tamimdba.wordpress.com/relational-database-management-system-material/>
2. <https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm>
3. <https://www.teachmint.com/tfile/studymaterial/class-2nd/rdbms/introductiontordbmspdf/ce6d47a5-e72e-43a8-9ce7-499bdf324111>

Rationale for Nature of the course:

The relational database management system is the most widely used database system that is used across the world. As this popular and used in many areas, learning this technology will help you to get a good job position in the organization and help you to compete with others and stand in the market at the top. Relational Database Management System stores data in the form of tables. RDBMS provides Data Safety, fault tolerance , accessing and managing the data in easy manner.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Introduction: Database System Applications-DBMS Vs. File System - View of Data-Data Model Database Languages	3	Chalk and talk and assignment
	Database users and Administrators -Transaction Management - Database System Structure - Application Architecture	4	
	Data Models: Basic Concepts - Constraint- Keys- ER Diagram -Weak Entity -	4	
	Extended ER Features - UML; Relational Model: Structure of Relational Databases - Relational Algebra - Views.	4	
II	SQL: Background-Basic Structure-Set Operation-	4	Chalk and talk, Group discussion
	Aggregate Function-Null Values-Nested Sub Queries	4	
	Views - Modification of the Database – Data Definition Language	4	
	- Embedded SQL - Dynamic SQL.	3	

III	Advance SQL : Integrity and Security: Domain - Constraint -	5	Chalk and talk, Quiz and assignment
	- assertions - Triggers - Security and Authorization -	5	
	Referential Integrity Authorization in SQL - Encryption and Authentication.	5	
IV	Relational Database Design: First Normal Form -	3	PPT, Chalk and talk, Quiz and assignment
	Pitfalls in Relational Database Design-Functional Dependencies (Second Normal Form)	5	
	Boyce-Codd Normal form - Third Normal Form -	4	
	- Fourth Normal Form - Overall Database Design Process.	3	
V	Transaction Management: Transaction concepts - States - Serializability. Lock based concurrency control:	5	PPT, Chalk and talk, Quiz and assignment
	Locks - Granting - Two-Phase Locking protocol. Time stamp based protocol:	5	
	Timestamps - Timestamp ordering protocol - Dead lock handling.	5	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Relational database management systems
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)
BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Relational database management systems

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the concepts of DB structure, data models and relational algebra	Up to K2
CLO-2	Understand the basic knowledge about structured query language and its various operations	Up to K3
CLO-3	Integrate the concepts of domain and SQL authorizations.	Up to K3
CLO-4	Understand the concepts of normalizations and DB design process	Up to K4
CLO-5	Analyse the concepts of transaction and locking and lock handling	Up to K3

MAPPING OF CLOs WITH POs:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO1	S		M		
CLO2		M	S		
CLO3	M			M	
CLO4	M			S	
CLO5	M	M	M	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):
Prof.R.Uma sankari
Prof.P.Sridevi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core-9	20U3DMC9	COMPUTER NETWORKS	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To understand the concept of Computer network
- To impart knowledge about networking and inter networking devices

Units	CONTENTS	Total Hours: 75	K-Level	CLO
I	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication – Guided Transmission Media	15 hrs	Up to K2	1
II	Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.	15 hrs	Up to K3	2
III	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Bluetooth.	15 hrs	Up to K3	3
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	15 hrs	Up to K3	4
V	Transport Layer - Services - Connection Management – Addressing Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography.	15 hrs	Up to K4	5

Books for Study:

1. A. S. Tanenbaum, “Computer Networks”, 4th Edition, Prentice-Hall of India, 2008.

Books for Reference :

1. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition, 2007.
2. F. Halsall, “Data Communications, Computer Networks and Open Systems”, Pearson Education, 2008.
3. D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, PHI, 2008.
4. Lamarca, “Communication Networks”, Tata McGraw- Hill, 2002

Web resources:

1. <https://www.javatpoint.com/computer-network-tutorial>
2. <https://www.geeksforgeeks.org/computer-network-tutorials/>

Rationale for Nature of the course:

The future of computer technology is in computer networks. Global connectivity can be achieved through computer networks. Networks can enable communication for every business, education, entertainment and research purpose.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models –	3	Chalk and talk and assignment
	– Example Networks: Internet, ATM, Ethernet and Wireless LANs	4	
	Physical Layer – Theoretical Basis for Data Communication	4	
	Guided Transmission Media	4	
II	Wireless Transmission - Communication Satellites –	4	Chalk and talk, Group discussion
	Telephone System: Structure, Local Loop,	4	
	Trunks and Multiplexing and Switching. Data Link Layer:	4	
	Design Issues – Error Detection and Correction.	3	
III	Elementary Data Link Protocols - Sliding Window Protocols	5	Chalk and talk, Quiz and assignment
	Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem	5	
	— Multiple Access Protocols – Bluetooth.	5	
IV	Network Layer - Design Issues - Routing Algorithms -	5	PPT, Chalk and talk, Quiz and assignment
	Congestion Control Algorithms	5	
	IP Protocol – IP Addresses – Internet Control Protocols.	5	
V	Transport Layer - Services - Connection Management –	5	PPT, Chalk and talk, Quiz and assignment
	Addressing Establishing and Releasing a Connection – Simple Transport Protocol –	5	
	Internet Transport Protocols (ITP) - Network Security: Cryptography.	5	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Computer networks
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Computer Networks

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
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2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the basics of network and its theoretical basis of data communication	Up to K2
CLO-2	Analyse the various switching methods and its usage and process of error detection and correction process.	Up to K3
CLO-3	Understand the usage of protocols used in various layers of the network structure and its algorithm.	Up to K3
CLO-4	Understand the design issues of various layers and routing methods.	Up to K4
CLO-5	Understand the concepts of network security and cryptography	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S				
CLO2		M	S		
CLO3	M			M	
CLO4	M			S	
CLO5	M	M	M	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Er.J.Rajendran

Prof.P.Sridevi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Multi-disciplinary	20U5DMD	E-Commerce Applications & Management	3	4	25	75	100

Nature of Course			
Knowledge and skill	✓		Employability oriented
Skill oriented			Entrepreneurship oriented

COURSE OBJECTIVES :

This course is designed to

- Understand concept of E-commerce and its types
- Study the various online payment and marketing management on Web
- Understand various E-business Strategies.

Units	CONTENTS	Total Hours: 60	K-Level	CLO
I	History of E-commerce and Indian Business Context: E-Commerce -Emergence of the Internet - Emergence of the WWW - Advantages of E-Commerce -Transition to E-Commerce in India - The Internet and India - E-transition Challenges for Indian Corporate.	10 hrs	Up to K2	1
II	Business Models for E-commerce: Business Model - E-business Models Based on the Relationship of Transaction Parties - E-business Models Based on the Relationship of Transaction Types.	10 hrs	Up to K2	2
III	Enabling Technologies of the World Wide Web: World Wide Web - Internet Client-Server Applications - Networks and Internets - Software Agents -Internet Standards and Specifications - ISP.E-Marketing : Traditional Marketing - Identifying Web Presence Goals - Online Marketing - E-advertising	10 hrs	Up to K2	3
IV	Management concepts in Technology: Management-Meaning-Definition- Features – Levels of Management – Principles of Management – Functions of Management. Planning – Steps in planning-MBO. Organization-Meaning-Types of Organization Structure-Centralization and Decentralization - Delegation of Authority. Staffing – Recruitment – Selection Process. Motivation – Maslow Theory. Leadership – Leadership Styles. Control – Meaning – Steps in control – Techniques – Budget – MBE – TQM – BEP.	15 hrs	Up to K2	4
V	Decision Analysis: Decision making under conditions of certainty-Uncertainty- Decision making under conditions of Risk-Expected value criterion- Expected Opportunity Loss(EOL) criterion-Expected Value of Perfect Information(EVPI)-Expected Profit with Perfect Information(EPPI)	15 hrs	Up to K2	5

Books for Study:

1. P.T.Joseph, "E-Commerce - An Indian Perspective", 4th Edition, PHI Learning, 2012. (for Units 1, 2 and 3)
2. L.M. Prasad, **Principles and Practice of Management**, Sixth Edition, Sultan Chand & Sons, New Delhi (For Unit 4)
3. P.K.Gupta, D.S.Hira, "Problems in Operation Research", S. Chand & Company LTD., New Delhi 1991. (For Unit 5)

Books for Reference :

1. David Whiteley, "E-Commerce Strategy, Technologies and Applications", 1st Edition, Tata McGraw-Hill, 2001.
2. Kamallesh K Bajaj and Debjani Nag, "E-Commerce - The cutting edge of Business", 2nd Edition, Tata McGraw-Hill Education, 2005.
3. R.N. Gupta, **Principles of Management**, S. Chand & Company Pvt. Ltd. New Delhi.
4. Dinkar Pagare, **Business Management**, Sultan Chand & Sons, New Delhi.
5. Kanti Swarup, P.K Gupta, Man Mohan, "Operations Research", Sultan Chand & Sons, New Delhi 1977.

Web resources:

1. https://www.tutorialspoint.com/e_commerce/index.htm
2. <https://blog.templatetoaster.com/what-is-ecommerce/>

Rationale for Nature of the course:

E-commerce has simplified sales and marketing as salespeople can complete sales online, saving time, increasing revenue and enhancing efficiency. Execution of online business transactions that are fast and cost effective. E-Commerce in education is not confined to students only, teachers can also benefit themselves through this medium.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	History of E-commerce and Indian Business Context: E-Commerce -Emergence of the Internet - -	3	Chalk and talk and assignment
	Emergence of the WWW - Advantages of E-Commerce - Transition to E-Commerce in India	4	
	The Internet and India - E-transition Challenges for Indian Corporate.	3	
II	Business Models for E-commerce: Business Model -	3	Chalk and talk, Group discussion
	- E-business Models Based on the Relationship of Transaction Types.	3	

	E-business Models Based on the Relationship of Transaction Parties	4	
III	Enabling Technologies of the World Wide Web: World Wide Web - Internet Client-Server Applications	3	Chalk and talk, Quiz and assignment
	Networks and Internets - Software Agents -Internet Standards and Specifications - ISP	4	
	-E-Marketing : Traditional Marketing - Identifying Web Presence Goals - Online Marketing - E-advertising	3	
IV	Management–Meaning-Definition– Features – Levels of Management – Principles of Management – Functions of Management. Planning – Steps in planning–MBO.	5	PPT, Chalk and talk, Quiz and assignment
	Organization–Meaning–Types of Organization Structure– Centralization and Decentralization - Delegation of Authority. Staffing – Recruitment – Selection Process.	5	
	Motivation – Maslow Theory. Leadership – Leadership Styles. Control – Meaning – Steps in control – Techniques – Budget – MBE – TQM – BEP.	5	
V	Decision making under conditions of certainty-Uncertainty- Decision making under conditions of Risk	5	PPT, Chalk and talk, Quiz and assignment
	Expected value criterion- Expected Opportunity Loss(EOL) criterion-	5	
	Expected Value of Perfect Information (EVPI)-Expected Profit with Perfect Information(EPPI)	5	

Continuous Internal Assessment (CIA): 25 Marks

Components	Marks	K – Level
Test (Average of two tests) (Conducted for 40 marks and converted into 10 marks)	10	(Refer Next Table)
Assignment	5	K2
Seminar	5	K2
Quiz	5	K2
Total	25	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – E-Commerce Applications & Management
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)
BLUE PRINT FOR INTERNAL ASSESSMENT – I

S.No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 4	Up to K 2	2	K1	2 (K2&K2)	2(K2)
2.	CLO 5	Up to K 2	1	K2	2 (K2&K2)	1(K2)
No. of Questions to be asked			3		4	3
No. of Questions to be answered			3		2	2
Marks for each Question			2		7	10
Total Marks for each Section			6		14	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 4	Up to K2	2	K1	2 (K2&K2)	2(K2)
2.	CLO 5	Up to K2	1	K2	2 (K2&K2)	1(K2)
No. of Questions to be asked			3		4	3
No. of Questions to be answered			3		2	2
Marks for each Question			2		7	10
Total Marks for each Section			6		14	20

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – E-Commerce Applications & Management
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)		Section C (Open Choice)
			Short Answers				
			No. of Questions	K-Level	No. of Questions	K-Level	
1	CLO 1	Up to K-2	1	K1	1	K2 & K2	1(K2)
2	CLO 2	Up to K-2	1	K2	1	K2 & K2	1(K2)
3	CLO 3	Up to K-2	1	K2	1	K2 & K2	1(K2)
4	CLO 4	Up to K-2	1	K1	1	K2 & K2	1(K2)
5	CLO 5	Up to K-2	1	K2	1	K2 & K2	1(K2)
No. of Questions to be asked			5		10		5
No. of Questions to be answered			5		5		3
Marks for each Question			2		7		10
Total Marks for each Section			10		35		30

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	10	---	---	10	7.69	8
K2	---	70	50	120	92.31	92
Total Marks	10	70	50	130	100.00	100%

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the basic idea and evolution of e-commerce	K1,K2
CLO-2	Understand the various business models for ecommerce and their relationships	K1, K2
CLO-3	Identify the technologies of the ecommerce activities and their goals	K1, K2
CLO-4	Analyse the online commercial and management activities	K1, K2
CLO-5	Understand the information systems and decision making on various applications of e-commerce.	K1, K2

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	1	1	2		
CLO2		2	2		
CLO3	2	1		1	
CLO4	2			1	1
CLO5	2	1		1	2

1- Basic Level

2-Intermediate Level

3-Advanced Level

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	2	1	1	2	1	1
CLO-2	2	2	2	1	1	1
CLO-3	2	2	1	1	1	2
CLO-4	2	2	2	1	2	1
CLO-5	2	2	2	2	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

1. Prof.J.Maya jothi ,Asst.Prof, Dept of CS
2. Prof. P.Sridevi Asst.Prof, Dept of CS
3. Dr.C.Thangapandi Assoc.Prof., Dept of Maths
4. Dr.R.Chitra Co-ordinator, Dept of Maths & Statistics
5. Dr.A.Mayil Murugan Assoc.Prof. & Head Dept of Commerce
6. Dr. Vennila Asst.Prof. Dept of Commerce

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Elective-1	20U5DME1(A)	Data mining and data warehouse	2	3	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To introduce the basic concepts and techniques of Data Mining
- To study the basic concepts of cluster analysis
- To study a set of typical clustering methodologies, algorithms, and applications

Units	CONTENTS	Total Hours: 60	K-Level	CLO
I	Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Pre-processing : Pre-processing the Data – Data cleaning – Data Integration and Transformation – Data Reduction	12 hrs	Up to K2	1
II	Data Mining, Primitives, Languages and System Architecture: Data Mining –Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures.	12 hrs	Up to K3	2
III	Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases – Multi dimension Association Rules from Relational Database and Data Warehouses.	12 hrs	Up to K3	3
IV	Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation. Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy.	12 hrs	Up to K3	4
V	Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Partitioning Methods – Hierarchical Methods-Density Based Methods – GRID Based Method – Model based Clustering Method	12 hrs	Up to K4	5

Books for Study:

1. J.Han and M. Kamber, “Data Mining Concepts and Techniques”, 2001, Harcourt India Pvt. Ltd, New Delhi.

Books for Reference :

1. K.P. Soman , Shyam Diwakar, V.Ajay “Insight into Data Mining Theory and Practice “ , Prentice Hall of India Pvt. Ltd, New Delhi

Web resources:

1. <https://www.tutorialspoint.com/dwh/index.htm>
2. <https://www.guru99.com/data-warehousing-tutorial.html>
3. <https://docs.oracle.com/database/121/DWHSG/concept.htm#DWHSG-GUID-452FBA23-6976-4590-AA41-1369647AD14D>

Rationale for Nature of the course:

Data mining improves the speed and efficiency of accessing various data sets and makes it easier for decision making. Data mining is considered for process of extracting useful data from very big set of data.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing–	4	Chalk and talk and assignment
	– Data Pre-processing : Pre-processing the Data – Data cleaning	4	
	Data Integration and Transformation – Data Reduction	4	
II	Data Mining, Primitives, Languages and System Architecture: Data Mining –Primitives –	4	Chalk and talk, Group discussion
	Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept	4	
	Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures.	4	
III	Mining Association Rules: Basic Concepts – Single Dimensional Boolean	4	Chalk and talk, Quiz and assignment
	Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases	4	
	Multi dimension Association Rules from Relational Database and Data Warehouses.	4	
IV	Classification and Prediction: Introduction – Issues – Decision Tree Induction –	4	PPT, Chalk and talk, Quiz and assignment
	Bayesian Classification – Classification of Back Propagation.	4	

	Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy.	4	
V	Cluster Analysis: Introduction – Types of Data in Cluster Analysis,	4	PPT, Chalk and talk, Quiz and assignment
	Petitioning Methods – Hierarchical Methods-Density Based Methods	4	
	– GRID Based Method – Model based Clustering Method	4	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Data mining and data warehouse

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Data mining and data warehouse

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Identify the scope and necessity of Data Mining and Warehousing	Up to K2
CLO-2	Understand data quality and methods and techniques for pre-processing of data	Up to K3
CLO-3	Analyse the patterns that can be discovered by classification and clustering	Up to K3
CLO-4	Understand data mining techniques clustering and association rule mining	Up to K4
CLO-5	Identify complex cluster data analysis methods	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	S		
CLO3	M			M	
CLO4	M			M	
CLO5	M	M	S	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):**Prof.R.Umasankari****Dr.T.Sree ram kumar**

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Elective-1	20U5DME1(B)	Programming in ASP	2	3	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To impart the knowledge of Active server pages.
- Learning the concept and operations of ASP & ADO objects

Units	CONTENTS	Total Hours: 45	K-Level	CLO
I	Need for active server pages - Automated Development - ASP Objects - ADO Objects - Asp Components - Relational Databases and other Data sources - Developing Online Applications - Client/Server or tiered Applications - Virtual Directories - The Website as Communications Channel - Development Issues - ASP and Web programming Basics: Website Coding languages.	9 hrs	Up to K2	1
II	Web-Based Communications- The Request Object- Collections-Accessing values from Forms or URL's- The Server Variables Collection- The Cookies Collection- The Client Certificate Collection-The Response Object-Response Object Collections-Response Object Properties-Response Object Methods - Writing Data to Browser - Redirecting Browser. The server object : Server object - The ASP error object-The application and session objects.	9 hrs	Up to K3	2
III	The scripting Object Model: Creating Objects-The Dictionary Object- The scripting file system Object-The Drive Object-The folder Object-The file Object-The Scripting Text stream Object. Major Active Server Components: Creating Server Components with ASP-The Ad Rotator Component-The Browser Capabilities Component-The Content Linking Component-The Content Rotator Component- More Active Server components.	9 hrs	Up to K3	3
IV	Interactivity and Latency: Optimizing Database interactions- The Connection Object - Advanced Error-Handling Techniques- The command Object- Recordset cursors- Recordset locking- Stored Procedures-The parameters Collection.	9 hrs	Up to K3	4
V	The Recordset Object-Recordset Methods and Properties- Recordset Navigation and Manipulation Operations-The Stream and Record Objects: Record Object Properties and Methods- Stream Object Properties and Methods.	9 hrs	Up to K4	5

Books for Study:

1. “Asp 3.0 a beginner’s Guide” – Dave Mercer –TMH.

Books for Reference :

1. “Beginning ASP 3.0” – Chris Ullman, Wrox Publications.
2. “Designing Active Server Pages” – Scott Mitchell - O’REILLY Publications.
3. “Master Active server Pages 3” –Russell Jones - Sybex Publications

Web resources:

1. <https://www.w3schools.com/asp/default.ASP>
2. <https://www.tutorialspoint.com/asp.net/index.htm>
3. <https://www.guru99.com/asp-net-tutorial.html>

Rationale for Nature of the course:

ASP is designed with built-in scalability features. This helps developers to easily manage sessions and events across the variety of servers. Features such as process configuration and pipeline optimization are immensely facilitated by ASP. With data-validation and authentication being one of the strong domains of ASP.NET, it’s a highly reliable development system. The streamlined components help the program automatically detect errors.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Need for active server pages - Automated Development - ASP Objects - ADO Objects - Asp Components - -	3	Chalk and talk and assignment
	Relational Databases and other Data sources - Developing Online Applications - Client/Server or tiered Applications - Virtual Directories	3	
	The Website as Communications Channel - Development Issues - ASP and Web programming Basics: Website Coding languages.	3	
II	Web-Based Communications- The Request Object- Collections-Accessing values from Forms or URL’s- The Server Variables Collection- -	3	Chalk and talk, Group discussion
	The Cookies Collection- The Client Certificate Collection- The Response Object-Response Object Collections- Response Object Properties-Response Object Methods	3	
	Writing Data to Browser - Redirecting Browser. The server object : Server object - The ASP error object-The application and session objects.	3	

III	The scripting Object Model: Creating Objects-The Dictionary Object- The scripting file system Object-The Drive Object-The folder Object-The file Object- -	3	Chalk and talk, Quiz and assignment
	The Scripting Text stream Object. Major Active Server Components: Creating Server Components with ASP-The Ad Rotator Component	3	
	The Browser Capabilities Component-The Content Linking Component-The Content Rotator Component- More Active Server components.	3	
IV	Interactivity and Latency: Optimizing Database interactions- The Connection Object - -	3	PPT, Chalk and talk, Quiz and assignment
	Advanced Error-Handling Techniques-The command Object	3	
	Recordset cursors- Recordset locking-Stored Procedures-The parameters Collection.	3	
V	The Recordset Object-Recordset Methods and Properties-	3	PPT, Chalk and talk, Quiz and assignment
	Recordset Navigation and Manipulation Operations-The Stream and Record Objects:	3	
	Record Object Properties and Methods-Stream Object Properties and Methods.	3	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Programming in ASP

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Programming in ASP

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the basic concept of server side scripting language.	Up to K2
CLO-2	Identify the importance and full usage of various objects	Up to K3
CLO-3	Understand the components of ASP and its scripting models	Up to K3
CLO-4	Develop the procedures for error handling and stored procedures	Up to K4
CLO-5	Understand the concepts of stream object and its options	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	1	1		2	3
CLO2		2	2		
CLO3	2			1	3
CLO4	2		2	1	
CLO5	2	2	2	1	2

1- Basic Level

2-Intermediate Level

3-Advanced Level

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):**Er.J.Rajendran****Prof.P.Sridevi**

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Elective-1	20U5DME1(C)	Client / Server computing	2	3	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To impart the knowledge of Client server technologies.
- Learning the concept and operations of various application development tools.

Units	CONTENTS	Total Hours: 45	K-Level	CLO
I	Overview of Client/Server Computing - Evolution of Client/Server Computing - Overview of Client/Server application - Understanding Client/Server computing.	9 hrs	Up to K2	1
II	Client Hardware and Software - Client Software Products - Client Requirements.	9 hrs	Up to K3	2
III	Server Hardware - Server Environment - Server Operating systems - Server Requirements - Server data management and access tools.	9 hrs	Up to K3	3
IV	Overview of Networking - LAN Hardware & software - Development methodology	9 hrs	Up to K3	4
V	Application Development tools - Managing the production environment - Production requirements - Future trends.	9 hrs	Up to K4	5

Books for Study:

1. "Client/Server Computing" - Dawna Travis Dewire – McGraw-Hill International Editions.

Books for Reference :

1. "Client/Server Computing" - Patrick Smith & Steve Guengerich – PHI – II Edition.
2. "The Essential Client/ Server survival Guide " – Robert Orfali, Dan Harkey, Jeri Edwards-II Edition – Galgotia publication.

Web resources:

1. <https://www.tutorialspoint.com/Client-Server-Computing>
2. <https://www.geeksforgeeks.org/client-server-model/>

Rationale for Nature of the course:

A client-server network is designed for end-users, called clients, to access resources such as files, songs, video collections, or some other service from a central computer called a server. The client and server should follow a common communication protocol so they can easily interact with each other. All the communication protocols are available at the application layer.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Overview of Client/Server Computing - Evolution of Client/Server Computing - -	3	Chalk and talk and assignment
	Overview of Client/Server application	3	
	Understanding Client/Server computing.	3	
II	Client Hardware and Software -.	3	Chalk and talk, Group discussion
	Client Software Products	3	
	- Client Requirements	3	
III	Server Hardware - Server Environment - -	3	Chalk and talk, Quiz and assignment
	Server Operating systems - Server Requirements	3	
	Server data management and access tools.	3	
IV	Overview of Networking -	3	PPT, Chalk and talk, Quiz and assignment
	LAN Hardware & software	3	
	- Development methodology	3	
V	Application Development tools -	3	PPT, Chalk and talk, Quiz and assignment
	Managing the production environment -	3	
	Production requirements - Future trends.	3	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Client / server computing
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Client / server computing

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the overview and evolution of Client server computing	Up to K2
CLO-2	Understand the client server components and its requirement while creating its architecture	Up to K3
CLO-3	Analyse the server hardware and environment and server operating systems	Up to K3
CLO-4	Understand the overview of networking and LAN hardware and software	Up to K4
CLO-5	Describe the applications of c/s and future trends of C/S	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	1			M	S
CLO2		2	2		
CLO3	2			1	
CLO4	2			1	2
CLO5	2	1	2	1	2

1- Basic Level

2-Intermediate level

3-Advanced Level

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Prof.P.Sridevi

Er.J.Rajendran

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	SBE-3	20U5DSE3	Android Programming	2	2	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To introduce the knowledge on the android application development.
- To study the SQLite Database

Units	CONTENTS	Total Hours: 30	K-Level	CLO
I	Introduction - History about Android operating system - Android program structure - User interface - Building blocks of User interface - Android Layout types - Layout attributes - Toasts - Activity.	6 hrs	Up to K2	1
II	Dialogs - Intent - types of intent - Explicit and Implicit intent - Intent data transfer from one activity to another - Android switch button.	6 hrs	Up to K3	2
III	Android life cycle: Android Activity life cycle - menus - menu Activity -Synchronous Task - RecyclerView - Broadcast receiver and Notification.	6 hrs	Up to K3	3
IV	Shared preferences - sqlite Database - Alarm manager - alarm Types - Android services.	6 hrs	Up to K3	4
V	Testing Activity - Publishing App - steps of Publishing App.	6 hrs	Up to K4	5

Books for Study:

- 1."Android For Beginners " Pratiyash Guleria, BPB publications.

Books for Reference :

1. "Android programming for Beginners " - By John Horton, Packt
2. "Android system programming " By Roger Ye, Packt

Web resources:

1. <https://www.credencys.com/blog/android-app-development-tutorials/>
2. <https://hackr.io/tutorials/learn-android-development>
3. <https://developer.android.com/courses>

Rationale for Nature of the course:

Android is an open-source platform that has access to everything you need and you may create anything you want. The scope of development in Android programming is getting smarter with smartphones. Hence, most of the business and web development companies prefer working with open source technologies.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Introduction - History about Android operating system - Android program structure -	2	Chalk and talk and assignment
	User interface - Building blocks of User interface	2	
	- Android Layout types - Layout attributes - Toasts - Activity.	2	
II	Dialogs - Intent - types of intent -	2	Chalk and talk, Group discussion
	- Explicit and Implicit intent - Intent data transfer from one activity to another	2	
	Android switch button.	2	
III	Android life cycle: Android Activity life cycle - menus - -	2	Chalk and talk, Quiz and assignment
	menu Activity - Synchronous Task	2	
	Recycler view - Broadcast receiver and Notification.	2	
IV	Shared preferences - sqlite Database	2	PPT, Chalk and talk, Quiz and assignment
	- Alarm manager - alarm Types	2	
	- Android services.	2	
V	Testing Activity -	2	PPT, Chalk and talk, Quiz and assignment
	Publishing App	2	
	steps of Publishing App	2	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Android Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)
BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Android Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the history and implementation of Android program and its layouts.	Up to K2
CLO-2	Impart the knowledge of various intent and transfer from one to another dialogs.	Up to K3
CLO-3	Understand the android activity life cycle and synchronous task	Up to K3
CLO-4	Identify the importance of SQLite and android services	Up to K4
CLO-5	Develop the activity related with publishing and details about publishing App.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		S	M		
CLO3	M			S	
CLO4	M			M	
CLO5	M	M	S	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Er.J.Rajendran

Prof.J.Mayajothi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	practical-5	20U5DMCP5	Programming in JAVA lab	2	3	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

- To be knowledgeable enough about basic Java language syntax and semantics to be able to successfully read and write Java computer programs;
- To implement interfaces, inheritance, and polymorphism as programming techniques and apply exceptions handling.

No.	List of Programmes
1	Define a class called Student with the attributes name, reg_number and marks obtained in four subjects(m1,m2,m3,m4).Write a suitable constructor and methods to find the total mark obtained by the student and display the details of the student.
2	Write a Java program to find the area of a square, rectangle and triangle by (i) Overloading Constructor (ii) Overloading Method.
3	Write a java program to add two complex numbers. [Use passing object as argument and return object
4	Define a class called Student super with data members name, roll number and age. Write a suitable constructor and a method output () to display the details.
5	. Derive another class Student from Student super with data members height and weight. Write a constructor and a method output () to display the details which overrides the super class method output().[Apply method Overriding concept.
6	Write a java program to create an interface called Demo, which contains a double type constant, and a method called area () with one double type argument. Implement the interface to find the area of a circle.
7	Write a java program to create a thread using Thread class.
8	Demonstrate Java inheritance using extends keyword.
9	Create an applet with four Checkboxes with labels MARUTI-800, ZEN, ALTO and ESTEEM and a Text area object. The program must display the details of the car while clicking a particular Checkbox.
10	Write a Java program to throw the following exception, 1) Negative Array Size 2) Array Index out of Bounds – Computer Science UG

11	Write a java program to create a file menu with option New, Save and Close, Edit menu with option cut, copy, and paste.
12	Write a java programming to illustrate Mouse Event Handling

Rationale for the nature of the course:

This lab helps to refresh students' knowledge of Java programming, and helps to explore the usage of this language to develop many application software. The portability of Java contributes to its wide use and popularity, but there are other reasons why software developers continue to choose Java. Since it is an object-oriented language; it's robust, secure and relatively simpler and easier to learn than languages such as C and C++.

Activities having direct bearing on Skill development / Employability /Entrepreneurship:

- Practising to solve the problem by writing programmes.
- Writing algorithm for various programmes for solving.
- Hands on training.

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	understand the basics of JAVA and its operators	Up to K2
CLO-2	Demonstrate the thread concepts and familiarize about thread class	Up to K4
CLO-3	Familiarize java interface programmes	Up to K3
CLO-4	Demonstrate java inheritance using the keywords	Up to K4
CLO-5	Understand the concepts of event handling.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	S		
CLO3	M			S	
CLO4	M			M	
CLO5	M	M	M	S	S

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcome s	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	2	1	1	1
CLO-2	1	2	2	1	1	1
CLO-3	2	1	2	1	1	2
CLO-4	2	1	2	1	1	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Dr.T.Sree ram kumar

Prof.J.Mayajothi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	practical-6	20U5DMCP6	SQL & PL/SQL Lab	2	3	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

- Study the various DDL, DML commands.
- Write queries in SQL to retrieve any type of information from a data base.

No.	List of Programmes
	Demonstrate the following SQL commands and can take any back end RDBMS system for implementation purpose.
1	Data Definition of Base Tables.
2	DDL with Primary key constraints
3	DDL with constraints and verification by insert command
4	Data Manipulation of Base Tables and Views
5	Demonstrate the Query commands
6	Write a PL/SQL code block that will accept an account number from the user and debit an amount of Rs. 2000 from the account if the account has a minimum balance of 500 after the amount is debited. The Process is to be fired on the Accounts table.
7	Write a PL/SQL code block to calculate the area of the circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in a table Areas. Areas – radius, area.
8	Write a PL/SQL block of code for reversing a number. (Example : 1234 as 4321).
9	Create a transparent audit system for a table Client_master (client_no, name, address, Bal_due). The system must keep track of the records that are being deleted or updated. The functionality being when a record is deleted or modified the original record details and the date of operation are stored in the audit client (client_no, name, bal_due, operation, userid, update) table, then the delete or update is allowed to go through.

Rationale for the nature of the course:

The purpose of PL/SQL is to combine database language and procedural programming language. We have included this lab for those (beginner to intermediate) who are familiar with SQL and Oracle. Exercises are designed to enhance your ability to write well-structured PL/SQL programs. Hope, these exercises help you to improve your PL/SQL query skills.

Activities having direct bearing on Skill development / Employability /Entrepreneurship:

- Practising to solve the problem by writing programmes.
- Writing algorithm for various programmes for solving.
- Hands on training.

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Design database schema with normalization and relationships between the tables	Up to K2
CLO-2	Write SQL queries to user specifications	Up to K4
CLO-3	Develop triggers , procedures in PL/SQL programs in oracle.	Up to K3
CLO-4	Prepare the report with various options described in the database using queries.	Up to K4
CLO-5	Develop programme with various business related application.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			S	
CLO2		M	S		
CLO3	M			S	
CLO4	M		S	S	
CLO5	M	M	M	S	S

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcome s	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	2	1	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	2	2	1	1	2
CLO-4	2	2	2	1	1	1
CLO-5	2	1	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Prof.P.Sridevi

Prof.R.Umasankari

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core-10	20U6DMC10	Web Technology	5	5	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- Study the various HTML tags and design simple web pages
- To study the scripting language Java Script

Units	CONTENTS	Total Hours: 75	K-Level	CLO
I	Structuring Documents for the Web: Introducing HTML and XHTML, Basic Text Formatting, Presentational Elements, Phrase Elements, Lists, Editing Text, Core Elements and Attributes, Attribute Groups. Links and Navigation: Basic Links, Creating Links with the <a> Element, Advanced E- mail Links. Images, Audio, and Video: Adding Images Using the Element, Using Images as Links Image Maps, Choosing the Right Image Format, Adding Flash, Video and Audio to your web pages.	15 hrs	Up to K2	1
II	Tables: Introducing Tables, Grouping Section of a Table, Nested Tables, Accessing Tables. Forms: Introducing Forms, Form Controls, Sending Form Data to the Server. Frames: Introducing Frameset, <frame> Element, Creating Links Between Frames, Setting a Default Target Frame Using <base> Element, Nested Framesets, Inline or Floating Frames with <iframe>.	15 hrs	Up to K3	2
III	Cascading Style Sheets: Introducing CSS, Where you can Add CSS Rules. CSS Properties: Controlling Text, Text Formatting, Text Pseudo Classes, Selectors, Lengths, Introducing the Box Model. More Cascading Style Sheets: Links, Lists, Tables, Outlines, The :focus and :activate Pseudo classes Generated Content, Miscellaneous Properties, Additional Rules, Positioning and Layout wit, Page Layout CSS , Design Issues.	15 hrs	Up to K3	3
IV	Java Script: How to Add Script to Your Pages, Variables and Data Types – Statements and Operators, Control Structures, Conditional Statements, Loop Statements – Functions - Message box, Dialog Boxes, Alert Boxes, Confirm Boxes, Prompt Boxes.	15 hrs	Up to K3	4
V	Working with JavaScript: Practical Tips for Writing Scripts, JavaScript Objects: Window Object - Document object - Browser Object - Form Object - Navigator object Screen object - Events, Event Handlers, Forms – Validations, Form Enhancements, JavaScript Libraries.	15 hrs	Up to K4	5

Books for Study:

1. Jon Duckett, Beginning HTML, XHTML, CSS and Java script , Wiley Publishing

Books for Reference :

1. Chris Bates, “Web Programming”, Wiley Publishing 3d Edition.

2. M. Srinivasan, “Web Technology: Theory and Practice”, Pearson Publication

Web resources:

1. <https://www.w3schools.com/>
2. <https://www.geeksforgeeks.org/web-technology/>
3. <https://www.tutorialride.com/web-technologies.htm>

Rationale for Nature of the course:

Web technology refers to the means by which computers communicate with each other using markup languages and multimedia packages. It gives us a way to interact with hosted information, like websites. Web technology involves the use of hypertext markup language (HTML) and cascading style sheets (CSS). Web technologies allow companies to design a certain image and to attract them involving in exploring the ideas.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Structuring Documents for the Web: Introducing HTML and XHTML, Basic Text Formatting, Presentational Elements,	3	Chalk and talk and assignment
	Phrase Elements, Lists, Editing Text, Core Elements and Attributes, Attribute Groups. Links and Navigation: Basic Links,	4	
	Creating Links with the <a> Element, Advanced E- mail Links. Images, Audio, and Video: Adding Images Using the Element, Using Images as Links Image Maps,	4	
	Choosing the Right Image Format, Adding Flash, Video and Audio to your web pages.	4	
II	Tables: Introducing Tables, Grouping Section of a Table, Nested Tables, Accessing Tables.	4	Chalk and talk, Group discussion
	Forms: Introducing Forms, Form Controls, Sending Form Data to the Server.	4	
	Frames: Introducing Frameset, <frame> Element, Creating Links Between Frames,	4	
	Setting a Default Target Frame Using <base> Element, Nested Framesets, Inline or Floating Frames with <iframe>.	3	

III	Cascading Style Sheets: Introducing CSS, Where you can Add CSS Rules. CSS Properties: Controlling Text, Text Formatting,	5	Chalk and talk, Quiz and assignment
	Text Pseudo Classes, Selectors, Lengths, Introducing the Box Model. More Cascading Style Sheets: Links, Lists, Tables, Outlines,	5	
	The :focus and :activate Pseudo classes Generated Content, Miscellaneous Properties, Additional Rules, Positioning and Layout wit, Page Layout CSS , Design Issues.	5	
IV	Java Script: How to Add Script to Your Pages, Variables and Data Types –Statements and Operators,	5	PPT, Chalk and talk, Quiz and assignment
	Control Structures, Conditional Statements, Loop Statements –	5	
	Functions - Message box, Dialog Boxes, Alert Boxes, Confirm Boxes, Prompt Boxes.	5	
V	Working with JavaScript: Practical Tips for Writing Scripts, JavaScript Objects: Window Object - Document object -	5	PPT, Chalk and talk, Quiz and assignment
	Browser Object - Form Object - Navigator object Screen object - Events, Event Handlers,	5	
	Forms – Validations, Form Enhancements, JavaScript Libraries.	5	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Web Technology

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Web Technology

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand operators, identifiers, variables, arrays, control structures, functions and objects in XHTML	Up to K2
CLO-2	Understand the concepts of forms control and tables.	Up to K3
CLO-3	Develop hands on experience using HTML	Up to K3
CLO-4	Understand arrays, control structures, functions and objects in JavaScript.	Up to K4
CLO-5	Analyse the fundamentals of browsers objects and JavaScript libraries	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		S	M		
CLO3	M			S	
CLO4	M			S	
CLO5	M	M	S	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Prof.R.Umasankari

Er.J.Rajendran

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core-11	20U6DMC11	Software engineering	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To understand the software engineering concepts.
- Understand the coding, testing and user interface design
- Design, develop the software projects and software reliability and quality

Units	CONTENTS	Total Hours: 75	K-Level	CLO
I	Introduction - Software Engineering Discipline - Evolution and Impact -Programs Vs Software Products. Software Life Cycle Models: Use of a Life Cycle Models - Classical Waterfall Model -Iterative Waterfall Model - Prototyping Model - Evolutionary Model - Spiral Model. Software Project Management: Responsibilities of a Software Project Manager - Project Planning - Metrics for Project Size Estimation - Project Estimation Techniques -Risk Management.	15 hrs	Up to K2	1
II	Requirements Analysis and Specification: Requirements Gathering and Analysis -Software Requirements Specification (SRS) - Formal System Development Techniques. Software Design: Characteristics of a Good Software Design - Cohesion and Coupling -Neat Arrangement - Software Design Approaches.	15 hrs	Up to K3	2
III	Function-Oriented Software Design: Overview of SA/SD Methodology -Structured Analysis - Data Flow Diagrams (DFDs).Object Modeling Using UML: Overview of Object-Oriented Concepts - UML Diagrams - Use Case Model -Class Diagrams - Interaction Diagrams - Activity Diagrams - State Chart Diagram.	15 hrs	Up to K3	3
IV	User Interface Design: Characteristics of a Good User Interface - Basic Concepts - Types of User Interfaces - Component-Based GUI Development; Coding and Testing: Coding - Testing - UNIT Testing - Black-Box Testing -White-Box Testing - Debugging -Integration Testing - System Testing.	15 hrs	Up to K3	4
V	Software Reliability and Quality Management: Software Reliability - Statistical Testing -Software Quality - Software Quality Management System - ISO 9000.Computer Aided Software Engineering: CASE Environment - CASE support in Software Life Cycle - Characteristics of CASE Tools - Architecture of a CASE Environment. Software Maintenance:	15 hrs	Up to K4	5

	Characteristics of Software Maintenance - Software Reverse Engineering - Software Maintenance Process Models - Estimation of Maintenance Cost. Software Reuse: Issues in any Reuse Program - Reuse Approach.			

Books for Study:

1. Rajib Mall, "Fundamentals of Software Engineering", 3rd Edition, Prentice Hall of India Private Limited, 2008.

Books for Reference :

1. Rajib Mall, "Fundamentals of Software Engineering", 4th Edition, Prentice Hall of India Private Limited, 2014.

2. Richard Fairley, "Software Engineering Concepts", TMGH Publications, 2004.

Web resources:

1. <https://www.javatpoint.com/software-engineering-tutorial>
2. https://www.tutorialspoint.com/software_engineering/index.htm
3. <https://www.guru99.com/software-engineering-tutorial.html>

Rationale for Nature of the course:

Software engineering is important because specific software is needed in almost every industry, in every business, and for every function. It becomes more important as time goes on – if something breaks within your application portfolio, a quick, efficient, and effective fix needs to happen as soon as possible.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Introduction - Software Engineering Discipline - Evolution and Impact - Programs Vs Software Products. -	3	Chalk and talk and assignment
	Software Life Cycle Models: Use of a Life Cycle Models - Classical Waterfall Model -Iterative Waterfall Model - Prototyping Model - Evolutionary Model - Spiral Model.	4	
	Software Project Management: Responsibilities of a Software Project Manager - Project Planning	4	
	Metrics for Project Size Estimation - Project Estimation Techniques -Risk Management.	4	
II	Requirements Analysis and Specification: Requirements Gathering and Analysis -	4	Chalk and talk, Group discussion
	Software Requirements Specification (SRS) - Formal System Development Techniques.	4	

	Software Design: Characteristics of a Good Software Design - Cohesion and Coupling	4	
	Neat Arrangement - Software Design Approaches.	3	
III	Function-Oriented Software Design: Overview of SA/SD Methodology -Structured Analysis -	5	Chalk and talk, Quiz and assignment
	Data Flow Diagrams (DFDs).Object Modelling Using UML: Overview of Object-Oriented Concepts - UML Diagrams -	5	
	Use Case Model -Class Diagrams - Interaction Diagrams - Activity Diagrams - State Chart Diagram.	5	
IV	User Interface Design: Characteristics of a Good User Interface - Basic Concepts - Types of User Interfaces -	5	PPT, Chalk and talk, Quiz and assignment
	Component-Based GUI Development; Coding and Testing: Coding -	5	
	Testing - UNIT Testing - Black-Box Testing -White-Box Testing - Debugging -Integration Testing - System Testing.	5	
V	Software Reliability and Quality Management: Software Reliability - Statistical Testing -Software Quality - Software Quality Management System - ISO 9000	5	PPT, Chalk and talk, Quiz and assignment
	Computer Aided Software Engineering: CASE Environment - CASE support in Software Life Cycle - Characteristics of CASE Tools - Architecture of a CASE Environment.	5	
	. Software Maintenance: Characteristics of Software Maintenance - Software Reverse Engineering - Software Maintenance Process Models - Estimation of Maintenance Cost. Software Reuse: Issues in any Reuse Program - Reuse Approach.	5	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Software engineering

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Software engineering

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1Question from Unit-V (K3 Level)

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand principles and practices of software engineering	Up to K2
CLO-2	Identify software models for different nature of projects	Up to K3
CLO-3	Familiarize tools for software design process. Understand the concepts of process planning and scheduling	Up to K3
CLO-4	Develop strategies for testing.	Up to K4
CLO-5	Understand the concepts of Software Reliability and Quality Management	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	S		
CLO3	M	M		S	
CLO4	M			M	
CLO5	M	M	M	S	M
S- STRONG	M-MEDIUM		L-LOW		

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Er.J.Rajendran

Prof.P.Sridevi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core-12	20U6DMC12	Open Source Technology	5	5	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- Introduces Open Source methodologies.
- To make the students to gain experience using open source tools, languages and frameworks to prepare for careers in software development.

Units	CONTENTS	Total Hours: 75	K-Level	CLO
I	Introduction : Open Source, Free Software, Free Software vs. Open Source software, Public Domain Software, FOSS does not mean no cost. History : BSD, The Free Software Foundation and the GNU Project.	15 hrs	Up to K2	1
II	Open Source History, Initiatives, Principle and methodologies. Philosophy : Software Freedom, Open Source Development Model Licences and Patents: What Is A License, Important FOSS Licenses (Apache, BSD, GPL, LGPL), copyrights and copylefts, Patents Economics of FOSS : Zero Marginal Cost, Income-generation opportunities, Problems with traditional commercial software, Internationalization	15 hrs	Up to K3	2
III	Community Building: Importance of Communities in Open Source Movement/Boss Community- Starting and Maintaining an Open Source Project - Open Source Hardware	15 hrs	Up to K3	3
IV	Apache HTTP Server and its flavours- WAMP server (Windows, Apache, MySQL, PHP)- Apache, MySQL, PHP, JAVA as development platform.	15 hrs	Up to K3	4
V	Open source vs. closed source Open source government, Open source ethics. Social and Financial impacts of open source technology, Shared software, Shared source.	15 hrs	Up to K4	5

Books for Study:

1. Sumitabha Das “Unix Concepts and Applications, Tata McGraw Hill Education 006
2. The Official Ubuntu Book, 8th Edition
3. Kailash Vadera, Bhavyesh Gandhi, “Open Source Technology”, University Science press, ker

Books for Reference :

1. Paul Kavanagh, “Open Source Software: Implementation and Management”, Elsevier Digital Press
2. The Linux Documentation Project : <http://www.tldp.org>
3. Docker Project Home : <http://www.docker.com>

Web resources:

1. https://www.tutorialspoint.com/basics_of_computers/basics_of_computers_open_source_software.htm
2. <https://ittutorials.net/open-source/>
3. <https://training.linuxfoundation.org/training/beginners-guide-open-source-software-development/>

Rationale for Nature of the course:

Open-source software may be developed in a collaborative public manner. Open-source software is a prominent example of open collaboration, meaning any capable user is able to participate online in development, making the number of possible contributors indefinite. The ability to examine the code facilitates public trust in the software. Open source code can be used for studying and allows capable end users to adapt software to their personal needs

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Introduction : Open Source, Free Software, Free Software vs. Open Source software,	5	Chalk and talk and assignment
	Public Domain Software, FOSS does not mean no cost.	5	
	History : BSD, The Free Software Foundation and the GNU Project.	5	
II	Open Source History, Initiatives, Principle and methodologies. Philosophy : Software Freedom, Open Source Development	4	Chalk and talk, Group discussion
	Model Licences and Patents: What Is A License, Important FOSS Licenses (Apache, BSD,GPL, LGPL),	4	
	copyrights and copyleft, Patents Economics of FOSS : Zero Marginal Cost, Income-generation opportunities,	4	
	Problems with traditional commercial software, Internationalization	3	
III	Community Building: Importance of Communities in Open Source -	5	Chalk and talk, Quiz and assignment
	MovementJBoss Community- Starting and Maintaining an Open Source Project	5	
	Open Source Hardware	5	
IV	Apache HTTP Server and its flavors- WAMP server (Windows, Apache, MySQL, PHP)-	5	PPT, Chalk and talk, Quiz and assignment
	Apache, MySQL,	5	
	PHP, JAVA as development platform.	5	

V	Open source vs. closed source Open source government, Open source ethics.	5	PPT, Chalk and talk, Quiz and assignment
	Social and Financial impacts of open source technology,	5	
	Shared software, Shared source.	5	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Open Source Technology

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Open Source Technology

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the concepts of Open Source, Free Software, Free Software vs. Open Source software, Public Domain Software,	Up to K2
CLO-2	Describe the Open Source History, Initiatives, Principle and methodologies.	Up to K3
CLO-3	Identify maintenance of open source project methods	Up to K3
CLO-4	Understand the procedures of Apache and WAMP server interfacing	Up to K4
CLO-5	Analyse the procedures for shared software and shared sources	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	M		
CLO3	M			S	
CLO4	M			S	
CLO5	M	M	M	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Dr.T.Sree ram kumar

Prof.J.Mayajothi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Elective - 2	20U6DME2(D)	Multimedia systems	3	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To understand the standards available for different audio, video and text applications
- To learn various multimedia authoring systems in multimedia production team

Units	CONTENTS	Total Hours: 60	K-Level	CLO
I	Multimedia Definition - Use Of Multimedia - Delivering Multimedia - Text: About Fonts and Faces - Using Text in Multimedia - Computers and Text - Font Editing and Design Tools - Hypermedia and Hypertext.	12 hrs	Up to K2	1
II	Images: Plan Approach - Organize Tools - Configure Computer Workspace - Making Still Images - Color - Image File Formats. Sound: The Power of Sound - Digital Audio - Midi Audio - Midi vs. Digital Audio - Multimedia System Sounds - Audio File Formats - Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project.	12 hrs	Up to K3	2
III	Animation: The Power of Motion - Principles of Animation - Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays - Digital Video Containers - Obtaining Video Clips - Shooting and Editing Video.	12 hrs	Up to K3	3
IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs - The Hardware Needs - The Software Needs - An Authoring Systems Needs- Multimedia Production Team.	12 hrs	Up to K3	4
V	Planning and Costing: The Process of Making Multimedia - Scheduling - Estimating - RFPs and Bid Proposals. Designing and Producing - Content and Talent: Acquiring Content - Ownership of Content Created for Project - Acquiring Talent.	12 hrs	Up to K4	5

Books for Study:

1. Tay Vaughan, "Multimedia: Making It Work", 8th Edition, Osborne/McGrawHill, 2001.

Books for Reference :

1. Ralf Steinmetz & Klara Nahrstedt "Multimedia Computing, Communication & Applications", Pearson Education, 2012.

Web resources:

1. <https://www.tutorialspoint.com/multimedia/index.htm>
2. <https://www.freetimelearning.com/basics-of-computer-science/basics-of-multimedia.php>

Rationale for Nature of the course:

A Multimedia System is a system capable of processing multimedia data and applications. It is characterized by the processing, storage, generation, manipulation and rendition of Multimedia information. Multimedia is the presentation of text, pictures, audio, and video with links and tools that allow the user to navigate, engage, create, and communicate using a computer.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Multimedia Definition - Use Of Multimedia - Delivering Multimedia - Text: About Fonts and Faces -	4	Chalk and talk and assignment
	Using Text in Multimedia - Computers and Text	4	
	- Font Editing and Design Tools - Hypermedia and Hypertext.	4	
II	Images: Plan Approach - Organize Tools - Configure Computer Workspace - Making Still Images -	4	Chalk and talk, Group discussion
	Color - Image File Formats. Sound: The Power of Sound - Digital Audio - Midi Audio - Midi vs. Digital Audio -	4	
	Multimedia System Sounds - Audio File Formats - Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project.	4	
III	Animation: The Power of Motion - Principles of Animation - Animation by Computer - -	4	Chalk and talk, Quiz and assignment
	Making Animations that Work. Video: Using Video - Working with Video and Displays	4	
	Digital Video Containers - Obtaining Video Clips - Shooting and Editing Video.	4	
IV	Making Multimedia: The Stage of Multimedia Project - -	4	PPT, Chalk and talk, Quiz and assignment
	The Intangible Needs - The Hardware Needs	4	
	The Software Needs - An Authoring Systems Needs- Multimedia Production Team.	4	
V	Planning and Costing: The Process of Making Multimedia - Scheduling - Estimating -	4	PPT, Chalk and talk, Quiz and assignment
	RFPs and Bid Proposals. Designing and Producing -	4	
	Content and Talent: Acquiring Content - Ownership of Content Created for Project - Acquiring Talent.	4	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Multimedia systems

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Multimedia systems

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the basic needs of multimedia systems	Up to K2
CLO-2	Identify the components of multimedia technology	Up to K3
CLO-3	Creating the projects with the multimedia components	Up to K3
CLO-4	Understand the stages of multimedia projects and streaming.	Up to K4
CLO-5	Analyse the idea about costing and scheduling of multimedia projects.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	S		
CLO3	M			S	
CLO4	M			S	
CLO5	S	M	S	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Prof.J.Mayajothi

Prof.P.Sridevi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Se m	Course Type	Course Code	Course Title	Credit s	Contact Hours/week	CI A	Ex t	Tota l
VI	Elective-2	20U6DME2(E)	Programming in PHP	3	4	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To learn and use open source database management system MySQL
- To create dynamic web pages and websites.
- To connect web pages with database.

Units	CONTENTS	Total Hours: 60	K- Level	CLO
I	Basic development Concepts – Creating first PHP Scripts – Using Variable and Operators – Storing Data in variable – Understanding Data types – Setting and Checking variables Data types – Using Constants – Manipulating Variables with Operators.	12 hrs	Up to K2	1
II	Writing Simple Conditional Statements - Writing More Complex Conditional Statements – Repeating Action with Loops – Working with String and Numeric Functions.	12 hrs	Up to K3	2
III	Storing Data in Arrays – Processing Arrays with Loops and Iterations – Using Arrays with Forms - Working with Array Functions – Working with Dates and Times.	12 hrs	Up to K3	3
IV	Creating User-Defined Functions - Creating Classes – Using Advanced OOP Concepts. Working with Files and Directories: Reading Files- Writing Files Processing Directories.	12 hrs	Up to K3	4
V	Introducing Database and SQL- Using MySQL-Adding and modifying Data Handling Errors – sing SQLite Extension and PDO Extension. Introduction XML - Simple XML and DOM Extension.	12 hrs	Up to K4	5

Books for Study:

1. VIKRAM VASWANI- PHP A Beginner's Guide, Tata McGraw-Hill

Books for Reference :

1. The PHP Complete Reference – Steven Holzner – Tata McGraw-Hill Edition.
- Spring into PHP5 – Steven Holzer, Tata McCraw Hill Edition

Web resources:

1. <https://www.w3schools.com/php/>
2. <https://www.tutorialspoint.com/php/index.htm>

Rationale for Nature of the course:

PHP (Hypertext Pre processor) is known as a general-purpose scripting language that can be used to develop dynamic and interactive websites. It was among the first server-side languages that could be embedded into HTML, making it easier to add functionality to web pages without needing to call external files for data.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Basic development Concepts – Creating first PHP Scripts – Using Variable and Operators –	4	
	Storing Data in variable – Understanding Data types – Setting and Checking variables	4	
	Data types – Using Constants – Manipulating Variables with Operators.	4	
II	Writing Simple Conditional Statements -	4	Chalk and talk, Group discussion
	Writing More Complex Conditional Statements	4	
	– Repeating Action with Loops – Working with String and Numeric Functions.	4	
III	Storing Data in Arrays – Processing Arrays with Loops and Iterations -	4	Chalk and talk, Quiz and assignment
	– Using Arrays with Forms	4	
	Working with Array Functions – Working with Dates and Times.	4	
IV	Creating User-Defined Functions - Creating Classes –	4	PPT, Chalk and talk, Quiz and assignment
	Using Advanced OOP Concepts.	4	
	Working with Files and Directories: Reading Files- Writing Files Processing Directories.	4	
V	Introducing Database and SQL- Using MySQL-Adding and modifying Data Handling Errors –	4	PPT, Chalk and talk, Quiz and assignment
	using SQLite Extension and PDO Extension.	4	
	Introduction XML - Simple XML and DOM Extension.	4	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Programming in PHP

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Programming in PHP

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the basic development concepts of PHP and creating scripts	Up to K2
CLO-2	Identify the conditional and control statements in PHP	Up to K3
CLO-3	Understand the concepts of Data in Arrays and Processing Arrays with Loops and Iterations	Up to K3
CLO-4	Describe the procedures for Working with Files and Directories in PHP	Up to K4
CLO-5	Understand the basics of XML ,Simple XML and DOM Extension	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			S	
CLO2		M	M		
CLO3	M			S	
CLO4	M			S	
CLO5	M	S	S	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Prof.R.Umasankari

DR.T.Sree ram kumar

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Se m	Course Type	Course Code	Course Title	Credit s	Contact Hours/week	CI A	Ex t	Tota l
VI	Elective- 2	20U6DME2(F)	Information Security	3	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To impart the knowledge of Information Security.
- Learning the concepts of Information Security and its application.

Units	CONTENTS	Total Hours: 60	K- Level	CLO
I	Security Trends – OSI Security architecture – Security attacks, Security services, Security Mechanism, Security System development life cycle – Legal ethical and professional issues	12 hrs	Up to K2	1
II	Stream ciphers – Block ciphers (DES, Triple DES, and AES) – Integrity – RSA – Diffie-Hellman – Elliptic curve cryptography- Uses for public key cryptography.	12 hrs	Up to K3	2
III	HMAC – Uses for Hash function – Miscellaneous crypto related topics – Authentication methods- passwords – Biometrics – Two factor authentication.	12 hrs	Up to K3	3
IV	Introduction – History of Authorization – Firewalls – Intrusion detection systems (Signature and Anomaly based IDS) – Authentication protocols – Authentication and TCP	12 hrs	Up to K3	4
V	Introduction – SSH – SSL – IPSec (Digital Signature, Symmetric Key, Public Key Encryption, Cookies) – Kerberos (Login, Ticket, Security) –GSM.	12 hrs	Up to K4	5

Books for Study:

1. “Information Security principles and practice” - Mark Stamp - Second edition - Wiley publishing.
2. “Cryptography and Network Security principles and practice” - William Stallings - Third Edition - Pearson education 2003.

Books for Reference :

1. “Principles of Information Security”- Michael E.Whitman and Herbert J.Mattor - Fifth Edition - Vikas publishing house.
2. “Elementary Information Security” - Richard E.Smith - Second Edition - John & Barlett publishers.

Web resources:

1. <https://www.javatpoint.com/cyber-security-tutorial>
2. <https://www.w3schools.com/cybersecurity/index.php>
3. <https://www.simplilearn.com/tutorials/cyber-security-tutorial>

Rationale for Nature of the course:

Information security is designed to protect the confidentiality, integrity and availability of computer system and physical data from unauthorized access whether with malicious intent or not. Information Security refers to the processes and methodologies which are designed and implemented to protect print, electronic, or any other form of confidential, private and sensitive information or data from unauthorized access.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Security Trends – OSI Security architecture – Security attacks,–	4	Chalk and talk and assignment
	Security services, Security Mechanism, Security System development life cycle	4	
	Legal ethical and professional issues	4	
II	Stream ciphers – Block ciphers (DES, Triple DES, and AES) –.	4	Chalk and talk, Group discussion
	Integrity – RSA – Diffie-Hellman – Elliptic curve cryptography	4	
	Uses for public key cryptography	4	
III	HMAC – Uses for Hash function – Miscellaneous crypto related topics –	4	Chalk and talk, Quiz and assignment
	Authentication methods- passwords – Biometrics –	4	
	Two factor authentication.	4	
IV	Introduction – History of Authorization – Firewalls	4	PPT, Chalk and talk, Quiz and assignment
	– Intrusion detection systems (Signature and Anomaly based IDS) –	4	
	Authentication protocols – Authentication and TCP	4	
V	Introduction – SSH – SSL–	4	PPT, Chalk and talk, Quiz and assignment
	– IPsec (Digital Signature, Symmetric Key, Public Key Encryption, Cookies)	4	
	Kerberos (Login, Ticket, Security) –GSM.	4	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Information Security
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Information Security

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the concepts of OSI security architecture, attacks and professional ethics issues	Up to K2
CLO-2	Describe the principles of various cryptography methods	Up to K3
CLO-3	Identify the methods used for authentication issues and methods	Up to K3
CLO-4	Understand the concepts of firewall security systems used in the communication protocols	Up to K4
CLO-5	Describe about the SSH , SSL and process of encryption methods	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	M		
CLO3	M			M	
CLO4	M			S	
CLO5	M	M	S	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge LBase)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Er.J.Rajendran

Dr.T.Sree ram Kumar

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Elective-3	20U6DME3(G)	Programming in Python	2	3	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To understand the basic components of computer programming using the Python language
- To demonstrate significant experience with the Python program development environment

Units	CONTENTS	Total Hours: 45	K-Level	CLO
I	Introduction to Python - Why Python - Installing in various Operating Systems - Executing Python Programs - Basic Programming concepts - Variables, expressions and statements - Input/ Output – Operators.	9 hrs	Up to K2	1
II	Conditions - Functions - Arguments - Return values - Iteration - Loops - Strings -Data Structures - Lists - Dictionaries - Tuples - Sequences - Exception Handling.	9 hrs	Up to K3	2
III	File Handling - Modules - Regular Expressions - Text handling – Object Oriented Programming - Classes - Objects - Inheritance - Overloading - Polymorphism Interacting with Databases - Introduction to MySQL - interacting with MySQL - Building a address book with add/edit/delete/search features.	9 hrs	Up to K3	3
IV	Introduction to Graphics programming - Introduction to GTK - PyGTK - Developing GUI applications using pyGTK - Scientific Programming using NumPy / SciPy - Image Processing - Processing multimedia files -Network Programming, Web services using SOAP, Introduction to Graphics programming - PyGame	9 hrs	Up to K3	4
V	Introduction to Version Control Systems - Subversion/Git, Writing Unit Tests, Creating Documentation, Contributing to Open Source Projects	9 hrs	Up to K4	5

Books for Study:

- Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 1st Edition 2012, O'Reilly.

Books for Reference :

- Jeff McNeil, "Python 2.6 Text Processing: Beginners Guide", 2010, Packet Publications
- Mark Pilgrim, "Dive Into Python", 2nd edition 2009, Apress

Web resources:

- <https://www.python.org/about/gettingstarted/>
- <https://www.javatpoint.com/python-tutorial>
- <https://www.guru99.com/python-tutorials.html>

Rationale for Nature of the course:

Python is a high-level, interpreted, interactive, and object-oriented scripting language. Python is an excellent language for beginning programmers and facilitates the construction of a wide range of programs ranging from simple text. Python is a very popular programming language today and often needs an introduction. It is widely used in various business sectors, such as programming, web development, machine learning, and data science.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Introduction to Python - Why Python - Installing in various Operating Systems -	3	Chalk and talk and assignment
	Executing Python Programs - Basic Programming concepts	3	
	- Variables, expressions and statements - Input/ Output – Operators.	3	
II	Conditions - Functions - Arguments - Return values - Iteration - Loops - -	3	Chalk and talk, Group discussion
	Strings -Data Structures - Lists - Dictionaries	3	
	Tuples - Sequences - Exception Handling.	3	
III	File Handling - Modules - Regular Expressions - Text handling - Object Oriented Programming -	3	Chalk and talk, Quiz and assignment
	Classes - Objects - Inheritance - Overloading - Polymorphism Interacting with Databases -	3	
	Introduction to MySQL - interacting with MySQL - Building a address book with add/edit/delete/search features.	3	
IV	Introduction to Graphics programming - Introduction to GTK - PyGTK - Developing GUI applications using pyGTK -	3	PPT, Chalk and talk, Quiz and assignment
	Scientific Programming using NumPy / SciPy - Image Processing - Processing multimedia files	3	
	-Network Programming, Web services using SOAP, Introduction to Graphics programming - PyGame	3	
V	Introduction to Version Control Systems -,	3	PPT, Chalk and talk, Quiz and assignment
	Subversion/Git, Writing Unit Tests, Creating Documentation	3	
	Contributing to Open Source Projects	3	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Programming in Python
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)
BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Programming in Python
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the concepts of python programming and various statements	Up to K2
CLO-2	Identify the arguments ,data structures and tuples and exception handling of python programming	Up to K3
CLO-3	Describe the idea about file handling and interacting with databases musing MySQL	Up to K3
CLO-4	Analyse the development of Graphics programming and GUI applications using pyGTK	Up to K4
CLO-5	Understand the procedures for creating documents to open source projects and version control systems.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	L
CLO2		S	M		
CLO3	M			S	
CLO4	M			S	
CLO5	M	M	S	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Prof.J.Mayajothi

Prof.P.Sridevi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Elective-3	20U6DME3(H)	Software Testing	2	3	25	75	100

Nature of Course			
Knowledge and skill	✓		Employability oriented
Skill oriented			Entrepreneurship oriented

COURSE OBJECTIVES :

This course is designed

- To impart the needs and various testing strategies in software testing
- To teach the methods for maintaining software quality management.

Units	CONTENTS	Total Hours: 45	K-Level	CLO
I	TESTING TECHNIQUES & TEST CASE DESIGN Using White Box Approach to Test design - Test Adequacy Criteria – Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White box Based Test Design – Code Complexity Testing – Evaluating Test Adequacy Criteria. Test Case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis –Decision tables – Equivalence Class Partitioning – Statebased testing – Cause-effect graphing – Error guessing – Compatibility testing – User documentation testing – Domain testing – Case study for Control Flow Graph and Statebased Testing.	9 hrs	Up to K2	1
II	LEVELS OF TESTING 9 The Need for Levels of Testing- Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording Results – Integration Tests – Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect Bash Elimination. System Testing – Acceptance testing – Performance testing – Regression Testing - Internationalization testing - Ad-hoc testing – Alpha, Beta Tests- Testing OO systems – Usability and Accessibility Testing – Configuration Testing - Compatibility Testing – Testing the documentation – Website Testing - Case Study for Unit and Integration Testing.	9 hrs	Up to K3	2
III	Testing Client / Server Systems – Testing in a Multiplatform Environment - Testing ObjectOriented Software – Object Oriented Testing – Testing Web based systems – Web based system – Web Technology Evolution – Traditional Software and Web based Software – Challenges in Testing for Web-based Software – Quality Aspects – Web Engineering – Testing of Web based Systems. Case Study for Web Application Testing	9 hrs	Up to K3	3

IV	Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.	9 hrs	Up to K3	4
V	Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics.	9 hrs	Up to K4	5

Books for Study:

1. Adithya P. Mathur, “ Foundations of Software Testing – Fundamentals algorithms and techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

Books for Reference :

1. Boris Beizer, “ Software Testing Techniques” , Dream Tech Press, 2009 3.
2. Dale H. Besterfield , “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint (2011).
3. Edward Kit, “ Software Testing in the Real World – Improving the Process”, Pearson Education, 1995
4. Glenford J. Myers, Tom Badgett, Corey Sandler, “The Art of Software Testing”, 3rd Edition, John Wiley & Sons Publication, 2012

Web resources:

1. <https://www.javatpoint.com/software-testing-tutorial>
2. https://www.tutorialspoint.com/software_testing/index.htm

Rationale for Nature of the course:

Software testing is the process of evaluating and verifying that a software product or application does what it is supposed to do. The benefits of testing include preventing bugs, reducing development costs and improving performance. Designing and developing effective verification, validation, and testing strategies is always a challenge. The testing strategy needs to take into account the crucial balance between cost and quality and make appropriate trade-offs depending on the specific project.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	TESTING TECHNIQUES & TEST CASE DESIGN Using White Box Approach to Test design - Test Adequacy Criteria – Static Testing Vs. Structural Testing —	3	Chalk and talk and assignment
	Code Functional Testing – Coverage and Control Flow Graphs –Requirements based testing – Boundary Value Analysis –Decision tables – Equivalence Class Partitioning – State based testing	3	
	Cause-effect graphing – Error guessing – Compatibility testing – User documentation testing – Domain testing – Case study for Control Flow Graph and State based Testing.	3	
II	LEVELS OF TESTING 9 The Need for Levels of Testing- Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording Results –	3	Chalk and talk, Group discussion
	Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect Bash Elimination. System Testing – Acceptance testing – Performance testing – Regression Testing - Internationalization testing	3	
	Integration Tests — Ad-hoc testing – Alpha, Beta Tests- Testing OO systems – Usability and Accessibility Testing – Configuration Testing - Compatibility Testing – Testing the documentation – Website Testing - Case Study for Unit and Integration Testing.	3	
III	Testing Client / Server Systems – Testing in a Multiplatform Environment - Testing ObjectOriented Software – Object Oriented Testing – Testing Web based systems –	3	Chalk and talk, Quiz and assignment
	Web based system – Web Technology Evolution – Traditional Software and Web based Software – Challenges in Testing for Web-based Software –	3	
	Quality Aspects – Web Engineering – Testing of Web based Systems. Case Study for Web Application Testing	3	
IV	Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation —	3	PPT, Chalk and talk, Quiz and assignment
	Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool	3	
	Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.	3	
V	Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics —	3	PPT, Chalk and talk, Quiz and assignment
	Defect Removal Effectiveness - FMEA - Quality Function Deployment	3	
	Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics.	3	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Software Testing
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)
BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Software Testing
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the basic concepts and processes that leads to software testing	Up to K2
CLO-2	Identify the test cases from various testing technologies	Up to K3
CLO-3	Know about the user acceptance testing and generate test cases for it.	Up to K3
CLO-4	Understand importance of testing techniques in software quality management and assurance	Up to K4
CLO-5	Create test case scenarios for different application software using various testing techniques.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	M		
CLO3	S			S	
CLO4	M			S	
CLO5	M	M	S	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Dr.T.Sree ram Kumar

Prof.P.Sridevi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Elective-3	20U6DME3(I)	Internet programming	2	3	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To understand different Internet Technologies.
- To learn java-specific web services architecture

Units	CONTENTS	Total Hours: 45	K-Level	CLO
I	Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.	9 hrs	Up to K2	1
II	Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objectsEvent Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.	9 hrs	Up to K3	2
III	Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.	9 hrs	Up to K3	3
IV	An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions – File handling – Cookies – Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).	9 hrs	Up to K3	4
V	AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.	9 hrs	Up to K4	5

Books for Study:

1. Deitel and Deitel and Nieto, Internet and World Wide Web – How to Program, Prentice Hall, 5th Edition, 2011.

Books for Reference :

1. Stephen Wynkoop and John Burke —Running a Perfect Website, QUE, 2nd Edition, 1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, —Web Technologies A Computer Science Perspective, Pearson Education, 2011.

Web resources:

1. https://www.tutorialspoint.com/internet_technologies/index.htm
2. <https://www.w3schools.com/whatis/>

Rationale for Nature of the course:

Internet programming refers to the writing, markup and coding involved in Web development, which includes Web content, Web client and server scripting and network security. The most common languages used for Web programming are XML, HTML, JavaScript, Perl 5 and PHP. Internet is not required during coding. But, it helps a lot in the developing process. Internet is required for accessing information

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients –	3 hrs	Chalk and talk and assignment
	Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls – CSS3 – Inline, embedded and external style sheets –	3 hrs	
	Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.	3 hrs	
II	Java Script: An introduction to JavaScript–JavaScript DOM Model–Date and Objects,-Regular Expressions-	3 hrs	Chalk and talk, Group discussion
	Exception Handling-Validation-Built-in objectsEvent Handling-	3 hrs	
	DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.	3 hrs	

III	Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies—	3 hrs	Chalk and talk, Quiz and assignment
	Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example	3 hrs	
	JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.	3 hrs	
IV	An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions –,	3 hrs	PPT, Chalk and talk, Quiz and assignment
	File handling – Cookies – Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML	3 hrs	
	XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).	3 hrs	
V	AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods;	3 hrs	PPT, Chalk and talk, Quiz and assignment
	Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-	3 hrs	
	Consuming a web service, Database Driven web service from an application –SOAP.	3 hrs	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Internet Programming

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Internet Programming

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the concepts of WWW ,its backgrounds and internet protocols	Up to K2
CLO-2	Identify the methods and function files in javascript	Up to K3
CLO-3	Describe the concepts of Servlets and Apache web server	Up to K3
CLO-4	Understand the concepts of PHP, XML schema and XSLT transformation	Up to K4
CLO-5	Analyse the architecture of AJAX architecture and java web services.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	M		
CLO3	S			S	
CLO4	M			S	
CLO5	S	M	M	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):**Er.J.Rajendran****Prof.P.Sridevi**

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	SBE-4	20U6DSE4	Distributed Programming	2	2	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To build concepts regarding the fundamental principles of distributed systems
- The design issues and distributed operating system concepts are studied

Units	CONTENTS	Total Hours: 30	K-Level	CLO
I	Introduction to distributed Computing – Challenges involved in establishing remote connection – Strategies involved in remote computation – Current Distributed computing practices through Dot Net and Java technologies.	6 hrs	Up to K2	1
II	Advanced ADO, NET – Disconnected Data Access – Gridview, Details View, Form View controls – Crystal Reports – Role of ADO, NET in Distributed Application	6 hrs	Up to K3	2
III	Advanced ASP, NET – AdRotator, Multiview, Wizard and Image Map Controls – Master Pages – Site Navigation – Web Parts – Uses of these controls and features in Website development	6 hrs	Up to K3	3
IV	Advanced features of ASP.NET – Security in ASP, NET – State Management in ASP, NET – Mobile Application development in ASP, NET – Critical usage of these features in Website development.	6 hrs	Up to K3	4
V	Web services – Role of Web services in Distributed Computing – WSDL, UDDI, SOAP concepts involved in Web Services – Connected a Web Service to a Data Base – Accessing a Web Service through ASP, NET application.	6 hrs	Up to K4	5

Books for Study:

1. Walther, “ASP.NET 3.5”, SAMS Publication, 2005

Books for Reference :

1. Distributed Programming , Theory and Practice - A. Udaya Shankar Springer Publication.

Web resources:

1. <https://www.tutorialspoint.com/Distributed-Systems>
2. <https://www.freecodecamp.org/news/a-thorough-introduction-to-distributed-systems-3b91562c9b3c/>

Rationale for Nature of the course:

The goal of distributed programming is to make such a network work as a single computer. Distributed systems offer many benefits over centralized systems, including the Scalability. A distributed system allows resource sharing, including software by systems connected to the network. Alternatively, each computer may have its own user with individual needs, and the purpose of the distributed system is to coordinate the use of shared resources .

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Presentation with ICT tools
- Live- demonstrations.

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations and assignments.

Lecture schedule:

Units	Topics	Hrs	Mode
I	Introduction to distributed Computing – Challenges involved in establishing remote connection –	2 hrs	Chalk and talk and assignment
	Strategies involved in remote computation –	2 hrs	
	Current Distributed computing practices through Dot Net and Java technologies.	2 hrs	
II	Advanced ADO, NET – Disconnected Data Access —	2 hrs	Chalk and talk, Group discussion
	Gridview, Details View, Form View controls	2 hrs	
	Crystal Reports – Role of ADO, NET in Distributed Application	2 hrs	
III	Advanced ASP, NET – AdRotator, Multiview, Wizard and Image Map Controls –	2 hrs	Chalk and talk, Quiz and assignment
	Master Pages – Site Navigation – Web Parts –	2 hrs	
	Uses of these controls and features in Website development	2 hrs	
IV	Advanced features of ASP.NET – Security in ASP, NET – State Management in ASP, NET –	2 hrs	PPT, Chalk and talk, Quiz and assignment
	Mobile Application development in ASP, NET –	2 hrs	
	Critical usage of these features in Website development.	2 hrs	
V	Web services – Role of Web services in Distributed Computing – WSDL, UDDI, SOAP concepts involved in Web Services —	2 hrs	PPT, Chalk and talk, Quiz and assignment
	Connected a Web Service to a Data Base	2 hrs	
	Accessing a Web Service through ASP, NET application.	2 hrs	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Distributed Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)
BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	2	K2	2 (K2&K2)	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	2	K1	2	2(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	20

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Distributed Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidences

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the basic concepts of distributed computing in real time	Up to K2
CLO-2	Analyse the data access in ADO and dot net technologies	Up to K3
CLO-3	Understand the advanced ASP and dot net programming	Up to K3
CLO-4	Identify the advantages and features of ASP NET and dot net technologies.	Up to K4
CLO-5	Understand the concepts of Web services ,Role of Web services in Distributed Computing and WSDL, UDDI, SOAP concepts involved in Web Services.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	L
CLO2		M	S		
CLO3	M			S	
CLO4	M			S	
CLO5	M	S	M	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Prof.R.Umasankari

Prof.P.Sridevi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Practical-7	20U6DMP7	Web Technology Lab	2	3	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed to

- Design web pages using various HTML tags
- Write simple programs in Java Script

No.	List of Experiments / Lab Programmes list
1	Create a form having number of elements (Textboxes, Radio buttons, Checkboxes, and so on). Write JavaScript code to count the number of elements in a form.
2	Create a HTML form that has number of Textboxes. When the form runs in the Browser fill the textboxes with data. Write JavaScript code that verifies that all textboxes has been filled. If a textboxes has been left empty, popup an alert indicating which textbox has been left empty.
3	Develop a HTML Form, which accepts any Mathematical expression. Write JavaScript code to Evaluates the expression and Displays the result.
4	Create a page with dynamic effects. Write the code to include layers and basic animation.
5	Write a JavaScript code to find the sum of N natural Numbers. (Use user-defined function)
6	Write a JavaScript code block using arrays and generate the current date in words, this should include the day, month and year.
7	Create a form for Student information. Write JavaScript code to find Total, Average, Result and Grade.
8	Create a form for Employee information. Write JavaScript code to find DA, HRA, PF, TAX, Gross pay, Deduction and Net pay.
9	Create a form consists of a two Multiple choice lists and one single choice list (a)The first multiple choice list, displays the Major dishes available (b)The second multiple choice list, displays the Starters available. (c)The single choice list, displays the Soft drinks available.
10	Create a web page using two image files, which switch between one another as the mouse pointer moves over the image. Use the on Mouse Over and on Mouse Out event handlers.

Rationale for the nature of the course:

During this lab sessions , students can develop a web application programmes using the languages and concepts learnt in the theory and exercises listed. They can use Markup languages and scripting tools for developing the exercises in web technologies and frameworks using databases.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Lab tutorial class
- Algorithm preparation
- Live- demonstrations.

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the concepts of identifiers, variables, arrays, control structures, functions and objects in JavaScript.	Up to K2
CLO-2	Develop hands on experience using HTML	Up to K3
CLO-3	Identify the creation of basic animation techniques	Up to K3
CLO-4	Understand the concepts of creating web pages for the customized applications.	Up to K4
CLO-5	Describe the concepts of creating the forms and integrating the database with forms.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	S		
CLO3	S			S	
CLO4	M			S	
CLO5	M	M	S	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):
Prof.R.Umasankari
Er.J.Rajendran

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Practical-8	20U6DMP8	Open Source Technology Lab	2	3	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

COURSE OBJECTIVES :

This course is designed

- To develop technical solutions for problems using the open source softwares readily available at free of cost.
- To install WampServer.
- Learn programming in PHP.

No.	Experiments / Programmes
1	Create a simple HTML form and accept the user name and display the name through PHP echo statement.
2	Write a PHP script to redirect a user to a different page.
3	Write a PHP function to test whether a number is greater than 30, 20 or 10 using ternary operator.
4	Create a PHP script which display the capital and country name from the given array. Sort the list by the name of the country
5	Write a PHP script to calculate and display average temperature, five lowest and highest temperatures.
6	Create a script using a for loop to add all the integers between 0 and 30 and display the total.
7	Write a PHP script using nested for loop that creates a chess board.
8	Write a PHP function that checks if a string is all lower case.
9	Write a PHP script to calculate the difference between two dates
10	Write a PHP script to display time in a specified time zone.

Rationale for the nature of the course:

Open source is a key enabler for all technological areas we encounter now and in the future. Open source technology is quickly becoming a necessity for success as enterprises are realising the benefits it can bring from a technological perspective, as well as providing a cost-effective option in comparison to proprietary alternatives.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Lab tutorial class
- Algorithm preparation
- Live- demonstrations.

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the installation of various packages in open source operating systems	Up to K2
CLO-2	Create simple GUI applications using PHP	Up to K3
CLO-3	Understand the usage of control and conditional statement of PHP	Up to K3
CLO-4	Implement various applications using build systems	Up to K4
CLO-5	Understand procedures for developing php scripts for various application problems.	Up to K3

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	S		
CLO3	M			S	
CLO4	S			S	
CLO5	S	M	M	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	1	1	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):
Dr.T.Sree Ram Kumar
Prof.J.Mayajothi

DEPARTMENT OF COMPUTER SCIENCE				CLASS: III B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Add-on course	20U6DMPRO	Project and Viva-voce	2	2	50	50	100

Nature of Course			
Knowledge and skill	✓		Employability oriented
Skill oriented			Entrepreneurship oriented

COURSE OBJECTIVES :

This course is designed

- To provide sufficient hands-on learning experience related to analysis, design and implementation of software programme code / product so as to enhance the technical skill development in the chosen software platform and languages.
- To examine the student's understanding and assimilation of the theoretical contents of the course with the software system environment .

Project Work:

The combined project shall be considered as an Add-On course and to be undertaken by all the students as an individual or as a team of two. Project work can be offered during the final semester of the degree. It should be done in the Department computer laboratory under the supervision of their faculty guides.

The following list of parameters is taken into account for the evaluation of Project work and Viva-voce. *Total Marks: 100 (Internal: 50 marks, External: 50 Marks)*

Parameters:

For Internal Marks:

Two review meetings : 2 x 15 = 30 Marks
Overall Performance : = 20 Marks

For External Marks:

Project Report : = 20 Marks
Project Demo & Presentation : = 15 Marks
Viva-Voce : = 15 Marks

Rationale for the nature of the course:

Project-based learning not only provides opportunities for students to collaborate both theory and practical knowledge with their own learning, but it also teaches them skills such as problem solving, and helps to develop an additional skills such as critical thinking and time management.

COURSE LEARNING OUTCOMES:

On the completion of the course the students will be able to

CLOs	COURSE LEARNING OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CLO-1	Understand the installation of various software platforms and environment packages	Up to K2
CLO-2	Create simple GUI and DB applications in the client/server environments	Up to K2
CLO-3	Understand the design and usage of both front-end and back-end tools	Up to K3
CLO-4	Implement various utility , application and system related programs to provide problem solution.	Up to K2
CLO-5	Demonstrate on software creativity , develop innovative ideas and to work in teams while developing software products for various applications.	Up to K2

MAPPING OF CLOs WITH POs:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO1	S			M	
CLO2		M	S		
CLO3	M			S	
CLO4	S			S	
CLO5	S	M	M	S	M

S- STRONG

M-MEDIUM

L-LOW

MAPPING OF CLOs WITH PSOs:

Course Outcomes	PSO 1 (Knowledge Base)	PSO 2 (Problem Analysis & Investigation)	PSO 3 (Communication Skills & Design)	PSO 4 (Individual and Team Work)	PSO 5 (Professionalism Ethics and equity)	PSO 6 (Life Long Learning)
CLO-1	3	2	2	2	1	1
CLO-2	2	3	2	1	1	1
CLO-3	2	3	1	1	1	2
CLO-4	3	2	2	1	2	1
CLO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Course Designer(s):

Er.J.Rajendran

Dr. T. Sree Ram Kumar

THE MADURA COLLEGE
 An Autonomous Institution affiliated to Madurai Kamaraj University
 Re-accredited (3rd cycle) with 'A' grade by NAAC
 Vidya Nagar, T.P.K. Road, Madurai – 625 011

Department of Computer Science

Programme : B.Sc. (Computer Science)
Metric and weight calculation

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U1TLA1/20U1HLA1/20U1SLA1	CLO1	0.000	0.053	0.053	0.105	0.105	1.684
	CLO2	0.000	0.105	0.105	0.158	0.105	
	CLO3	0.000	0.158	0.053	0.000	0.105	
	CLO4	0.158	0.000	0.053	0.000	0.105	
	CLO5	0.000	0.000	0.158	0.000	0.105	
	Total	0.158	0.316	0.421	0.263	0.526	
20U1NEN1	CLO1	0.000	0.105	0.158	0.105	0.000	1.842
	CLO2	0.000	0.105	0.158	0.158	0.000	
	CLO3	0.000	0.105	0.105	0.105	0.000	
	CLO4	0.000	0.105	0.105	0.105	0.000	
	CLO5	0.000	0.105	0.158	0.158	0.000	
	Total	0.000	0.526	0.684	0.632	0.000	
20U1VEN1	CLO1	0.158	0.000	0.105	0.158	0.158	2.947
	CLO2	0.158	0.000	0.105	0.158	0.158	
	CLO3	0.158	0.000	0.105	0.158	0.158	
	CLO4	0.105	0.000	0.105	0.158	0.158	
	CLO5	0.158	0.105	0.105	0.158	0.158	
	Total	0.737	0.105	0.526	0.789	0.789	
20U1DMC1	CLO1	0.158	0.105	0.105	0.053	0.053	2.632
	CLO2	0.158	0.053	0.053	0.053	0.105	
	CLO3	0.158	0.105	0.158	0.053	0.053	
	CLO4	0.158	0.158	0.158	0.105	0.053	
	CLO5	0.158	0.158	0.158	0.053	0.053	
	Total	0.789	0.579	0.632	0.316	0.316	
20U1DMC2	CLO1	0.105	0.158	0.053	0.053	0.053	2.263
	CLO2	0.105	0.105	0.053	0.053	0.105	
	CLO3	0.158	0.105	0.105	0.053	0.053	
	CLO4	0.105	0.158	0.105	0.053	0.053	
	CLO5	0.158	0.105	0.105	0.053	0.053	
	Total	0.632	0.632	0.421	0.263	0.316	

20U1DAT1	CLO1	0.158	0.105	0.053	0.053	0.105	2.263
	CLO2	0.158	0.105	0.053	0.053	0.105	
	CLO3	0.105	0.105	0.053	0.053	0.053	
	CLO4	0.158	0.105	0.105	0.053	0.053	
	CLO5	0.158	0.105	0.105	0.053	0.053	
	Total	0.737	0.526	0.368	0.263	0.368	
20U1DMCP1	CLO1	0.158	0.158	0.158	0.053	0.105	3.158
	CLO2	0.158	0.158	0.158	0.053	0.105	
	CLO3	0.158	0.158	0.158	0.053	0.105	
	CLO4	0.158	0.158	0.158	0.053	0.105	
	CLO5	0.158	0.158	0.158	0.053	0.105	
	Total	0.789	0.789	0.789	0.263	0.526	
20U2TLA2/20U2HLA2/20U2SLA2	CLO1	0.053	0.000	0.158	0.000	0.105	1.737
	CLO2	0.000	0.000	0.105	0.000	0.158	
	CLO3	0.053	0.000	0.158	0.053	0.105	
	CLO4	0.105	0.053	0.158	0.053	0.158	
	CLO5	0.000	0.000	0.158	0.053	0.053	
	Total	0.211	0.053	0.737	0.158	0.579	
20U2NENH2	CLO1	0.000	0.105	0.158	0.105	0.000	1.842
	CLO2	0.000	0.105	0.158	0.158	0.000	
	CLO3	0.000	0.105	0.105	0.105	0.000	
	CLO4	0.000	0.105	0.105	0.105	0.000	
	CLO5	0.000	0.105	0.158	0.158	0.000	
	Total	0.000	0.526	0.684	0.632	0.000	
20U2EVS1	CLO1	0.105	0.000	0.000	0.053	0.158	2.211
	CLO2	0.105	0.000	0.105	0.053	0.158	
	CLO3	0.105	0.158	0.000	0.053	0.158	
	CLO4	0.105	0.000	0.000	0.158	0.158	
	CLO5	0.105	0.158	0.000	0.158	0.158	
	Total	0.526	0.316	0.105	0.474	0.789	
20U2DMC3	CLO1	0.158	0.158	0.105	0.053	0.105	2.947
	CLO2	0.158	0.158	0.105	0.053	0.105	
	CLO3	0.158	0.158	0.158	0.053	0.105	
	CLO4	0.158	0.158	0.105	0.053	0.105	
	CLO5	0.158	0.158	0.105	0.053	0.105	
	Total	0.789	0.789	0.579	0.263	0.526	
20U2DMC4	CLO1	0.158	0.105	0.053	0.053	0.053	2.474
	CLO2	0.158	0.158	0.105	0.053	0.053	
	CLO3	0.158	0.105	0.105	0.053	0.053	
	CLO4	0.158	0.158	0.105	0.053	0.053	
	CLO5	0.158	0.158	0.105	0.053	0.053	
	Total	0.789	0.684	0.474	0.263	0.263	

20U2DAT2	CLO1	0.158	0.158	0.105	0.053	0.053	2.632
	CLO2	0.158	0.158	0.105	0.053	0.053	
	CLO3	0.158	0.158	0.105	0.053	0.053	
	CLO4	0.158	0.158	0.105	0.053	0.053	
	CLO5	0.158	0.158	0.105	0.053	0.053	
	Total	0.789	0.789	0.526	0.263	0.263	
20U2DMCP2	CLO1	0.158	0.158	0.158	0.053	0.105	3.158
	CLO2	0.158	0.158	0.158	0.053	0.105	
	CLO3	0.158	0.158	0.158	0.053	0.105	
	CLO4	0.158	0.158	0.158	0.053	0.105	
	CLO5	0.158	0.158	0.158	0.053	0.105	
	Total	0.789	0.789	0.789	0.263	0.526	
20U3TLA3/17U3HLA3/20U3SLA3	CLO1	0.000	0.053	0.053	0.105	0.105	1.684
	CLO2	0.000	0.105	0.105	0.158	0.105	
	CLO3	0.000	0.158	0.053	0.000	0.105	
	CLO4	0.158	0.000	0.053	0.000	0.105	
	CLO5	0.000	0.000	0.158	0.000	0.105	
	Total	0.158	0.316	0.421	0.263	0.526	
20U3NENH3	CLO1	0.000	0.105	0.158	0.105	0.000	1.842
	CLO2	0.000	0.105	0.158	0.158	0.000	
	CLO3	0.000	0.105	0.105	0.105	0.000	
	CLO4	0.000	0.105	0.105	0.105	0.000	
	CLO5	0.000	0.105	0.158	0.158	0.000	
	Total	0.000	0.526	0.684	0.632	0.000	
20U3DMC5	CLO1	0.158	0.158	0.105	0.053	0.053	2.632
	CLO2	0.158	0.158	0.105	0.053	0.053	
	CLO3	0.158	0.158	0.105	0.053	0.053	
	CLO4	0.158	0.158	0.105	0.053	0.053	
	CLO5	0.158	0.158	0.105	0.053	0.053	
	Total	0.789	0.789	0.526	0.263	0.263	
20U3DSM1	CLO1	0.158	0.158	0.158	0.105	0.105	3.421
	CLO2	0.158	0.158	0.158	0.105	0.105	
	CLO3	0.158	0.158	0.158	0.105	0.105	
	CLO4	0.158	0.158	0.158	0.105	0.105	
	CLO5	0.158	0.158	0.158	0.105	0.105	
	Total	0.789	0.789	0.789	0.526	0.526	
20U3DAT3	CLO1	0.158	0.105	0.053	0.053	0.053	2.526
	CLO2	0.158	0.158	0.105	0.053	0.053	
	CLO3	0.158	0.158	0.105	0.053	0.053	
	CLO4	0.158	0.158	0.105	0.053	0.053	
	CLO5	0.158	0.158	0.105	0.053	0.053	
	Total	0.789	0.737	0.474	0.263	0.263	

20U3DMCP3	CLO1	0.158	0.158	0.158	0.105	0.105	3.421
	CLO2	0.158	0.158	0.158	0.105	0.105	
	CLO3	0.158	0.158	0.158	0.105	0.105	
	CLO4	0.158	0.158	0.158	0.105	0.105	
	CLO5	0.158	0.158	0.158	0.105	0.105	
	Total	0.789	0.789	0.789	0.526	0.526	
20U4TLA4/17U4HLA4/20U4SLA4	CLO1	0.000	0.053	0.053	0.105	0.105	1.684
	CLO2	0.000	0.105	0.105	0.158	0.105	
	CLO3	0.000	0.158	0.053	0.000	0.105	
	CLO4	0.158	0.000	0.053	0.000	0.105	
	CLO5	0.000	0.000	0.158	0.000	0.105	
	Total	0.158	0.316	0.421	0.263	0.526	
20U4NEN4	CLO1	0.000	0.105	0.158	0.105	0.000	1.842
	CLO2	0.000	0.105	0.158	0.158	0.000	
	CLO3	0.000	0.105	0.105	0.105	0.000	
	CLO4	0.000	0.105	0.105	0.105	0.000	
	CLO5	0.000	0.105	0.158	0.158	0.000	
	Total	0.000	0.526	0.684	0.632	0.000	
20U4DMC6	CLO1	0.158	0.158	0.158	0.105	0.105	3.421
	CLO2	0.158	0.158	0.158	0.105	0.105	
	CLO3	0.158	0.158	0.158	0.105	0.105	
	CLO4	0.158	0.158	0.158	0.105	0.105	
	CLO5	0.158	0.158	0.158	0.105	0.105	
	Total	0.789	0.789	0.789	0.526	0.526	
20U4DSM2	CLO1	0.158	0.105	0.105	0.053	0.053	2.316
	CLO2	0.158	0.105	0.158	0.053	0.053	
	CLO3	0.158	0.105	0.105	0.053	0.053	
	CLO4	0.158	0.105	0.053	0.053	0.053	
	CLO5	0.158	0.105	0.053	0.053	0.053	
	Total	0.789	0.526	0.474	0.263	0.263	
20U4DAT4	CLO1	0.158	0.158	0.105	0.053	0.105	2.895
	CLO2	0.158	0.158	0.105	0.053	0.105	
	CLO3	0.158	0.158	0.105	0.053	0.105	
	CLO4	0.158	0.158	0.105	0.053	0.105	
	CLO5	0.158	0.158	0.105	0.053	0.105	
	Total	0.789	0.789	0.526	0.263	0.526	
20U4DMCP4	CLO1	0.158	0.105	0.158	0.053	0.053	2.579
	CLO2	0.158	0.105	0.158	0.053	0.053	
	CLO3	0.158	0.105	0.158	0.053	0.053	
	CLO4	0.158	0.158	0.105	0.053	0.053	
	CLO5	0.158	0.105	0.105	0.053	0.053	
	Total	0.789	0.579	0.684	0.263	0.263	

20U5DMC7	CLO1	0.158	0.053	0.053	0.053	0.053	2.105
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.053	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.474	0.316	
20U5DMC8	CLO1	0.158	0.053	0.105	0.053	0.053	2.211
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.474	0.526	0.316	
20U5DMC9	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U5DSE3	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U5DMCP5	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U5DMCP6	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U5DMDC	CLO1	0.053	0.053	0.105	0.000	0.000	1.158
	CLO2	0.000	0.105	0.105	0.000	0.000	
	CLO3	0.105	0.053	0.000	0.053	0.000	
	CLO4	0.105	0.000	0.000	0.053	0.053	
	CLO5	0.105	0.053	0.000	0.053	0.105	
	Total	0.368	0.263	0.211	0.158	0.158	

20U5DME1	CLO1	0.158	0.000	0.000	0.105	0.000	1.579
	CLO2	0.000	0.105	0.158	0.000	0.000	
	CLO3	0.105	0.000	0.000	0.105	0.000	
	CLO4	0.105	0.000	0.000	0.105	0.000	
	CLO5	0.105	0.105	0.158	0.158	0.105	
	Total	0.474	0.211	0.316	0.474	0.105	
20U6DMC10	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U6DMC11	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U6DMC12	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U6DME2	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U6DME3	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U6DSE4	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	

20U6DMP7	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
20U6DMP8	CLO1	0.158	0.053	0.053	0.053	0.053	2.158
	CLO2	0.053	0.105	0.158	0.053	0.053	
	CLO3	0.105	0.053	0.053	0.105	0.053	
	CLO4	0.105	0.053	0.053	0.158	0.053	
	CLO5	0.105	0.105	0.105	0.158	0.105	
	Total	0.526	0.368	0.421	0.526	0.316	
	Total	22.579	20.526	21.474	17.737	14.684	97

NME COURSES

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U3DNM1	CLO1	0.058	0.038	0.058	0.038	0.058	
	CLO2	0.058	0.038	0.038	0.038	0.038	
	CLO3	0.058	0.038	0.038	0.019	0.058	
	CLO4	0.058	0.019	0.019	0.019	0.058	
	CLO5	0.058	0.019	0.019	0.019	0.038	
	Total	0.288	0.154	0.173	0.135	0.250	1
20U4DNM2	CLO1	0.053	0.018	0.035	0.053	0.018	
	CLO2	0.053	0.018	0.035	0.035	0.035	
	CLO3	0.053	0.035	0.035	0.053	0.035	
	CLO4	0.053	0.053	0.018	0.053	0.053	
	CLO5	0.053	0.053	0.018	0.035	0.053	
	Total	0.263	0.175	0.140	0.228	0.193	1

All the course outcomes are adequately mapped against the programme outcomes and all the programme outcomes carry adequate weight against the cumulative outcome of the programme.



DEPARTMENT OF INFORMATION TECHNOLOGY

Revised Curriculum
(Choice Based Credit system with Outcome Based Education)
Academic Year 2020-2021 onwards

V and VI semesters (B.Sc. Information Technology)
III and IV semesters (M.Sc. Computer Science)



The Madura College (Autonomous), Madurai – 625 011
Department of Information Technology
UG Programme Structure

Sem	Course Code	Title of the Course	Hrs	Credits	Nature of Course (Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision/New
					Empl	Ent	Skill	Local	National	Global	
I	20U1T/S/HL A1	Tamil-I/Sanskrit-I/Hindi-I	6	3							
	20U1NEN1	English-I	6	3							
	20U1FAC1	Discrete Mathematics	6	5			✓	✓			No Revision
	20U1FMC1	C Programming	3	3			✓			✓	No Revision
	20U1FMC2	Principles of Information Technology	3	3			✓			✓	No Revision
	20U1FMP1	C Programming - Lab	3	2			✓			✓	80
II	20U2T/S/HL A2	Tamil-II/Sanskrit-II/Hindi-II	6	3							
	20U2NEN2	English-II	6	3							
	20U2FAC2	Resource Management Techniques	6	5			✓		✓		100
	20U2FMC3	Object Oriented Programming With C++	3	3			✓			✓	8
	20U2FMC4	Digital Principles and Applications	3	3			✓			✓	No Revision
	20U2FMP2	OOPs with C++ - Lab	3	2			✓			✓	80

Sem	Course Code	Title of the Course	Hrs	Credits	Nature of Course (Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision/New
					Empl	Ent	Skill	Local	National	Global	
III	20U3T/S/HL A3	Tamil-III/Sanskrit-III/Hindi-III	6	3							
	20U2NEN2	English-II	6	3							
	20U3FNM1	PC Software	2	2			✓	✓			43
	20U3FSM1	Office Automation	2	2			✓	✓			100
	20U3FAC3	Financial Accounting	6	5					✓		84
	20U3FMC5	Data Structures and Algorithms	5	5			✓			✓	3
	20U3FMP3	Data Structures and Algorithms - Lab	3	2			✓			✓	80
IV	20U4T/S/HL A4	Tamil-IV/Sanskrit-IV/Hindi-IV	6	3							
	20U4NEN4	English-IV	6	3							
	20U4FNM2	Introduction to Internet	2	2		✓	✓			✓	3
	20U4FSM2	Visual Programming	2	2			✓			✓	No Revision
	20U4FAC4	Business Statistics	6	5					✓		100
	20U4FMC6	Java Programming	5	5			✓			✓	No Revision
	20U4FMP4	Java Programming - Lab	3	2	✓		✓			✓	80

Sem	Course Code	Title of the Course	Hrs	Credits	Nature of Course (Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision/New
					Empl	Ent	Skill	Local	National	Global	
V	20U5FSM3	Web Technologies	2	2	✓		✓		✓		59
	20U5FMC7	Dot Net Technologies	5	5	✓		✓			✓	4
	20U5FMC8	Relational Database Management System	5	5	✓	✓	✓			✓	32
	20U5FMC9	Data Communication and Computer Network	5	5			✓			✓	32
	20U5FMP5	Dot Net Technologies – Lab	3	2			✓			✓	80
	20U5FMP6	RDBMS – Lab	3	2	✓	✓	✓			✓	80
	20U5FIDC	Bio-Applications in Artificial Intelligence	4	3	✓		✓			✓	100
	20U5FME1	Computer Graphics	3	2			✓			✓	100
		Linux Programming	3	2	✓	✓	✓			✓	No Revision
		Computer Architecture	3	2			✓			✓	64

Sem	Course Code	Title of the Course	Hrs	Credits	Nature of Course (Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision/New
					Empl	Ent	Skill	Local	National	Global	
VI	20U6FSM4	Multimedia and Its Applications	2	2	✓		✓		✓		58
	20U6FMC10	Programming in PHP	5	5	✓		✓			✓	7
	20U6FMC11	Operating System	5	5			✓			✓	6
	20U6FMC12	Software Engineering	5	5	✓		✓			✓	No Revision
	20U6FMP7	Programming in PHP – Lab	3	2	✓		✓			✓	80
	20U6FMPR	Project & Viva-Voce	3	2	✓	✓	✓			✓	
	20U6FME2	Python Programming	4	3	✓		✓			✓	100
		Android Programming	4	3	✓		✓			✓	97
		Software Testing	4	3			✓			✓	100
	20U6FME3	Data Mining	3	2			✓			✓	82
		Network Security	3	2	✓		✓			✓	59
		Cloud Computing	3	2			✓			✓	96

Emp- Employability; Ent- Entrepreneurship; Skill- Skill Development



The Madura College (Autonomous), Madurai-625011
(Self Financed Stream)
Department of Information Technology
Curriculum Structure for B.Sc. Information Technology
(With Mathematics & Commerce ancillaries)

Sem.	Course Type	Subject Code	Course title	Contact hours/ week	Credits
I	Part -I : Lang-I	20U1T/S/HLA1	Tamil-I/Sanskrit-I/Hindi-I	6	3
	Part - II : English –I	20U1NEN1	English –I	6	3
	VE &PE	20U1VEN1	Value Education & Professional Ethics	3	3
	Part III: Allied –I / I	20U1FAC1	Discrete Mathematics	6	5
	Major Core -1	20U1FMC1	C Programming	3	3
	Major Core- 2	20U1FMC2	Principles of Information Technology	3	3
	Major Core	20U1FMP1	C Programming – Lab	3	2
	Total			30	22
II	Part - I : Lang-II	20U2T/S/HLA2	Tamil-II/Sanskrit-II/Hindi-II	6	3
	Part - II : English-II	20U2NEN2	English-II	6	3
	E & G S	20U2EVS1	Environmental Science & Gender studies	3	3
	Part III :Allied-I / II	20U2FAC2	Resource Management	6	5
	Major Core -3	20U2FMC3	Object Oriented Programming with C++	3	3
	Major Core- 4	20U2FMC4	Digital Principles and Applications	3	3
	Major Core	20U2FMP2	OOPs with C++ - Lab	3	2
	Extension Activities			--	1
	Total			30	23
III	Part -I : Lang-III	20U3T/S/HLA3	Tamil-III/Sanskrit-III/Hindi-	6	3
	Part - II : English-III	20U3NEN3	English-III	6	3
	Non Major Elective	20U3FNM1	PC Software	2	2
	Skill based Elective	20U3FSM1	Office Automation	2	2
	Part III: Allied-II /I	20U3FAC3	Financial Accounting	6	5
	Major Core -5	20U3FMC5	Data Structures and	5	5
	Major Core Practical-3	20U3FMP3	Data Structures and Algorithms – Lab	3	2
	Total			30	22

Sem.	Course Type	Subject Code	Course title	Contact hours/ week	Credits
IV	Part- I : Lang –IV	20U4T/S/HLA	Tamil-IV/Sanskrit-	6	3
	Part - II : English-IV	20U4NEN4	English-IV	6	3
	Non-Major Elective – II	20U4FNM2	Introduction to Internet	2	2
	Skill Based Elective –II	20U4FSM2	Visual Programming	2	2
	Part III: Allied –II / II	20U4FAC4	Business Statistics	6	5
	Major Core -6	20U4FMC6	Java Programming	5	5
	Major Core Practical-4	20U4FMP4	Java Programming – Lab	3	2
	Total			30	22
V	Skill Based Elective-III	20U5FSM3	Web Technologies	2	2
	Major Core -7	20U5FMC7	Dot Net Technologies	5	5
	Major Core- 8	20U5FMC8	Relational Database Management System	5	5
	Major Core -9	20U5FMC9	Data Communication and Computer Network	5	5
	Major Core Practical-5	20U5FMP5	Dot Net Technologies – Lab	3	2
	Major Core Practical-6	20U5FMP6	RDBMS – Lab	3	2
	IDC	20U5FIDC	Bio-Applications in Artificial Intelligence	4	3
	Major Elective –I	20U5FME1	Computer Graphics / Linux Programming / Computer Architecture	3	2
	Total			30	26
VI	Skill Based Elective –IV	20U6FSM4	Multimedia and Its Applications	2	2
	Major Core -10	20U6FMC10	Programming in PHP	5	5
	Major Core- 11	20U6FMC11	Operating System	5	5
	Major Core -12	20U6FMC12	Software Engineering	5	5
	Major Core Practical-7	20U6FMP7	Programming in PHP – Lab	3	2
	Major Core Practical-8	20U6FMPR	Project & Viva-voce – Lab	3	2
	Major Elective –II	20U6FME2	Python Programming / Android Programming / Software Testing	4	3
	Major Elective –III	20U6FME3	Data Mining / Network Security / Cloud Computing	3	2
	Total			30	26

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
V	Skill Based Elective- III	20U5FSM3	Web Technologies	2	2	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To learn the concept of creating web page using links, images, audio and video.
- To impart the knowledge in creating forms with various controls.
- To know, how to control the presentation of text using CSS.
- To develop JavaScript code to access web document and object properties.
- To focus on creating interactive web pages.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Structuring Documents for the Web: Introducing HTML and XHTML- Basic Text Formatting- Presentational Elements- Phrase Elements-Using the Element to Create Unordered Lists- Ordered Lists-Core Elements and Attributes. Links and Navigation: Creating Links with the <a> Element. Images, Audio, and Video: Adding Images Using the Element- Adding Videos to your site- Adding Audio to your web site.	6	K2	1
II	Tables: Basic Table Elements and Attributes- Adding a <caption> to a Table- Spanning Columns Using the colspan Attribute- Spanning Rows Using the rowspan Attribute. Forms: Creating a Form with the <form> Element- Form Controls - Sending Form Data to the Server.	6	K3	2
III	Frames: <frame> Element - Creating Links between Frames - Setting a Default Target Frame Using <base> Element. Cascading Style Sheets: Introducing CSS- CSS Properties-Controlling Text- Text Formatting. More Cascading Style Sheets: Links- Backgrounds.	6	K3	3
IV	Learning Java Script: How to Add a Script to Your Pages- The Document Object Model-Starting to Program with JavaScript – Variables – Operators – Functions - Conditional Statements – Looping – Events - Writing JavaScript.	6	K4	4
V	Working with JavaScript: Reusable Functions - Using External JavaScript Files - Place Scripts in a Scripts Folder - Forms Validations - Form Enhancements.	6	K3	5

Book(s) for Study

“Beginning HTML, XHTML, CSS and JavaScript”, Jon Duckett, Wiley Publishing, 2013.

Chapters

Unit – I: 1, 2, 3

Unit – II: 4, 5

Unit – III: 6, 7, 8

Unit – IV: 11

Unit – V: 12

Books for Reference

1. “Web Technology-A Developer’s Perspective”, N P Gopalan, J Akilandeswari , Second Edition, PHI New Delhi, 2008.
2. “Web Technology and Design”, C.Xavier, New Age International Publisher.
3. “Web Enabled Commercial Application Development Using HTML, DHTML, JavaScript, Perl CGI”, Ivan Bayross, BPB Publication.

Web Resources

1. https://www.w3schools.com/html/html_links.asp
2. https://www.w3schools.com/html/html_images.asp
3. https://www.tutorialspoint.com/html/html_tables.htm
4. <https://www.javatpoint.com/html-form>
5. https://developer.mozilla.org/en-US/docs/Web/CSS/CSS_Properties_Reference
6. <https://www.javascripttutorial.net/>

Rationale for Nature of the course

Design and develop websites using fundamental web languages, technologies, and tools.

Activities on Knowledge and Skill Development

Practice to design dynamic webpage using HTML, CSS and JavaScript and conduct group discussion.

Activities on Employability

Practice to design webpage using HTML, CSS and JavaScript and motivate the students for Content Development and Management.

Pedagogy

Chalk and talk, E-Content, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction and Demonstration.

Course Designer Names

1. Ms. S.Saranya
2. Mrs. K.Vaira Meenakshi

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	Structuring Documents for the Web: Introducing HTML and XHTML- Basic Text Formatting- Presentational Elements- Phrase Elements-Using the Element to Create Unordered Lists- Ordered Lists-Core Elements and Attributes. Links and Navigation: Creating Links with the <a> Element. Images, Audio, and Video: Adding Images Using the Element- Adding Videos to your site- Adding Audio to your web site.	3	Chalk and talk & Quiz
		1	Chalk and talk & Demonstration
		2	Chalk and talk & Demonstration
II	Tables: Basic Table Elements and Attributes- Adding a <caption> to a Table- Spanning Columns Using the colspan Attribute- Spanning Rows Using the rowspan Attribute. Forms: Creating a Form with the <form> Element- Form Controls, Sending Form Data to the Server.	3	Chalk and talk, Demonstration& Quiz
		3	Chalk and talk & PPT
III	Frames: <frame> Element, Creating Links between Frames, Setting a Default Target Frame Using <base> Element. Cascading Style Sheets: Introducing CSS- CSS Properties-Controlling Text- Text Formatting. More Cascading Style Sheets: Links- Backgrounds.	2	Chalk and talk & PPT
		2	Quiz & Demonstration
		2	Chalk and talk & Demonstration
IV	Learning Java Script: How to Add a Script to Your Pages- The Document Object Model–Starting to Program with JavaScript Variables. Operators-Functions- Conditional Statements- Looping-Events- Writing JavaScript.	3	Chalk and talk, E-Content & Quiz
		3	Chalk and talk & PPT
V	Working with JavaScript: Reusable Functions-Using External JavaScript Files- Place Scripts in a Scripts Folder Forms Validations, Form Enhancements.	4	Chalk and talk & Seminar
		2	Chalk and talk & Assignment

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Levels
CLO 1	Describe how to create a basic HTML document using HTML elements.	Up to K2
CLO 2	Use tables to organize information and configure page layout.	Up to K3
CLO 3	Utilize CSS, to format web pages and create style sheets that configure common color and text properties.	Up to K3
CLO 4	Focus the importance of JavaScript programming concepts such as variables, functions, conditions and loops.	Up to K4
CLO 5	Construct the interactive web page using JavaScript.	Up to K3

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	1	2	2	3
CLO 2	1	1	3	2	3
CLO 3	2	1	2	2	3
CLO 4	1	1	3	2	3
CLO 5	2	1	3	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	1	1	1	2
CLO 2	2	2	1	2	1	3
CLO 3	2	3	1	1	2	2
CLO 4	2	1	1	2	2	2
CLO 5	2	3	2	1	2	2

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Web Technologies (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either /or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K1)	1 (K2)
	CLO 2	Up to K3	2	K1 & K2	2	K2	2 (K2&K2)	2 (K3)
CIA II	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1 (K3)
	CLO 4	Up to K4	2	K1 & K2	2	K1	2 (K4&K4)	2 (K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for each section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	2	10	-	14	23.33	67
K2	2	4	10	10	26	43.33	
K3	-	-	-	20	20	33.33	33
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	-	-	6	10	17
K2	2	2	-	-	4	6.7	
K3	-	-	10	10	20	33.3	33
K4	-	-	10	20	30	50	50
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for Web Technologies
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K - Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K1& K2	1	K2	2 (K2&K2)	1 (K3)
3	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1 (K3)
4	CLO 4	Up to K4	2	K1 & K2	1	K1	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1 (K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
V	Major Core -7	20U5FMC7	Dot Net Technologies	5	5	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the concept of GUI Design tools.
- To make aware of controls in VB.NET
- To impart the knowledge of Functions and subroutines.
- Be familiar with the Menus and Dialog Boxes.
- To understand the concepts of ADO.Net.

Course Content

UNIT	CONTENT	Hrs	K-Level	CLO
I	Getting started in Visual Basic to .Net: Starting Visual Basic Dot Net - Creating and Running very first application - Using the Command Window. IDE: What is IDE - Opening and Closing Windows and Toolbars - Using the Auto hide facility – Using the Properties windows – Setting the properties of forms and controls – Using the solution explorer - Writing an event procedure - The Standard Toolbar. Setting properties using the Properties Window: Classification of Properties – Various Properties of Form – Various Properties of Label.	15	K2	1
II	Control structure & Looping: Variables and Data types-Text box control–Radio button control. Programming Statements: IF...Then, IF...THEN...END IF - IF...THEN...ELSE...END IF – Constants – Visual Basic .NET Programming Language-II: The MsgBox() function - The InputBox() function - List box control. Programming Statement: Select Case. Visual Basic .NET Programming Language-III: Check box control - Iteration Statements - Do While Loop statement - Do Until Loop statement - Do Loop Until statement - For Next statement - Arrays.	15	K3	2

III	Menus and Dialog Boxes: Basic elements of menu - Generic procedure of creating menus - Creating a simple menu application. Structured Programming: What is Structured Programming - Events, Subroutines & Functions - Scope of variables - Scope of procedures - Creating Multiple Forms - Elementary and composite data types.	15	K3	3
IV	Object-Oriented programming: What is OOPS - Implementing OOPS - Inheritance overriding - Collections. Working with files: Introduction to files - Classification of files - Handling files and folders using functions - File processing using streams. Advanced Techniques in Visual Basic .Net: Single document interface and multiple document interface.	15	K4	4
V	Data Access with ADO .Net: What are databases? - Connections, Data Adapters and Datasets - Accessing Data with Server Explorer - Accessing Data with Data Adapters and Datasets - Working with ADO.Net - Overview of ADO.Net Objects.	15	K4	5

Book(s) for Study

1. “Visual Basic Dot Net”, Shirish Chavan, Fourth Edition, Pearson Edition.
2. “Visual Basic Dot Net Black Book”, Steven Holzner, Wiley Press.

Chapters

Unit – I: 1.5, 1.6, 1.10, 2.2, 2.3, 2.5, 2.14, 2.15, 2.16, 2.18, 2.22, and 3.
Unit – II : 5.1, 5.11, 5.12, 5.13, 5.14, 6.3, 6.7, 6.9, 6.10, 7.2, 7.3, 7.5, 7.6, 7.8, 7.9, 7.11. } Textbook1
Unit – III: 9.1, 9.2, 9.3, 10.1, 10.2, 10.3, 10.4, 10.5, 10.7.
Unit – IV: 11.1, 11.2, 11.4, 11.6, 13.1, 13.2, 13.4, 13.10, 14.1.
Unit – V: 21 → Textbook 2

Books for Reference

1. “Visual Basic Dot Net-A Beginner’s guide”, Jeffery Kent, First Edition, Tata McGraw Hill.
2. “Visual Basic Dot Net Step by Step”, Michael Halvorson, First Edition, Prentice Hall of India Pvt., 2002.
3. “The Complete reference Visual Basic Dot Net “, Jeffrey R.Shapiro, Sixteenth Reprint, Tata McGraw Hill, 2010.
4. “Visual Basic Dot Net”, John Smiley, First Edition, Tata McGraw Hill, 2002.

Web Resources

1. <https://www.tutorialspoint.com/vb.net/index.htm>
2. <https://www.javatpoint.com/vb-net>
3. <https://docs.microsoft.com/en-us/dotnet/visual-basic/>
4. <https://www.udemy.com/course/learning-visual-basic-net/>

Rationale for Nature of the course

Helps to develop GUI based applications and connect them to handle functions provided by the application.

Activity on Knowledge and Skill

Practice to students for creating interactive web application and to take seminar.

Activities on Employability

Motivate the students for creating of GUI based application and spotting and rectifying Bugs.

Pedagogy

Chalk and talk, E-content, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction and Demonstration.

Course Designer Names

1. Mrs. K. Imaya
2. Ms. S.Saranya

Lesson Plan

Unit	Topics	Hours	Mode
I	Starting Visual Basic Dot Net-Creating and Running very first application.	5	Chalk and talk
	What is IDE-Using the Auto hide facility-Using the Properties windows.	5	Chalk and talk
	Setting the properties of forms and controls-Using the solution explorer-Writing an event procedure-The Standard Toolbars.	5	Chalk and talk & Quiz
II	Variables and Data types-Text box control-Radio button control.	5	Chalk and talk and Demonstration.
	Programming Statements: IF Then, IF THEN END IF, ELSE...END IF-The MsgBox() function-The InputBox () function-List box control.	5	Chalk and talk& Problem solving
	Programming Statement: Select Case-Check box control-Iteration Statements-Do While Loop- Do Until Loop- Do Loop Until-For Next-Arrays.	5	Chalk and talk& Quiz
III	Basic elements of menus-Generic procedure of creating menus-Creating a simple menu application.	5	Chalk and talk& Interaction and Demonstration.
	What is Structured Programming-Events, Subroutines & Functions.	5	Chalk and talk & E-Content
	Scope of variables-Scope of procedures-Elementary and composite data types.	5	Chalk and talk & Quiz

IV	What is OOPS-Implementing OOPS-Inheritance Overriding-Collections.	5	Chalk and talk & E-Content
	Working with files: Introduction to files-Classification of files-Handling files and folders using functions-File processing using streams.	5	Chalk and talk & PPT
	Advanced Techniques in Visual Basic Dot Net: Single document interface and multiple document interface.	5	Chalk and talk & Quiz
V	What are databases-Connections, Data Adapters and Datasets-Accessing Data with Server Explorer.	5	Chalk and talk & Assignment
	Accessing Data with Data Adapters and Datasets.	5	Chalk and talk & Seminar
	Working with ADO.Net-Overview of ADO.Net Objects.	5	Chalk and talk & GD

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Levels
CLO 1	Demonstrate the concept of IDE, form properties and controls	Up to K2
CLO 2	Utilize the concept of Variables, Data types and Programming Statements.	Up to K3
CLO 3	Identify the basic elements of Menus, Events and Methods.	Up to K3
CLO 4	Analyze the efficacy of Object-Oriented Programming and MDI	Up to K4
CLO 5	Focus the significance of Data access with ADO.NET	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	1	2	2	3
CLO 2	2	1	2	2	3
CLO 3	2	1	2	2	2
CLO 4	2	1	2	2	3
CLO 5	2	2	2	1	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	3	2	2	3	3
CLO 2	2	3	2	1	2	2
CLO 3	2	2	2	1	2	2
CLO 4	2	2	2	1	2	2
CLO 5	2	2	2	2	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print - Model for Dot Net Technologies (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either /or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K1)	1 (K2)
	CLO 2	Up to K3	2	K1 & K2	2	K2	2 (K2&K2)	2 (K3)
CIA II	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1 (K3)
	CLO 4	Up to K4	2	K1 & K2	2	K2	2 (K3&K3)	2 (K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	2	10	-	14	23.33	67
K2	2	4	10	10	26	43.33	
K3	-	-	-	20	20	33.33	33
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	-	-	-	2	3.33	17
K2	2	6	-	-	8	13.33	
K3	-	-	20	10	30	50	50
K4	-	-	-	20	20	33.33	33
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print - Model for Dot Net Technologies
Articulation Mapping – K Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K - Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K – Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K1& K2	1	K2	2 (K2&K2)	1 (K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1 (K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1 (K4)
5	CLO 5	Up to K4	2	K1& K2	1	K1	2 (K4&K4)	1 (K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consoli -dated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credit	Contact Hours/Week	CIA	Ext	Total
V	Major Core - 8	20U5FMC8	Relational Database Management System	5	5	25	75	100

Nature of the Course			
Knowledge and Skill	✓	Employability Oriented	✓
Skill oriented		Entrepreneurship Oriented	✓

Course Objectives

- To understand the basic concepts and the applications of database systems.
- To learn the database Schema and Relational Algebra.
- To Master the basics of SQL and construct queries.
- To Familiarize with Normal forms and Functional Dependencies.
- To realize the significance of database storage structures and access techniques.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introduction: Database system applications – Purpose of database system – View of data – Database Languages – Relational databases – Transaction Management – Database Architecture. Database Design and E-R Model: Overview of the Design Process - The Entity-Relationship Model – Constraints - Entity-Relationship Diagrams - Extended E-R Features.	15	K2	1
II	Relational Models: Structure of Relational Databases – Database schema – Keys – Schema diagrams. Relational Algebra: Fundamental Operation - Formal Definition of the Relational Algebra - Additional Relational-Algebra Operations.	15	K3	2
III	Introduction to SQL: Overview of the SQL Query Language – SQL Data Definition – Basic Structure of SQL Queries – Additional Basic Operations - Set Operations – Null Values – Aggregate Functions –Nested Sub queries – Modification of the Database.	15	K4	3
IV	Intermediate SQL: Join expressions – Views – Transactions – Integrity Constraints. Advanced SQL: Functions and procedures – Triggers – Advanced Aggregate functions - OLAP.	15	K4	4

V	Relational Database Design: Features of Good Relational Designs – Atomic Domains and First Normal Form – Decomposition Using Functional Dependencies – Functional Dependency Theory- Database-Design Process. Storage and File Structure: RAID – File Organization – Organization of Records in Files – Data-Dictionary Storage.	15	K3	5

Book(s) for Study

“Database System Concepts”, Abraham Silberchatz, Henry K.Forth, S.Sudarshan, 6th Edition, McGraw Hill Education (India) Private Limited, 2013

Chapters

Unit I - 1.1 - 1.9, 7.1 -7.3, 7.5, 7.8

Unit II - 2.1 - 2.4, 6.1.1, 6.1.2, 6.1.3

Unit III - 3.1 - 3.9.

Unit IV - 4.1 - 4.4, 5.2, 5.3, 5.5, 5.6.

Unit V - 8.1 - 8.4, 10.3, 10.5 - 10.7.

Books for Reference

1. “Database Systems”, Thomas Connolly, Addison Wesley, New Print 2000.
2. “Database Management Systems”, Ragu Rama Krishnan, Johannes Gehrke, 3rd Ed., McGraw Hill Edition, New Delhi.
3. “Fundamentals of Database Systems”, Ramez Elmasri, Shamkant B Navathe, 5th Edition, Pearson Education.

Web Resources

1. <https://towardsdatascience.com/practical-sql-create-and-query-a-relational-database-8bac84d78703>
2. <https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm>
3. https://www.w3schools.com/mysql/mysql_rdbms.asp

Rationale for Nature of the course

Helps in maintaining the data integrity, data accuracy, reduces data redundancy to a minimum, data scalability, data flexibility and facilitates to implement security methods.

Activities on Knowledge and Skill

Practice to write Queries, Assignment and attend Periodic Quiz

Activities on Employability

Practice to design different Backend Applications and motivate them to take Seminar

Activities on Entrepreneurship

Trained to design and Maintain Databases, Big Data

Pedagogy

Chalk and talk E-Content, PPT, Assignment, Quiz, Debugging and Demonstration, Seminar.

Course Designer Names

1. Mrs. K.R.Ramadevi
2. Mr. K. Rajasaravanakumar

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	Introduction: Database system applications – Purpose of database system – View of data – Database Languages. Relational databases – Transaction Management – Database Architecture.	4	Chalk and talk
	Database Design and E-R Model: Overview of the Design Process - The Entity-Relationship Model – Constraints.	3	Chalk and talk, PPT
	Entity-Relationship Diagrams - Extended E-R Features.	4	Chalk and talk Quiz
II	Relational Models: Structure of Relational Databases – Database schema.	4	Chalk and talk
	Keys – Schema diagrams.	4	Chalk and talk
	Relational Algebra: Fundamental Operation - Formal Definition of the Relational Algebra	4	Chalk and talk
	Additional Relational-Algebra Operations.	3	Quiz
III	Introduction to SQL: Overview of the SQL Query Language – SQL Data Definition.	5	Debugging and Demonstration.
	Basic Structure of SQL Queries – Additional Basic Operations - Set Operations – Null Values - Aggregate Functions.	5	Chalk and talk, PPT
	Nested Sub queries – Modification of the Database.	5	Chalk and talk, Quiz
IV	Intermediate SQL: Join expressions – Views – Transactions – Integrity Constraints.	8	Chalk and talk, PPT
	Advanced SQL: Functions and procedures – Triggers - Advanced Aggregate functions - OLAP.	7	Chalk and talk, Quiz
V	Relational Database Design: Features of Good Relational Designs – Atomic Domains and First Normal Form - Decomposition Using Functional Dependencies – Functional Dependency Theory- Database-Design Process.	8	Chalk and talk& Seminar
	Storage and File Structure: RAID – File Organization. Organization of Records in Files – Data-Dictionary Storage.	7	Assignment

Course Learning Outcomes

On the completion of the course, the student will be able to

CLO No.	COURSE LEARNING OUTCOMES	K - Levels
CLO 1	Describe database applications and languages. Express E-R Model.	Up to K2
CLO 2	Make use of Relational Model, Keys and Relational Algebra in databases.	Up to K3
CLO 3	Devise various types of Queries.	Up to K4
CLO 4	Illustrate advanced Queries.	Up to K4
CLO 5	Identify relations based on functional dependency and Normal form and the Storage, File structure.	Up to K3

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	2	1	3
CLO 2	3	3	1	1	2
CLO 3	2	2	1	1	2
CLO 4	2	2	1	3	2
CLO 5	3	3	2	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	2	1	1	1	2
CLO 2	2	2	2	1	2	2
CLO 3	2	2	2	1	2	3
CLO 4	2	2	2	1	2	3
CLO 5	3	2	2	2	1	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Relational Database Management System (CIA I & II)
Articulation Mapping - K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
CIA I	CLO 1	Up to K2	2	K1& K2	1	K1	2(K1&K1)	2(K2)
	CLO 2	Up to K3	2	K1&K2	2	K1	2(K2&K2)	1(K3)
CIA II	CLO 3	Up to K4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
	CLO 4	Up to K4	2	K1& K2	2	K2	2(K4&K4)	2(K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	6	10	-	18	30.00	83
K2	2	-	10	20	32	53.33	
K3	-	-	-	10	10	16.7	17
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	-	-	-	2	3.33	17
K2	2	6	-	-	8	13.33	
K3	-	-	10	20	20	50.00	50
K4	-	-	10	10	30	33.33	33
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)

Summative - Blue Print – Model for Relational Database Management System
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Unit	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No Of Questions	K - Level	No Of Questions	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2(K2&K2)	1(K3)
3	CLO 3	Up to K4	2	K1 & K2	1	K2	2(K3&K3)	1(K4)
4	CLO 4	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
5	CLO 5	Up to K3	2	K1 & K2	1	K2	2(K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels *

K - Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consoli -dated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
V	Major Core-9	20U5FMC9	Data Communication And Computer Network	5	5	25	75	100

Nature of the Course			
Knowledge and Skill	✓	Employability Oriented	
Skill Oriented		Entrepreneurship oriented	

Course Objectives

- To provide the overview of the data and computer communications.
- To understand how errors are detected and corrected during transmission.
- To impart the skills of subnetting and routing mechanism.
- To emphasize the significance and functions of Transport Layer.
- To maintain the Confidentiality, Integrity and Availability of a data.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introduction: Data Communications – Networks – Network Types – Standard and Administration. Physical Layer: Data and Signal – Digital Signal - Performance. Transmission Media: Introduction – Guided Media – Unguided Media.	15	K2	1
II	Error Detection and Correction: Introduction – Block coding – Cycle codes – Checksum – Forward error correction. Data Link Control: DLC services – Data Link Layer protocols – HDLC – Point to Point Protocol.	15	K3	2
III	Ethernet: Ethernet Protocol – Standard Ethernet. Network Layer: Network Layer services – Packet switching – Network Layer performance – IPV4 Addresses - Routing algorithm.	15	K4	3
IV	Transport Layer: Introduction– Transport-Layer Protocol. Transport Layer Protocol: Introduction – User Datagram Protocol – Transmission Control Protocol.	15	K4	4
V	Application Layer: WWW and HTTP - FTP – E-Mail – Telnet – DNS – Cryptography: Introduction – Confidentiality.	15	K3	5

Book(s) for Study

“Data communication and Networking”, Behrouz A. Forouzan, Tata McGraw-Hill, 5th Edition

Chapters

Unit I: 1.1-1.3, 1.5, 3.1, 3.3, 3.6, 7.1 - 7.3.

Unit II: 10.1 - 10.5, 11.1 - 11.4.

Unit III: 13.1, 13.2, 18.1 - 18.4, 20.2

Unit IV: 23.1, 23.2, 24.1 - 24.3.

Unit V: 25.1, 26.1 - 26.4, 26.6, 31.1, 31.2

Books for Reference

1. "Computer Networking: A Top-Down Approach Featuring the Internet", James F. Kurose and Keith W. Ross, Pearson Education, 2003.
2. "Computer Networks", Larry L. Peterson and Peter S. Davie, Harcourt Asia Pvt. Ltd., Second Edition.
3. "Computer Networks", Andrew S. Tanenbaum, PHI, Fourth Ed., 2003.
4. "Data and Computer Communication", William Stallings, Sixth Edition, Pearson Education, 2000.

Web Resources

1. https://www.tutorialspoint.com/data_communication_computer_network/index.htm
2. https://www.vssut.ac.in/lecture_notes/lecture1428550521.pdf
3. <http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf>

Rationale for Nature of the Course

Enable students to have insight into technology involved in making the network communication.

Activities on Knowledge and Skill

Practice to give Assignments and train them to solve Problems by conducting Group Discussion and Quiz.

Pedagogy

Chalk and talk, PPT, Assignment, Seminar, Problem solving, Group discussion and Quiz.

Course Designer Names

1. Mrs. R.LakshaPriya
2. Mrs. K.Vairameenakshi

Lesson Plan

Unit	Topics	Hours	Mode
I	Introduction - Data Communications – Networks – Network Types.	5	Chalk and talk
	Standard and Administration – Data and Signal.	5	Chalk and talk& GD
	Transmission Media: Introduction – Guided Media – Unguided Media.	5	
			Quiz &PPT

II	Data Link Layer Error Detection and Correction: Introduction – Block coding –	5	Chalk and talk& GD PPT, Quiz
	Cycle codes – Checksum – Forward error correction.	5	Chalk and talk& PPT
	Data Link Control: DLC services – Data Link Layer protocols. HDLC – Point to Point Protocol.	5	Chalk and talk
III	Network Layer Ethernet: Ethernet Protocol – Standard Ethernet.	5	Chalk and talk
	Network Layer: Network Layer services – Packet switching – Network Layer performance.	5	Chalk and talk& Quiz
	IPV4 Addresses - Routing algorithm.	5	Chalk and talk& GD
IV	Transport Layer : Introduction to Transport Layer : Introduction – Transport-Layer Protocol.	5	Chalk and talk &GD
	Transport Layer Protocol: Introduction – User Datagram Protocol – Transmission Control Protocol.	5	Chalk and talk & GD
	Quality of Services: Data Flow Characteristics – Flow control to improve QOS.	5	PPT & Quiz
V	Application Layer: Introduction – FTP – E-Mail – Telnet – DNS.	7	Chalk and talk & Seminar
	Cryptography: Introduction – Confidentiality.	8	Problem Solving &Assignment

Course Learning Outcomes

On the completion of the course, the student will be able to

CLO	COURSE LEARNING OUTCOMES	K – Levels
CLO 1	Describe the types of Networks, Protocols and functioning of Transmission media.	Up to K2
CLO 2	Identify the various error detections and corrections techniques.	Up to K3
CLO 3	Analyze the functions of routing algorithms.	Up to K4
CLO 4	Focus on Transport layer protocols.	Up to K4
CLO 5	Apply cryptography and network security Techniques to understand confidentiality algorithms.	Up to K3

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	3	1	1	1	1
CLO 2	3	1	2	1	2
CLO 3	3	1	2	1	2
CLO 4	3	1	2	1	2
CLO 5	3	2	2	2	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	2	1	1	1	1
CLO 2	3	3	2	2	2	2
CLO 3	3	3	2	2	1	2
CLO 4	3	3	2	2	1	2
CLO 5	3	3	3	2	2	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print Model for - Data Communication and Computer Network (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Quest ions	K – Level	No. of Question s	K - Level		
CIA I	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	2 (K2)
	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	1 (K3)
CIA II	CLO 3	Up to K4	2	K1 & K2	1	K2	2 (K4&K4)	2 (K3)
	CLO 4	Up to K4	2	K1 & K2	2	K2	2 (K2&K2)	1 (K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for each Section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consoli - dated %
K1	2	2	10	-	14	23.33	67
K2	2	4	-	20	26	43.33	
K3	-	-	10	10	20	33.34	33
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without Choice	Consoli - dated %
K1	2	-	-	-	2	3.33	34
K2	2	6	10	-	18	30	
K3	-	-	-	20	20	33.34	33
K4	-	-	10	10	20	33.33	33
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for Data Communication and Computer Networks
Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K - Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K – Level	No. of Questi ons	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1 (K3)
3	CLO 3	Up to K4	2	K1 & K2	1	K2	2 (K4&K4)	1 (K3)
4	CLO 4	Up to K4	2	K1 & K2	1	K2	2 (K2&K2)	1 (K4)
5	CLO 5	Up to K3	2	K1 & K2	1	K1	2 (K3&K3)	1 (K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without Choice	Consoli -dated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
V	Major Core Practical -5	20U5FMP5	Dot Net Technologies - LAB	2	3	40	60	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the concept of GUI Design tools.
- To make them aware of controls in VB.NET
- To impart the knowledge of Functions and subroutines.
- Be familiar with the Menus and Dialog Boxes.
- To understand and apply the concepts Data access with ADO.Net.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	1. Write a Program for changing the properties of form at run time and displaying the message in the textbox. 2. Develop a program to create the Login page using various controls. 3. Develop a form in VB.NET to pick a date from Calendar control and display the day, month, and year details in separate text boxes.	9	K2	1
II	4. Develop a program to retrieve images using combo box and button control. 5. Develop a Console application to find the grade of the students as per their percentage using select case. 6. Write a program for changing the font and its style according to checkbox and radio button selection.	9	K3	2
III	7. Write a program to stimulate Notepad application using MenuStrip. 8. Write a Program to compute Summation of elements of an array Using Function. 9. Write a program to implement String handling functions.	9	K3	3
IV	10. Write a program to prepare employee payslip using inheritance. 11. Write a program to generate user defined exception. 12. Write a program to create a file and display its content.	9	K4	4

V	13. Develop a student database application using ADO.NET. 14. Develop a database application using ADO.NET to insert, update and delete operations. 15. Develop a Inventory database application using ADO.NET.	9	K4	5

Book(s) for Study

1. “Visual Basic Dot Net”, Shirish Chavan, Fourth Edition, Pearson Edition.
2. “Visual Basic Dot Net Black Book”, Steven Holzner, Wiley Press.

Books for Reference

1. “Visual Basic Dot Net-A Beginner’s guide”, Jeffery Kent, First Edition, Tata McGraw Hill.
2. “Visual Basic Dot Net Step by Step”, Michael Halvorson, First Edition, Prentice Hall of India Pvt., 2002.
3. “The Complete reference Visual Basic Dot Net “, Jeffrey R.Shapiro, Sixteenth Reprint, Tata McGraw Hill, 2010.
4. “Visual Basic Dot Net”, John Smiley, First Edition, Tata McGraw Hill, 2002.

Web Resources

1. <https://www.tutorialspoint.com/vb.net/index.htm>
2. <https://www.javatpoint.com/vb-net>
3. <https://docs.microsoft.com/en-us/dotnet/visual-basic/>
4. <https://www.udemy.com/course/learning-visual-basic-net/>

Activity on Knowledge and Skill

Practice to students for creating interactive web application and to take seminar.

Activities on Employability

Motivate the students for creating of GUI based application and spotting and rectifying Bugs.

Pedagogy

Projector, Demonstration and Practical Session.

Course Designer Name(s)

1. Mrs. K. Imaya
2. Ms. S.Saranya

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	Program for changing the properties of form at run time and displaying the message in the textbox “Welcome to VB.Net”.	3	Demo & Practical Session
	Program to perform Basic Arithmetic Operations using various controls in Tool box.	3	
	Develop a form in VB.NET to pick a date from Calendar control and display the day, month, and year details in separate text boxes.	3	
II	Console program for checking the odd/even number using simple if statements.	3	Demo & Practical Session
	Console program for decision making in grade of the students as per their percentage using select case.	3	
	Windows application for designing GUI with command button, Textbox, checkbox and radio button. Write a code for changing the font and its style according to checkbox and radio button selection.	3	
III	Program to create Menus using Menu Strip in VB.Net.	3	Demo & Practical Session
	Program to create Summation of elements of an array Using Function.	3	
	Write a VB.net program using String handling functions.	3	
IV	Write a program for calculation of employee salary using inheritance.	3	Demo & Practical Session
	Write a user defined exception for checking the divide by zero error.	3	
	Write a VB.net program to Read and Write a File.	3	
V	Develop a database application to store the details of students using ADO.NET.	3	Demo & Practical Session
	Develop a database application using ADO.NET to insert, modify, update and delete operations.	3	
	Develop a database application to store the details of Employee using ADO.NET.	3	

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Levels
CLO 1	Demonstrate the concept of IDE and form properties and controls.	Up to K2
CLO 2	Understand the concept of Variables and Data types and Programming Statements.	Up to K3
CLO 3	Gain knowledge in basic elements of Menus and Structured Programming.	Up to K3
CLO 4	Ability to identify the concept of Object oriented programming and MDI	Up to K4
CLO 5	Implement and analyze the concept of Data access with ADO.NET	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	1	2	2	3
CLO 2	2	1	2	2	3
CLO 3	2	1	2	2	2
CLO 4	2	1	2	2	3
CLO 5	2	2	2	1	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	3	2	2	3	3
CLO 2	2	3	2	1	2	2
CLO 3	2	2	2	1	2	2
CLO 4	2	2	2	1	2	2
CLO 5	2	2	2	2	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
V	Major Core Practical -6	20U5FMP6	RDBMS – Lab	2	3	40	60	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	✓

Course Objectives

- To create relations, Insert and Display tuples
- To Master the basics of SQL and construct queries.
- To construct multiple queries and join tables.
- To write coding for functions and Procedures.
- To write coding for Exceptions, Cursors and Triggers.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	1. Create table Employee (emp_no, emp_name, salary, dept_no) Execute the following queries. a) Insert 10 records into the employee table. b) Display name, number and salary of those employees whose name is 5 characters long and first three characters are 'Ani'. c) Display the details of employee where employee name's second character should be 'n'. d) Display employee no, name and department details of those employee whose department lies in(10,20) e) Display all the records in the employee table. 2. Create table for book with attributes bookcode, bookname, authername, publication, cost. Insert five records. Execute the following queries. a) Add the primary key to bookcode. b) Display the details of all the books c) Display the name of the books written by "Balagurusamy". d) Display the total number of books in the table. e) Display the total cost of all the books in the library.	9	K2	1

	f) Display the minimum and maximum cost of the book. 3. Consider the employee table given exercise 1. Execute the following queries. a) Alter the table by adding DA, HRA, PF, Grosspay, Netpay b) Update the table by calculating - DA – 50% of the Salary - HRA – 10% of the Salary - PF – 8% of the salary c) Grosspay = salary + DA + HRA d) Netpay = Grosspay – PF e) Display all the updated records			
II	4. Consider the following tables: WORKS (Pname, Cname, City) LIVES (Pname, Street, City) LOCATED_IN (Cname, City) MANAGER (Pname, Mgrname) Write the SQL for the following: a) List the names of the people who work for the company Wipro along with the cities they live in. b) Find the people who work for the company Infosys with a salary more than Rs.50000/-. c) Find the names of the persons who live and work in the same city. d) Find the names of the persons who do not work for Infosys. e) List the names of the people, along with the street and city addresses. 5. Consider the following tables: STUDENT (Name, SNO, Class, Major) COURSE (CName, CNO, Cr_hrs, Dept) SECTION (SID, CNO, Semester, Year, Instructor) GRADE_REPORT (SNO, SID, Grade) Execute the following queries. a) Retrieve the names of all senior students (class=3) majoring in CS. b) Retrieve the names of all courses taught by Professor Chandra Sekar in the year 2019 & 2020. c) Retrieve the names and major departments of students whose grade is "A" d) For each section taught by professor Chandra Sekar, retrieve the course number, credit hours, semester, year, grade for each course completed by the student.	9	K3	2

	6. Consider the following tables. MASTER (ACNO, Cname, Caddress, CDOB, con_num, Cus_mail, Balance_amt, ACTYPE, BNAME) TRANSACTION (ACNO, Amount, Trans_type,DT_TRANS,BNAME) Execute the following queries. - Retrieve all the senior citizens who have account in SBI. - Retrieve the details of customers whose account type is 'current' and bank name is Indian Bank. - Update MASTER table from Transaction table by today's date. - List the total amount deposited and total amount withdrawn today.			
III	7. Consider the following tables: STUDENT (SNO, SNAME, CLASS, MAJOR) MARKS (SNO, SUB1, SUB2,SUB3, SUB4) PROJECT (SNO, PTITLE, COMPANY) Execute the following queries. - Using Inner join display student details and marks. - Using left outer join display student details and marks. - Using Right outer join display student and their project details. - Using full Outer join display student and their project details. 8. Create the following tables: PRODUCT (Pcode, Pname, Brandname, Suppliercode, Sname, Quantity, Cost) SALES(Pcode,Pname,Customername, Quantity, Cost,DT_sales) Execute the following queries. - Calculate the total cost of sales for the given date. - Retrieve sales details group by DT_sales. - Retrieve product details whose product code having in (P001, P010, P020) - Update product table quantity with quantity in sales table to calculate the current quantity. 9. Write a PL/SQL program to prepare an Electricity bill.	9	K3	1
IV	10. Write a PL/SQL program to prepare student mark list. 11. Write a program to count the total number of employees using the function. 12. Write a PL/SQL code to update values in employee table by using implicit cursor.	9	K4	1

V	13. Write a PL/SQL code to display employee details by using explicit cursor. 14. Write a PL/SQL code to create exception for string employee names in a string. 15. Write a program to create a trigger to avoid inserting data during weekend in the employee table.	9	K3	1

Book(s) for Study

Database System Concepts, Abraham Silberchatz, Henry K.Forth, S.Sudarshan, 2013, 6th Edition, McGraw Hill Education (India) Private Limited.

Books for Reference

1. "Database Systems" - Thomas Connolly - Addison Wesley - New Print 2000.
2. "Database Management Systems" - Ragu Rama Krishnan, Johannes Gehrke - III Ed. – Mc Graw Hill Edition, New Delhi.
3. "Fundamentals of Database Systems" – Ramez Elmasri, Shamkant B Navathe – 5th Edition, Pearson Education.

Web Resources

1. <https://www.w3schools.com/sql/>
2. <https://towardsdatascience.com/practical-sql-create-and-query-a-relational-database-8bac84d78703>
3. <https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm>
4. https://docs.oracle.com/cd/B19306_01/server.102/b14200/statements_6009.htm

Rationale for Nature of the course

The world of data is constantly changing, by accurately recording data, updating and tracking them on an efficient and regular basis, Computer Professionals can address their challenges.

Activity on Knowledge and Skill Oriented

Practice to write Queries and Procedures, train to spot Bugs and rectify it

Activities on Employability

Practice to design different Backend Applications.

Activities on Entrepreneurship

Trained to design and Maintain Databases,Big Data

Pedagogy

Projector, Demonstration and Practical Session.

Course Designer Names

1. Mrs. K. R.Ramadevi
2. Mr.K.Rajasaravanakumar

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	- Create table Employee (emp_no, emp_name, salary, dept_no) Execute the following queries. - Insert 10 records into the employee table. - Display name, number and salary of those employees whose name is 5 characters long and first three characters are 'Ani'. - Display the details of employee where employee name's second character should be 'n'. - Display employee no, name and department details of those employee whose department lies in(10,20) - Display all the records in the employee table. - Create table for book with attributes bookcode, bookname, authorname, publication, cost. Insert five records. Execute the following queries. - Add the primary key to bookcode. - Display the details of all the books - Display the name of the books written by "Balagurusamy". - Display the total number of books in the table. - Display the total cost of all the books in the library. - Display the minimum and maximum cost of the book. - Consider the employee table given exercise 1. Execute the following queries. - Alter the table by adding DA, HRA, PF, Grosspay, Netpay - Update the table by calculating - DA – 50% of the Salary - HRA – 10% of the Salary - PF – 8% of the salary - Grosspay = salary + DA + HRA - Netpay = Grosspay – PF - Display all the updated records	9	Demo & Practical Session
II	- Consider the following tables: WORKS (Pname, Cname, City) LIVES (Pname, Street, City) LOCATED_IN (Cname, City) MANAGER (Pname, Mgrname) Write the SQL for the following: - List the names of the people who work for the company Wipro along with the cities they live in.	9	Demo & Practical Session

	b) Find the people who work for the company Infosys with a salary more than Rs.50000/-. c) Find the names of the persons who live and work in the same city. d) Find the names of the persons who do not work for Infosys. e) List the names of the people, along with the street and city addresses. 5. Consider the following tables: STUDENT (Name, SNO, Class, Major) COURSE (CName, CNO, Cr_hrs, Dept) SECTION (SID,CNO,Semester, Year, Instructor) GRADE_REPORT (SNO,SID,Grade) Execute the following queries. a) Retrieve the names of all senior students (class=3) majoring in CS. b) Retrieve the names of all courses taught by Professor Chandra Sekar in the year 2019 & 2020. c) Retrieve the names and major departments of students whose grade is "A" d) For each section taught by professor Chandra Sekar, retrieve the course number, credit hours, semester, year, grade for each course completed by the student. 6. Consider the following tables. MASTER (ACNO, Cname, Caddress, CDOB, con_num, Cus_mail, Balance_amt, ACTYPE, BNAME) TRANSACTION (ACNO, Amount, Trans_type, DT_TRANS, BNAME) Execute the following queries. a) Retrieve all the senior citizens who have account in SBI. b) Retrieve the details of customers whose account type is 'current' and bank name is Indian Bank. c) Update MASTER table from Transaction table by today's date. d) List the total amount deposited and total amount withdrawn today.		
III	7. Consider the following tables: STUDENT (SNO, SNAME, CLASS, MAJOR) MARKS (SNO, SUB1, SUB2, SUB3, SUB4) PROJECT (SNO, PTITLE, COMPANY) Execute the following queries. a) Using Inner join display student details and marks. b) Using left outer join display student details and marks. c) Using Right outer join display student and their project details.	9	Demo & Practical Session

	d) Using full Outer join display student and their project details. 8. Create the following tables: PRODUCT (Pcode, Pname, Brandname, Suppliercode, Sname, Quantity, Cost) SALES(Pcode,Pname,Customername, Quantity, Cost,DT_sales) Execute the following queries. a) Calculate the total cost of sales for the given date. b) Retrieve sales details group by DT_sales. c) Retrieve product details whose product code having in (P001, P010, P020) d) Update product table quantity with quantity in sales table to calculate the current quantity. 9. Write a PL/SQL program to prepare an Electricity bill.		
IV	10. Write a PL/SQL program to prepare student mark list. 11. Write a program to count the total number of employees using the function. 12. Write a PL/SQL code to update values in employee table by using implicit cursor.	9	Demo & Practical Session
V	13. Write a PL/SQL code to display employee details by using explicit cursor. 14. Write a PL/SQL code to create exception for string employee names in a string. 15. Write a program to create a trigger to avoid inserting data during weekend in the employee table.	9	Demo & Practical Session

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Levels
CLO 1	Demonstrate the DDL queries.	Up to K2
CLO 2	Construct basic queries, apply Aggregate functions.	Up to K3
CLO 3	Construct multiple queries and various joins.	Up to K3
CLO 4	Devise procedures and functions.	Up to K4
CLO 5	Devise exceptions, triggers and cursors.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	2	1	3
CLO 2	3	3	1	1	2
CLO 3	2	2	1	1	2
CLO 4	2	2	1	3	2
CLO 5	3	3	2	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	2	1	1	1	2
CLO 2	2	2	2	1	2	2
CLO 3	2	2	2	1	2	3
CLO 4	2	2	2	1	2	3
CLO 5	3	2	2	2	1	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
V	IDC	20U5FIDC	Bio-Applications in Artificial Intelligence	3	4	25	75	100

Nature of the Course			
Knowledge and Skill	✓	Employability Oriented	✓
Skill Oriented		Entrepreneurship oriented	

Course Objectives

- To impart the knowledge of fundamental of Artificial Intelligence.
- To become familiar with basic principles of AI towards problem solving.
- To learn the concept of deep learning for image analysis.
- To apply the principles of AI in biological process.
- To apply the concepts of AI in Agro ecosystem.

Unit	Content	Hrs	K-Level	CLO
I	Introduction - What Is Artificial Intelligence? - Brain Science and Problem Solving - The Turing Test and Chatterbots - The History of AI - The First Beginnings - Logic Solves (Almost) All Problems - The New Connectionism - Reasoning Under Uncertainty - Distributed, Autonomous and Learning Agents - AI Grows Up - The AI Revolution- AI and Society - Does AI Destroy Jobs? - AI and Transportation - Service Robotics - Agents Knowledge-Based Systems.		K2	1
II	First-order Predicate Logic - Syntax - Semantics - Equality - Quantifiers and Normal Forms - Proof Calculi - Resolution - Resolution Strategies - Equality. Limitations of Logic - The Search Space Problem - Decidability and Incompleteness - The Flying Penguin .		K2	2

III	Search, Games and Problem Solving : Introduction - Uninformed Search - Breadth-First Search - Depth-First Search - Iterative Deepening - Comparison - Cycle Check - Heuristic Search - Greedy Search - A* Search - Route Planning with the A* Search Algorithm - IDA * Search - Empirical Comparison of the Search Algorithms. Biomedical Imaging and Analysis through Deep learning: Introduction – Tomographic image reconstruction – Image segmentation – Image registration – Deep –learning- based radiomics.		K2	3
IV	Artificial Intelligence in Drug Designing Genes, gene concept – central dogma, genetic variation addition, deletion, substitution SNP, HGP, DNA Sequences – focus on genetic variation in health. Phases of drug design, Applications of AI in drug design. Insilico ADMET prediction – materials – dataset descriptive set, machine learning algorithm software, hardware model development and automated .high through put protein ligand. Docking – introduction, chemical libraries protein preparation, docking protocol common machine learning /docking virtual screening workflow.	12	K2	4
V	Artificial Intelligence Driven Smart Agriculture Agroecosystem an Introduction- Crop Disease- Bacterial Infection - Citrus Canker Disease; Fungal infection- sheath Blight of Paddy; Viral Infection - Tobacco Mosaic Virus; Control measures of crop diseases- –Cultural practices – Chemical control –Biology control- Integrated plant diseases management- genetic engineering tool- transgenic plants – Viral, Fungal and Bacterial Disease Resistance in Transgenic Plants; artificial intelligence and machine learning approach to control crop disease – high accuracy in disease prediction using image analysis, detection and classification of crop disease using image analysis and control measures using Drones.	12	K2	5

Books for Study

1. Wolfgang Ertel – “Introduction to Artificial Intelligence –Springer publications – 2017 – II Edition.
2. Lei Xing, Maryellen Giger, James K.Min – Artificial Intelligence in Medicine – Academic Press – 2021.
3. Brian Hilbush.In Silico Dreams How Artificial Intelligence and Biotechnology Will Create the Medicines of the Future, 2021, John Wiley & Sons, Inc.
4. Alexander Heifetz ,Artificial Intelligence in Drug Design , Computational Drug Discovery, Evotec (UK) Ltd., Abingdon, Oxfordshire, UK , Humana Press.

Chapters

Unit I: 1.1 – 1.5.

Unit II: 3.1 -3.5, 4.1 -4.3

Unit III: 6.1 –6.3(Book 1), 4.1-4.5(Book 2)

Unit IV: Web Resources

Unit V: Web Resources

Books for Reference

1. Stuart Russell and Peter Norvig - Artificial Intelligence – A Modern Approach -3rd Edition – Pearson publication.
2. Latief Ahmad and FirasthNabi – Agriculture 5.0 – Artificial Intelligence, IoT and Machine Learning – CRC press, Taylor and Francis Group.
3. K.R. Aneja – Experiments in microbiology, plant pathology and biotechnology- 4th revised edition— New Age International Publishers.

Web Resources

1. <https://www.javatpoint.com/artificial-intelligence-tutorial>
2. <https://training.ti.com/sites/default/files/docs/introduction-to-deep-learning.pdf>
3. <https://ieeexplore.ieee.org/document/8698004>

Rationale for Nature of Course

- ✓ Helps the students to learn how AI pervasive and how we continue to use AI powered solutions in our day to life.

Activities on Knowledge and Skill Development

- ✓ Involve the students in group discussion by discussing the various applications of AI.

Activities on Employability Oriented

- ✓ Practice to solve different real time problem using Artificial intelligence techniques.

Pedagogy

Chalk and talk, PPT, Assignment, Seminar, Problem solving, Group discussion and Quiz

Course Designer(s) Name

1. Mrs. R.LakshaPriya
2. Mrs. K.Imaya
3. Ms. S.Saranya
4. Dr. N. Kamaladhasan

Lesson Plan

Unit	Topics	Hours	Mode
I	Introduction - What Is Artificial Intelligence? - Brain Science and Problem Solving - The Turing Test and Chatterbots - The History of AI - The First Beginnings - Logic Solves (Almost) All Problems.	4	Chalk and talk& Quiz
	The New Connectionism - Reasoning Under Uncertainty - Distributed, Autonomous and Learning Agents - AI Grows Up - The AI Revolution- AI and Society - Does AI Destroy Jobs?	4	Chalk and talk
	AI and Transportation - Service Robotics - Agents Knowledge-Based Systems.	4	GD
II	First-order Predicate Logic - Syntax - Semantics - Equality - Quantifiers and Normal Forms - Proof Calculi - Resolution - Resolution Strategies - Equality.	6	Chalk and talk, Quiz
	Limitations of Logic - The Search Space Problem - Decidability and Incompleteness - The Flying Penguin.	6	PPT & Problem Solving
III	Search, Games and Problem Solving : Introduction - Uninformed Search - Breadth-First Search - Depth-First Search - Iterative Deepening - Comparison - Cycle Check - Heuristic Search	4	Chalk and talk
	Greedy Search - A* Search - Route Planning with the A* Search Algorithm - IDA * Search	4	Chalk and talk& QUIZ

	- Empirical Comparison of the Search Algorithms. Biomedical Imaging and Analysis through Deep learning: Introduction – Tomographic image reconstruction – Image segmentation – Image registration – Deep –learning- based radiomics.	4	Chalk and talk& GD
IV	Artificial Intelligence in Drug Designing Genes, gene concept – central dogma, genetic variation addition, deletion, substitution SNP, HGP, DNA Sequences – focus on genetic variation in health.. Phases of drug design, Applications of AI in drug design.	4	Chalk and talk& Quiz
	Insilico ADMET prediction – materials – dataset descriptive set , machine learning algorithm software ,hardware model development and automated .high through put protein ligand .	4	Chalk and talk& Quiz
	Docking – introduction, chemical libraries protein preparation , docking protocol common machine learning /docking virtual screening workflow.	4	Chalk and talk, Problem Solving& Quiz
V	Artificial Intelligence Driven Smart Agriculture Agroecosystem an Introduction- Crop Disease- Bacterial Infection - Citrus Canker Disease; Fungal infection- sheath Blight of Paddy; Viral Infection - Tobacco Mosaic Virus;	4	Chalk and talk& Quiz
	Control measures of crop diseases- –Cultural practices – Chemical control –Biology control- Integrated plant diseases management- genetic engineering tool- transgenic plants – Viral, Fungal and Bacterial Disease Resistance in Transgenic Plants;	4	Chalk and talk& Quiz
	Artificial intelligence and machine learning approach to control crop disease – high accuracy in disease prediction using image analysis, detection and classification of crop disease using image analysis and control measures using Drones.	4	Chalk and talk, Problem Solving& Quiz

Course Learning Outcomes

On the completion of the course ,The students will be able to

CLO	Course Learning Outcomes	K – Levels
CLO 1	Discuss the core components of Artificial Intelligence.	Up to K2
CLO 2	Illustrate the basic principles and algorithms of AI to solve real time problems.	Up to K2
CLO 3	Identify the searching and deep learning algorithms which more appropriate for various types of learning task in various domains.	Up to K2
CLO 4	Elaborate the various aspects of drug design and docking methods	Up to K2
CLO 5	Explain the importance and uses of AI in modern agriculture practices	Up to K2

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	2	1	1	2
CLO 2	2	2	2	1	1	2
CLO 3	2	2	2	1	2	2
CLO 4	2	3	3	2	3	3
CLO 5	2	3	3	2	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	3	2	1	2	3
CLO 2	3	2	1	2	3
CLO 3	3	3	2	2	3
CLO 4	3	3	3	3	3
CLO 5	3	3	3	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)

Blue Print for Formative Examination – Bio-Applications in Artificial Intelligence (CIA I & II)

Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K - Level		
CIA	CLO X	Up to K2	2	K1	2 (K2&K2)	2 (K2)
	CLO Y	Up to K2	1	K1	2 (K2&K2)	1 (K2)
Question Pattern (CIA I & II)	No. of Questions to be asked		3		4	3
	No. of Questions to be answered		3		2	2
	Marks for each Question		2		7	10
	Total Marks for each Section		6		14	20

- CLO3 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

Internal	K - Level	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice
CIA I	K1	6	-	-	6	9.37
	K2	-	28	30	58	90.63
	Marks	6	28	30	64	100
CIA II	K1	6	-	-	6	9.37
	K2	-	28	30	58	90.63
	Marks	6	28	30	64	100

- K1- Remembering and recalling facts with specific answers.
- K2- Basic understanding of facts and stating main ideas with general answers.

Outcome Based Education & Assessment (LOBE)

Blue Print for Summative Examination - Bio-Applications in Artificial Intelligence

Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K - Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K – Level		
1	CLO 1	Up to K2	1	K1	2 (K2&K2)	1 (K2)
2	CLO 2	Up to K2	1	K1	2 (K2&K2)	1 (K2)
3	CLO 3	Up to K2	1	K1	2 (K2&K2)	1 (K2)
4	CLO 4	Up to K2	1	K1	2 (K2&K2)	1 (K2)
5	CLO 5	Up to K2	1	K1	2 (K2&K2)	1 (K2)
No. of Questions to be Asked			5		10	5
No. of Questions to be Answered			5		5	3
Marks for each question			2		7	10
Total Marks for each Section			10		35	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers

Distribution of Section–wise Marks with K - Levels*

K - Level	Section A (No choice)	Section B (Either/or)	Section C (Open choice)	Total Marks	% of Marks without Choice	Consolidated (%)
K1	10	-	-	10	7.69	100%
K2		70	50	120	92.31	
Total Marks	10	70	50	130	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS:III B.Sc Information Technology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	EXT	Total
V	Major Elective – I	20U5FME1	Computer Graphics	2	3	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To acquire basic knowledge of pixels, frames and buffer and line generations using algorithms
- To familiarize the concept of Polygon generation algorithms.
- To explore the concepts of basic Transformations and its Routines.
- To be familiar with Segmentation, Image transformations and various Clipping algorithms.
- To focus on 3D Transformations.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Geometry & Line Generation: Introduction – Lines – Line Segments- Perpendicular Lines-Distance Between a point and a Line-Vectors - Pixels & frame buffers - Vector generation - Bresenham's algorithm - Character generation - Displaying the frame buffer. Graphics Primitives: Introduction-Display Devices-Primitive Operations- Normalized Device Coordinates-Display File Structure-Display-File Algorithms-Display Control-The Line Style Primitive.	9	K3	1
II	Polygons: Introduction – Polygons - Polygon representation - Entering polygons - An inside test - Polygon interfacing algorithms - Filling polygons - Filling with a pattern.	9	K2	2
III	Transformations: Introduction - Matrices - Scaling transformations – Rotation - Homogeneous coordinates & translation - Coordinate Transformations - Rotation about an arbitrary point - Other Transformations – Inverse transformations - Transformation Routines - Display procedures.	9	K4	3
IV	Segments: Introduction - The segment table - Segment creation - Closing a segment - Deleting a segment - Renaming a segment - Visibility – Image transformation. Windowing & Clipping: Introduction - The viewing transformation - Clipping - The Cohen - Sutherland out code algorithm - The Sutherland houghman algorithm.	9	K3	4

V	Three Dimensions:- Introduction-3D Geometry-3D Primitives-3D Transformations-Rotation about an Arbitrary Axis-Parallel Projection-Perspective Projection-Conversion to View Plane Coordinates.	9	K4	5

Book(s) for Study

“Computer Graphics, A Programming Approach” – Steven Harrington – Second Edition
McGraw Hill International Edition.

Chapters

Unit – I: 1, 2
Unit – II: 3
Unit – III: 4
Unit – IV: 5, 6
Unit – V: 8

Books for Reference

1. “Principles of Interactive Computer Graphics”- Newman & Sproull – Second Edition
McGraw Hill Edition.
2. “Computer Graphics”- Donald Hearn, M.Pauline Baker- Second Edition-PHI.
3. “Fundamentals of Computer Graphics”-Steve Marschner,Peter Shirley –Fourth Edition –
CRC Press

Web Resources

1. <https://cglearn.codelight.eu/pub/computer-graphics>
2. <https://math.hws.edu/eck/cs424/downloads/graphicsbook-linked.pdf>
3. <https://www.dgp.toronto.edu/~hertzman/418notes.pdf>

Rationale for Nature of the Course

Prepares students for activities involving the design, development, rendering, and animation solutions to a broad variety of problems found in entertainment, science and engineering.

Activities on Knowledge and Skill Oriented

Practice the students to solve problems and work out case Studies for the given Scenario

Pedagogy

Chalk and Talk, E content, PPT, Assignment, Group discussion, Quiz, Seminar.

Course Designer Names

1. Mrs. S.Brindha
2. Mrs. S.Sasikala

Lesson Plan

Unit	Topics to be Covered	Allotted Hours	Mode
I	Geometry & Line Generation: Introduction – Lines – Line Segments- Perpendicular Lines-Distance Between a point and a Line-Vectors - Pixels & frame buffers - Vector generation - Bresenham's algorithm - Character generation - Displaying the frame buffer.	5	Chalk and Talk, Quiz
	Graphics Primitives: Introduction-Display Devices-Primitive Operations- Normalized Device Coordinates-Display File Structure-Display-File Algorithms-Display Control-The Line Style Primitive.	4	Chalk and Talk
II	Polygons: Introduction – Polygons - Polygon representation - Entering polygons - An inside test. Polygon interfacing algorithms - Filling polygons - Filling with a pattern.	4	Chalk and Talk & GD
		5	Chalk and Talk & Quiz
III	Transformations: Introduction - Matrices - Scaling transformations – Rotation - Homogeneous coordinates & translation. Coordinate Transformations - Rotation about an arbitrary point - Other Transformations – Inverse transformations - Transformation Routines - Display procedures.	4	Chalk and Talk & PPT
		5	Chalk and Talk & Quiz
IV	Segments: Introduction - The segment table - Segment creation - Closing a segment - Deleting a segment - Renaming a segment Visibility – Image transformation. Windowing & Clipping Introduction - The viewing transformation - Clipping - The Cohen - Sutherland out code algorithm- The Sutherland hodgman algorithm.	4	Chalk and Talk & E-Content
		5	Chalk and Talk & Quiz
V	Three Dimensions:- Introduction-3D Geometry-3D Primitives-3D Transformations-Rotation about an Arbitrary Axis-Parallel Projection. Perspective Projection-Conversion to View Plane Coordinates.	5	Chalk and Talk & Seminar
		4	Chalk and Talk & Assignment

Course Learning Outcomes

On the completion of the course, the student will be able to

CLOs	COURSE LEARNING OUTCOMES	K-Level
CLO 1	Apply Line generating algorithms to create 2D Images.	Up to K3
CLO 2	Describe the concept of Polygons and its algorithms.	Up to K2
CLO 3	Examine the Use of geometric transformations on graphics objects and their application in composite form.	Up to K4
CLO 4	Organize the various clipping techniques.	Up to K3
CLO 5	Illustrate the concept of 3DTransformations and Clippings.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	3	1	3
CLO 2	3	3	2	1	2
CLO 3	2	2	3	1	2
CLO 4	2	3	3	1	3
CLO 5	3	3	3	1	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	2	3	2	2	3
CLO 2	2	2	3	1	2	3
CLO 3	2	2	3	1	2	2
CLO 4	2	2	3	1	3	2
CLO 5	3	3	3	3	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)

Formative - Blue Print - Model for Computer Graphics (CIA I & II)

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
CIA I	CLO1	Up to K3	2	K1 & K2	1	K2	2(K3&K3)	1(K3)
	CLO2	Up to K2	2	K1 & K2	2	K1	2(K2&K2)	2(K2)
CIA II	CLO3	Up to K4	2	K1 & K2	1	K2	2(K1&K1)	2(K4)
	CLO4	Up to K3	2	K1 & K2	2	K1	2(K3&K3)	1(K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	-	-	6	10	67
K2	2	2	10	20	34	56.67	
K3	-	-	10	10	20	33.33	33
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	26.67	34
K2	2	2	-	-	4	6.67	
K3	-	-	10	10	20	33.33	33
K4	-	-	-	20	20	33.33	33
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for Computer Graphics
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Unit	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No Of Questions	K - Level	No Of Questions	K -Level		
1	CLO1	Up to K3	2	K1 & K2	1	K2	2(K3&K3)	1(K3)
2	CLO2	Up to K2	2	K1 & K2	1	K1	2(K2&K2)	1(K2)
3	CLO3	Up to K4	2	K1 & K2	1	K2	2(K1&K1)	1(K4)
4	CLO4	Up to K3	2	K1 & K2	1	K1	2(K3&K3)	1(K3)
5	CLO5	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels *

K Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.66	42
K4	-	-	10	10	20	16.66	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
V	Major Elective- I	20U5FME1	Linux Programming	2	3	25	75	100

Nature of the Course			
Knowledge and Skill	✓	Employability Oriented	✓
Skill Oriented		Entrepreneurship Oriented	✓

Course Objectives

- To learn the basic commands of Shell Programming.
- To understand the concepts of file and directories.
- To impart the knowledge of inter process communication.
- To be familiar with the concepts of process and signals.
- To develop the basic skills required to write network programs using sockets.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Getting started: An introduction to UNIX, Linux and GNU - Programming Linux. Shell programming: Introduction - Pipes and redirection - The shell as a Programming language-Shell syntax - Going Graphical - Dialog utility - Putting it altogether.	9	K2	1
II	Working With Files: Linux file structure-System calls and device drivers - Library functions - low level file access -The Standard I/O library - Formatted input and output - File and directory maintenance - Scanning Directories – Errors - The /Proc file systems. Advanced Topics: fcntl and mmap.	9	K3	2
III	Debugging: Types of Errors – General Debugging Techniques – Debugging with gdb – More debugging tools – Assertions – Memory Debugging. Processes and Signals: Introduction to process - Process structure - Starting new processes - Signals.	9	K4	3
IV	POSIX Threads: What is a Thread – Advantages and Drawbacks of Threads – A First Threads Program – Simultaneous Execution – Synchronization – Thread Attributes – Cancelling a Thread – Threads in Abundance. Inter Process Communication: Pipes - Process pipes - Sending output to ‘popen’ - The pipe call - Parent and child processes - Named pipes: FIFOs - The CD database applications.	9	K3	4

V	Semaphores, Shared memory and Message queues: Semaphores - Shared memory - Message queues – IPC Status commands. Sockets: Introduction - Socket connections - Network information - Multiple clients - Datagrams.	9	K4	5

Book(s) for Study

“Beginning Linux Programming”, Neil Mathew, Richard Stones, Fourth Edition, Wiley Publishing Inc, 2008.

Chapter

Unit-I: 1, 2

Unit-II: 3

Unit-III: 10, 11

Unit-IV: 12, 13

Unit-V: 14, 15

Books for Reference

1. The Complete Reference: LINUX – Richard Petersen – Sixth Edition – McGraw Hill.
2. Linux System Programming – Robert Love, O'Reilly SPD.

Web Resources

1. <https://www.javatpoint.com/linux-tutorial>
2. <https://ubuntu.com/tutorials/command-line-for-beginners#1-overview>
3. <https://www.mygreatlearning.com/blog/linux-tutorial/>

Rationale for Nature of the Course

To know the essential features of open source platform, anyone can run, study, modify, and redistribute the source code.

Activities on Knowledge and Skill

Giving Assignments and Workout Case Studies with Given Scenario

Activities on Employability Oriented

Practice to write program and train to fix Bugs, practice to work on Network Environment (LAN)

Activities on Entrepreneurship Oriented

Offer the students to learn the Networking Environment and Software Installation.

Pedagogy

Chalk and talk, PPT, Assignment, Seminar, Problem solving, Group discussion and Quiz.

Course Designer Names

1. Mr. N. Radha Krishnan
2. Mr. K. Rajasaravanakumar

Lesson Plan

Unit	Topics	Hours	Mode
I	Getting started: An introduction to UNIX, Linux and GNU - Programming Linux.	3	Chalk and talk & Quiz
	Shell programming: Introduction - Pipes and redirection - The shell as a Programming language-Shell syntax Going Graphical - Dialog utility - Putting it altogether.	6	Chalk and talk & PPT
II	Working With Files Linux file structure-System calls and device drivers - Library functions - low level file access -The Standard I/O library.	5	Chalk and talk, & Quiz
	Formatted input and output - File and directory maintenance -Scanning Directories – Errors - The /Proc file systems - Advanced Topics: fcntl and mmap.	4	Chalk and talk & Problem solving
III	Debugging: Types of Errors – General Debugging Techniques – Debugging with gdb – More debugging tools – Assertions – Memory Debugging.	5	Chalk and talk, & Quiz
	Processes and Signals : Introduction to process - Process structure - Starting new processes - Signals.	4	Chalk and talk, & GD
IV	POSIX Threads: What is a Thread – Advantages and Drawbacks of Threads – A First Threads Program – Simultaneous Execution – Synchronization – Thread Attributes – Cancelling a Thread – Threads in Abundance.	4	Chalk and talk PPT & Quiz
	Inter Process Communication: Pipes - Process pipes - Sending output to ‘popen’ - The pipe call - Parent and child processes - Named pipes: FIFOs - The CD database applications.	5	Chalk and talk
V	Semaphores, Shared memory and Message queues: Semaphores - Shared memory - Message queues – IPC Status commands.	5	Seminar & Assignment
	Sockets: Introduction - Socket connections - Network information - Multiple clients - Datagrams.	4	Chalk and talk

Course Learning Outcomes

On the completion of the course, the student will be able to

CLO	Course Learning Outcomes	K – Levels
CLO 1	Describe the fundamental concepts of a shell programming.	Up to K2
CLO 2	Identify the usage of files and directory maintenance in shell programming.	Up to K3
CLO 3	Illustrate the significance of process structures and signals	Up to K4
CLO 4	Identify the concept of POSIX and Inter process Communication.	Up to K3
CLO 5	Focus on the principles of semaphores, shared memory and socket connections & Datagrams.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	3	1	3
CLO 2	3	3	2	1	2
CLO 3	2	2	3	1	2
CLO 4	2	3	3	1	3
CLO 5	3	3	3	1	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	2	3	2	2	3
CLO 2	2	2	3	1	2	3
CLO 3	2	2	3	1	2	2
CLO 4	2	2	3	1	3	2
CLO 5	3	3	3	3	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print Model for Linux Programming (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questi ons	K - Level	No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	2 (K2)
	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K2&K2)	1 (K3)
CIA II	CLO 3	Up to K4	2	K1 & K2	1	K2	2 (K4&K4)	2 (K3)
	CLO 4	Up to K3	2	K1 & K2	2	K2	2 (K3&K3)	1 (K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for each Section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	2	10	-	14	23.33	83
K2	2	4	10	20	36	60	
K3	-	-	-	10	10	16.67	17
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	-	-	-	2	3.33	16
K2	2	6	-	-	8	13.33	
K3	-	-	10	30	40	66.67	67
K4	-	-	10	-	10	16.67	17
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for Linux Programming
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K - Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K1& K2	1	K2	2 (K2&K2)	1 (K3)
3	CLO 3	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1 (K3)
4	CLO 4	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1 (K3)
5	CLO 5	Up to K4	2	K1& K2	1	K1	2 (K3&K3)	1 (K4)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without Choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
V	Major Elective-I	20U5FME1	Computer Architecture	2	3	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the basic concepts of Register Transfer and Micro Operations.
- To know the importance of Register Organization and Addressing modes.
- To analyze the essentials of Pipelining and Arithmetic Operations.
- To familiarize the concept of I/O Organization.
- To observe the efficiency of the Multiprocessing Architecture.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introduction to Registers & Micro Operations: Register Transfer and Micro Operations: Register transfer language - Register transfer - Bus and Memory Transfer - Arithmetic Micro operations – Logic operations - Shift Micro Operations. Micro Programmed Control: Control Memory - Address sequencing - Design of Control Unit.	9	K2	1
II	Register Organisation: Central Processing Unit: General Register Organisation - Stack Organisation - Instruction formats -Addressing Modes –Data transfer and manipulation- Program Control.	9	K3	2
III	Pipeline and Vector Processing: Parallel Processing - Pipelining-Arithmetic Pipeline-Instruction Pipeline. Computer Arithmetic: Introduction - Addition and Subtraction – Multiplication Algorithms – Division Algorithms.	9	K3	3
IV	Input Output Organisation: Input output Interface- Asynchronous Data Transfer – Modes of Transfer – Priority Interrupt – Direct Memory Access – Input Output Processor.	9	K4	4
V	Memory Organisation: Memory Hierarchy – Main Memory – Auxiliary Memory - Associative Memory – Cache Memory - Virtual Memory. Multi Processors: Characteristics of Multi Processor- Interconnection Structures.	9	K4	5

Book(s) for Study

“Computer System Architecture”, M.Morris Mano ,Third Edition Revised, Pearson Publications.

Chapters

Unit I: 5.1- 5.6, 8.1, 8.2, 8.4

Unit II: 9.2, 9.5- 9.7

Unit III: 10.1- 10.4, 11.1 - 11.4

Unit IV: 12.2- 12.7

Unit V: 13.1 – 13.6, 14.1 – 14.2

Books for Reference

1. “Computer system architecture” , Technical publication, A.P. Godse, Dr. D.A. Godse
2. “Computer Organisation and Architecture” (Designing for Performance) Ninth Edition, William Stallings Pearson Publication.
3. “Computer system organisation and architecture”, John D Carpinelli , Pearson Publication.

Web Resources

1. <https://www.studytonight.com/computer-architecture/registers>
2. <https://www.studytonight.com/computer-architecture/pipelining>
3. <https://www.geeksforgeeks.org/io-interface-interrupt-dma-mode/>
4. <https://www.studytonight.com/computer-architecture/input-output-organisation>
5. <https://www.elprocus.com/memory-hierarchy-in-computer-architecture/>

Rationale for Nature of the course

Represents the means of interconnectivity for computer’s hardware as well as the mode of data transfer and processing exhibited.

Activities on Knowledge and Skill

Practice to conduct group discussion, write Assignment.

Pedagogy

Chalk and talk, Materials, PPT, Assignment, Seminar, Problem solving, Group discussion, Quiz.

Course Designer Names

1. Mr. M.Ashok Kumar
2. Mrs. K.Imaya

Lesson Plan

Unit	Topics	Hours	Mode
I	Introduction to Registers & Micro Operations: Register Transfer and Micro Operations: Register transfer language - Register transfer - Bus and Memory Transfer.	3	Chalk and talk & Quiz
	Arithmetic Micro operations – Logic operations - Shift Micro Operations.	3	Chalk and talk & Problem Solving
	Micro Programmed Control: Control Memory - Address sequencing - Design of Control Unit.	3	Chalk and talk & PPT
II	Register Organisation: Central Processing Unit: General Register Organisation - Stack Organisation - Instruction formats.	5	Chalk and talk & PPT
	Addressing Modes –Data transfer and manipulation- Program Control.	4	Chalk and talk & Quiz
III	Pipeline and Vector Processing: Parallel Processing - Pipelining- Arithmetic Pipeline-Instruction Pipeline.	4	Chalk and talk & Quiz
	Computer Arithmetic: Introduction - Addition and Subtraction – Multiplication Algorithms – Division Algorithms.	5	Chalk and talk & Problem Solving
IV	Input Output Organisation: Input output Interface- Asynchronous Data Transfer – Modes of Transfer.	5	Chalk and talk & PPT
	Priority Interrupt – Direct Memory Access – Input Output Processor.	4	Chalk and talk & Quiz
V	Memory Organisation: Memory Hierarchy – Main Memory – Auxiliary Memory - Associative Memory – Cache Memory - Virtual Memory.	5	Chalk and talk & Seminar
	Multi Processors: Characteristics of Multi Processor- Interconnection Structures.	4	Chalk and talk & Assignment

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Levels
CLO 1	Express the Effectiveness of Registers & Micro Operations.	Up to K2
CLO 2	Organize Stack, Instruction formats and Addressing Modes.	Up to K3
CLO 3	Apply Parallel Processing in real time applications.	Up to K3
CLO 4	Classify various Modes of Transfer and Interrupts.	Up to K4
CLO 5	Focus on the significance of Memory and Multiprocessors.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	3	1	3
CLO 2	3	3	2	1	2
CLO 3	2	2	3	1	2
CLO 4	2	3	3	1	3
CLO 5	3	3	3	1	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	2	3	2	2	3
CLO 2	2	2	3	1	2	3
CLO 3	2	2	3	1	2	2
CLO 4	2	2	3	1	3	2
CLO 5	3	3	3	3	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Computer Architecture (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questi ons	K - Level	No. of Quest ions	K - Level		
CIA I	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K1)	2(K2)
	CLO 2	Up to K3	2	K1 & K2	2	K2	2 (K3&K3)	1(K3)
CIA II	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K2&K2)	2(K3)
	CLO 4	Up to K4	2	K1 & K2	2	K1	2 (K3&K3)	1(K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for each Section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consoli - dated %
K1	2	2	10	-	14	23.33	67
K2	2	4	-	20	26	43.33	
K3	-	-	10	10	20	33.34	33
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without Choice	Consoli - dated %
K1	2	4	-	-	6	10	33
K2	2	2	10	-	14	23.33	
K3	-	-	10	20	30	50	50
K4	-	-	-	10	10	16.67	17
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print - Model for Computer Architecture
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K – Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K – Level	No. of Questions	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1 (K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K2&K2)	1 (K3)
4	CLO 4	Up to K4	2	K1& K2	1	K1	2 (K3&K3)	1 (K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1 (K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section–wise Marks with K - Levels*

K - Level	Section A (NoChoice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consoli- dated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
VI	Skill Based Elective-IV	20U6FSM4	Multimedia and its Applications	2	2	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the basic Applications of Multimedia.
- To know the importance of Bitmaps and Colors.
- To familiarize the principles of Digital Audio with Animations.
- To make use of video editing and Animation Tools.
- To learn Various Skills and User Interface in Designing.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introduction to Multimedia: What Is Multimedia- Definitions - Where to Use Multimedia: Multimedia in Business - Multimedia in Schools Multimedia at Home -Multimedia in Public Places - Virtual Reality - CD-ROM, DVD, Flash Drives. Introduction to Text: Using Text in Multimedia - Hypermedia and Hypertext.	6	K2	1
II	Introduction to Images: Before You Start to Create: Plan Your Approach - Organize Your Tools - Configure Your Computer Workspace. Making Still Images: Bitmaps - Vector Drawing - Vector-Drawn Objects vs. Bitmaps - 3-D Drawing and Rendering. Color: Understanding Natural Light and Color - Computerized Color-Color Palettes - Image File Formats.	6	K3	2
III	Sound: The Power of Sound - Digital Audio - Making Digital Audio Files - MIDI Audio - Audio File Formats. Animation: Principles of Animation - Animation by Computer- Animation Techniques - Animation File Formats. Making Animations That Work: A Bouncing Ball- Creating a sequence frames in Flash.	6	K3	3
IV	Video: How Video Works and Is Displayed - Analog Video - Digital Video. Making Multimedia : The Stages of a Multimedia Project What You Need: Creativity – Organization- What You Need: Software- Text Editing and Word Processing Tools- OCR Software- Painting and Drawing Tools - 3-D Modeling and Animation Tools - Image-Editing Tools - Sound-Editing Tools - Animation, Video, and Digital Movie Tools.	6	K3	4

V	Multimedia Skills: The Team- Planning and Costing: The Process of Making Multimedia - Idea Analysis - Pretesting - Task Planning - Prototype Development - Alpha Development - Beta Development - Delivery. Scheduling – Estimating. Designing and Producing: Designing- Designing the structure and user interface-producing – Starting Up-Working with Clients – Tracking- Copyrights.	6	K4	5

Book(s) for Study

“Multimedia making it work”, Tay Vaughan, MCH Education, Ninth Edition.

Chapters

Unit I: 1, 2
Unit II: 3
Unit III: 4, 5
Unit IV: 6, 7
Unit V: 8, 9

Reference Books

1. Multimedia: An Introduction, Villamil & Molina, PHI.
2. Sound & Video, Lozano. Multimedia, PHI.
3. Multimedia: Production. Planning and Delivery, Villamil & Molina, PHI
4. Multimedia on the Pc, Sinclair, BPB.

Web Resources

1. https://users.dimi.uniud.it/~antonio.dangelo/MMS/materials/Fundamentals_of_Multimedia.pdf
2. <https://slideplayer.com/slide/7871271/>
3. <http://www.engpvt.com/2012/08/multimedia-applicationsmultimedia.html>
4. <https://yslaiseblog.files.wordpress.com/2013/10/gfx-multimedia-making-it-work-8th-edition.pdf>

Rationale for Nature of the course

Helps to vary and enhance the learning process, and leads to better knowledge retention.

Activity on Knowledge and Skill

Give Practices to conduct Seminar and Group Discussion and Preparing Assignments.

Activity on Employability

By Providing DTP Oriented tasks such as Video and Audio Editing and practicing simple video game designing.

Pedagogy

Chalk and talk, Materials, PPT, Assignment, Seminar, Group discussion, Quiz, Demonstration.

Course Designer Names

1. Mr. M. Ashok Kumar
2. Mrs. S. Brindha

Lesson Plan

Units	Topics	Allotted Hours	Mode
I	Introduction to Multimedia: What Is Multimedia- Definitions - Where to Use Multimedia: Multimedia in Business - Multimedia in Schools Multimedia at Home -Multimedia in Public Places - Virtual Reality - CD-ROM, DVD, Flash Drives.	3	Chalk and talk& Quiz
	Introduction to Text: Using Text in Multimedia - Hypermedia and Hypertext.	3	Chalk and talk& PPT
II	Introduction to Images: Before You Start to Create: Plan Your Approach - Organize Your Tools - Configure Your Computer Workspace.	3	Chalk and talk& PPT
	Making Still Images: Bitmaps - Vector Drawing - Vector-Drawn Objects vs. Bitmaps - 3-D Drawing and Rendering. Color: Understanding Natural Light and Color - Computerized Color- Color Palettes - Image File Formats.	3	Chalk and talk & Quiz
III	Sound: The Power of Sound - Digital Audio - Making Digital Audio Files - MIDI Audio - Audio File Formats.	2	Chalk and talk& Quiz
	Animation: Principles of Animation - Animation by Computer- Animation Techniques - Animation File Formats - Making Animations That Work: A Bouncing Ball- Creating a sequence frames in Flash.	4	Chalk and talk, Materials
IV	Video: How Video Works and Is Displayed - Analog Video - Digital Video.	3	Chalk and talk, Group Discussion & Demonstration
	Making Multimedia :The Stages of a Multimedia Project What You Need: Creativity – Organization- What You Need: Software Text Editing and Word Processing Tools- OCR Software- Painting and Drawing Tools - 3-D Modeling and Animation Tools - Image-Editing Tools - Sound-Editing Tools - Animation, Video, and Digital Movie Tools.	3	Chalk and talk & Quiz
V	Multimedia Skills: The Team- Planning and Costing: The Process of Making Multimedia - Idea Analysis - Pretesting - Task Planning - Prototype Development - Alpha Development - Beta Development - Delivery. Scheduling – Estimating.	3	Chalk and talk, Seminar
	Designing and Producing: Designing- Designing the structure and user interface-producing – Starting Up-Working with Clients – Tracking- Copyrights.	3	Chalk and talk, PPT & Assignment

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Levels
CLO 1	Describe about the Usage of Multimedia.	Up to K2
CLO 2	Make use of Bitmaps and colors	Up to K3
CLO 3	Use the Audio Editing tools in applications.	Up to K3
CLO 4	Utilize Animation tools to Design effective videos.	Up to K3
CLO 5	Focus with Multimedia Skills to Design simple applications.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	1	1	1	1	1
CLO 2	3	1	3	1	1
CLO 3	2	1	3	2	2
CLO 4	3	2	3	2	3
CLO 5	1	3	1	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	1	1	1	1	1
CLO 2	2	1	1	1	3	1
CLO 3	3	2	1	2	3	3
CLO 4	2	2	1	2	3	3
CLO 5	3	2	2	2	2	2

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Multimedia and its Applications (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questi ons	K - Level	No. of Questi ons	K - Level		
CIA I	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K1)	2(K2)
	CLO 2	Up to K3	2	K1 & K2	2	K2	2 (K3&K3)	1 (K3)
CIA II	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K2&K2)	1 (K3)
	CLO 4	Up to K3	2	K1 & K2	2	K1	2 (K3&K3)	2 (K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for each Section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K- Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without Choice	Consoli - dated %
K1	2	2	10	-	14	23.33	67
K2	2	4	-	20	26	43.33	
K3	-	-	10	10	20	33.34	33
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without Choice	Consoli - dated %
K1	2	4	-	-	6	10	33
K2	2	2	10	-	14	23.33	
K3	-	-	10	30	40	66.67	67
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print Model for Multimedia and its Applications
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K – Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K – Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1 (K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K2&K2)	1 (K3)
4	CLO 4	Up to K3	2	K1& K2	1	K1	2 (K3&K3)	1 (K3)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1 (K4)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (NoChoice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS:III B.Sc Information Technology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
VI	Major Core-10	20U6FMC10	Programming in PHP	5	5	25	75	100

Nature of the Course			
Knowledge and skill		Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	

Course Objectives

- To acquire knowledge on the origin of PHP programming and train them to develop PHP script.
- To familiarize the concept of Operators, Arrays, Decision making and looping Statements.
- To understand the concepts of Functions and its types.
- Be familiar with File Concepts and implementing HTML forms.
- To learn the concept of Database Connectivity.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introduction to PHP Overview of PHP: PHP Origin-PHP Getting started: Writing PHP-Naming files-comments- The semicolon- Delivering text as output- White spaces- Running the PHP script- The Basics of PHP: Data types-variables-constants. Operators: Unary operators-Negation operators-Increment/Decrement operators-Cast operators-Binary operators-Numeric operators-Assignment operators-Concatenation operators-Comparison operators-Logical operators-Bitwise operators-Ternary operators-Operator precedence.	15	K2	1
II	Arrays: Array Creation-Array Data Retrieval-Associative array- Conditional Statements: The if statement-Executing multiple statements-The else if clause-The switch statement. Iterations: looping-The For loop-The While loop-Controlling an array using a while loop -Do while statement-The for each loop-Infinite loops-Special Loop keywords - Loops within Loops.	15	K3	2
III	User defined functions: Functions with arguments-Functions with multiple Arguments-Functions Accepting and returning values by reference- Functions Accepting and returning values by value-Accessing global variables within function-Globalizing functions-Functions in Files-Recursion-Anonymous Functions-Built-in Functions-PHP Server	15	K4	3

	variables-Working with DATE and TIME Functions-Performing mathematical operations-Working with String Functions.			
IV	Working with files: Working with files: the concept of resource-recognizing newline characters, end of file character-opening and closing a file-reading from a file-writing a string to a file-moving the file pointer-reading directory contents. Working with forms: Introducing HTML Form Tags and Elements-The main <form> Tag - Form elements: Text Box-Text Area-Password-Radio Button-Check Box-The Combo Box or Drop Down List Box-Hidden Field-Image-Submit and Reset buttons. Adding Elements To A Form: Adding A Textbox- Adding Radio buttons- Adding Check boxes- Adding A select box- Adding A password field- Adding A Text area-Adding A Submit and Reset button-Adding a Hidden Field-Uploading Files to the web server using PHP-The move_uploaded_file() function.	15	K3	4
V	Database driven Programming: Introduction-Downloading MySQL for Windows-Installing MySQL-Changing the default database Storage Engine on a window box-Interaction between PHP and MySQL-Demonstrating PHP and MySQL interaction using a form.	15	K4	5

Book(s) for Study

1. "PHP 5.1 for beginners", Ivan Bayross, Sharnam Shah, First Edition, SPD publishers.
2. "Beginning Php and Mysql", W.Jason Gilmore, Fourth Edition, Springer publishers.

Chapters

Book-1

Unit –I: 1 & 6(Pg no:(82-107))

Unit –II: 6(Pg no:111-137)

Unit –III: 7

Unit –V: 11

Unit –IV:

Book -1: 8

Book-2:10(pages 229-248)

Books for Reference

1. "Build your own database driven web site using PHP & MySQL", Kevin Yank2011, 4th edition, sitepoint.
2. "Straight to the point PHP", Dinesh Maidasani,First Edition, Firewall media.
3. "SAMS Teach yourself PHP4 in 24 hours", Matt Zandstra.

Web Resources

1. <https://stackify.com/learn-php-tutorials/>
2. <https://www.arpatech.com/blog/top-20-websites-learn-php-programming/>
3. <https://medium.com/javarevisited/top-10-free-courses-to-learn-php-and-mysql-for-web-development-e96e69982675>

Rationale for Nature of the Course

Open source, Powerful, Efficient Server Side Scripting Language used to create dynamic and Interactive Webpages.

Activities on Skill Oriented

Practice to write programs, Bug fixing and to design dynamic webpages.

Activities on Employability

Creating dynamic web pages and bug fixing.

Pedagogy

Chalk and Talk PPT, Assignment, Group discussion, Interaction and Demonstration, Seminar and Quiz

Course Designer Names

Mrs. S. Brindha

1. Mrs. K.R.Ramadevi

Lesson Plan

Unit	Topics to be Covered	Allotted Hours	Mode
I	Overview of PHP: PHP Origin- Getting started: Writing PHP-Naming files-comments- The semicolon- Delivering text as output- White spaces Arithmetic Expressions- Evaluation of Expressions.	3	Chalk and Talk & Quiz
	Running the PHP script- Data types-variables-constants.	6	Chalk and Talk & GD
	Operators: Unary operators-Negation operators-Increment/Decrement operators-Cast operators-Binary operators-Numeric operators-Assignment operators-Concatenation operators-Comparison operators-Logical operators-Bitwise operators-Ternary operators-Operator precedence.	6	Chalk and Talk & GD
II	Arrays: Array Creation-Array Data Retrieval-Associative array.	5	Chalk and Talk
	Conditional Statements: The if statement-Executing multiple statements-The else if clause-The switch statement.	5	Chalk and Talk & Interaction
	Iterations: looping-The For loop-The While loop-Controlling an array using a while loop -Do while statement-The for each loop-Infinite loops-Special Loop keywords - Loops within Loops.	5	Chalk and Talk ,Quiz & PPT

III	Functions with arguments-Functions with multiple Arguments-Functions Accepting and returning values by reference- Functions Accepting and returning values by value-Accessing global variables within a function.	5	Chalk and Talk, PPT
	Globalizing functions-Functions in Files-Recursion-Anonymous Functions-Built-in Functions-PHP Server variables.	5	Chalk and Talk
	Working with DATE and TIME Functions-Performing mathematical operations-Working with String Functions.	5	PPT, Quiz
IV	Working with files: the concept of resource-recognizing newline characters, end of file character-opening and closing a file-reading from a file-writing a string to a file-moving the file pointer-reading directory contents.	5	Chalk and Talk &PPT
	Introducing HTML Form Tags and Elements-The main <form> Tag - Form elements: Text Box-Text Area-Password-Radio Button-Check Box-The Combo Box or Drop Down List Box-Hidden Field-Image-Submit and Reset buttons.	5	Chalk and Talk &Interaction and Demonstration
	Adding Elements To A Form: Adding A Textbox-Adding Radio buttons- Adding Check boxes- Adding A select box- Adding A password field- Adding A Text area- Adding A Submit and Reset button-Adding a Hidden Field-Uploading Files to the web server using PHP-The move_uploaded_file() function.	5	Chalk and Talk, Quiz
V	Introduction-Downloading MySQL for Windows-Installing MySQL.	5	Chalk and Talk, Assignment
	Changing the default database Storage Engine on a window box-Interaction between PHP and MySQL.	5	Chalk and Talk, Assignment
	Demonstrating PHP and MySQL interaction using a form.	5	Chalk and Talk, Seminar

Course Learning Outcomes

On the completion of the course, the student will be able to

CLOs	COURSE LEARNING OUTCOMES	K-Level
CLO 1	Describe the Expressions, Variable, Data types and Operators.	Up to K2
CLO 2	Make use of the concept of Control structures and Arrays for developing the code.	Up to K3
CLO 3	Compare the concept of Functions.	Up to K4
CLO 4	Develop the code with file operations and HTML Form Elements.	Up to K3
CLO 5	Connect MySQL with PHP by applying the concept of Database Connectivity.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	2	1	1
CLO 2	2	2	2	1	1
CLO 3	1	2	1	1	2
CLO 4	1	3	2	2	3
CLO 5	1	2	1	2	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSO

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	3	1	2	2
CLO 2	2	1	3	1	2	2
CLO 3	2	2	3	1	3	2
CLO 4	3	2	3	3	3	3
CLO 5	3	3	3	2	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print - Model for PHP Programming (CIA I & II)
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
CIA I	CLO1	Up to K2	2	K1 & K2	1	K1	2(K1&K1)	1(K2)
	CLO2	Up to K3	2	K1 & K2	2	K1	2(K3&K3)	2(K3)
CIA II	CLO3	Up to K4	2	K1 & K2	1	K2	2(K2&K2)	1(K4)
	CLO4	Up to K3	2	K1 & K2	2	K2	2(K3&K3)	2(K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	6	10	-	18	30	50
K2	2	-	-	10	12	20	
K3	-	-	10	20	30	50	50
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	-	-	-	2	3.33	33
K2	2	6	10	-	18	30	
K3	-	-	10	20	30	50	50
K4	-	-	-	10	10	16.67	17
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print - Model for PHP Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S.No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No Of Questions	K - Level	No Of Questions	K -Level		
1	CLO1	Up to K2	2	K1 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K1 & K2	1	K1	2(K3&K3)	1(K3)
3	CLO3	Up to K4	2	K1 & K2	1	K2	2(K2&K2)	1(K4)
4	CLO4	Up to K3	2	K1 & K2	1	K2	2(K3&K3)	1(K3)
5	CLO5	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels *

K Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.sc Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
VI	Major Core-11	20U6FMC11	Operating System	5	5	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To know the basic concepts of Operating System and its structures.
- To familiar with the concepts of Processes, Threads and CPU Scheduling.
- To understand the concepts of Deadlock.
- To familiarize with Memory Management Techniques.
- To understand the concepts of Files and I/O Management.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introduction: Operating system basics – Computer System organization – Computer system architecture – operating system structure – Operating system operations – Open source operating systems. Operating System structures: Operating system services – User operating system interface – System calls – Operating system structure.	15	K2	1
II	Processes: Process concepts – Process scheduling – Inter-process communication. Threads: Overview – Multicore Programming- Multithreading models. CPU Scheduling: Basic concepts – Scheduling criteria – Scheduling algorithms.	15	K3	2
III	Synchronization: Background – The Critical-Section problem – Semaphores. Deadlocks: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance-Deadlock detection-Recovery from Deadlock.	15	K3	3
IV	Main Memory: Background – Swapping – Contiguous memory allocation – Segmentation - Paging – Structure of the page table. Virtual memory management: Background – Demand paging – Copy-on-write – Page replacement – Thrashing.	15	K4	4
V	Mass- Storage Structures: Overview of Mass-storage structure – Disk structure – Disk scheduling – Disk management - RAID structure. File System Interface: File concepts – Access methods – File sharing – Protection. I/O systems: Overview – I/O hardware.	15	K4	5

Book(s) for study

“Operating System Concepts “, Abraham Silberschatz, Peter B. Galvin, Greg Gagne – Wiley Student Edition – 9th Edition - 2010.

Chapters

Unit I : 1.1 -1.5, 1.12, 2.1-2.3, 2.7

Unit II : 3.1, 3.2, 3.4, 4.1, 4.2, 4.3, 6.1-6.3

Unit III : 5.1, 5.2, 5.6, 7.1-7.7

Unit IV : 8.1-8.6, 9.1-9.4, 9.6

Unit V : 10.1-10.5, 10.7, 11.1, 11.2, 11.5, 11.6, 13.1, 13.2

Reference Books

1. “Operating systems – A concept based approach”, D.M. Damdhere, 2nd Edition, TMH.
2. “Operating system, Internals and design principles”, William Stallings, 2008, PHI.
3. “Operating Systems, Internals and Design Principles”, Stallings (2006), 5th edition, Pearson Education, India.
4. “Modern Operating Systems”, Andrew S. Tanenbaum (2007), 2nd edition, Prentice Hall of India, India.
5. “Operating systems”, Deitel & Deitel (2008), 3rd edition, Pearson Education, India.

Web Resources

1. https://www.crectirypati.com/sites/default/files/lectur_notes/OpertingSystemsLectureNotes.pdf
2. <http://www2.cs.uic.edu/~jbell/CourseNotes/OperatingSystems>
3. <http://www.smartzworld.com/notes/linux-programming-pdf-lp-pdf-notes/>

Rationale for Nature of the course

Purpose of having an operating system is to manage the device's hardware and software resources and provides the necessary common services & interfaces for installed programs to run.

Activities on Knowledge and Skill

Work out Case Studies for the given scenario and comparing the various results.

Pedagogy

Chalk and talk Materials, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction and Demonstration.

Course Designer Names

1. Mrs. R. Tamil Selvi
2. Mrs. S. Brindha

Lesson Plan

Unit	Topics to be covered	Allotted Hours	Mode
I	Operating system basics – Computer System organization – Computer system architecture – operating system structure – Operating system operations – Open source operating systems.	6	Chalk and talk, GD
	Operating System structures: Operating system services – User operating system interface – System calls – Operating system structure.	9	Chalk and talk, Quiz
II	Processes: Process concepts – Process scheduling – Inter-process communication. Threads : Overview – Multicore Programming-Multithreading models.	6	Chalk and talk, Quiz
	CPU Scheduling: Basic concepts – Scheduling criteria – Scheduling algorithms.	9	Chalk and talk, Problem solving
III	Synchronization: Background – The Critical-Section problem – Semaphores.	6	Chalk and talk
	Deadlocks: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance.	9	Chalk and talk, Quiz
IV	Main Memory: Background – Swapping – Contiguous memory allocation – Segmentation – Paging – Structure of the page table.	7	Chalk and talk
	Virtual memory management: Background – Demand paging – Copy-on-write – Page replacement – Thrashing.	8	Chalk and talk, GD, Quiz
V	Mass- Storage Structures: Overview of Mass-storage structure – Disk structure – Disk scheduling – Disk management - RAID structure.	7	Chalk and talk, Assignment
	File System Interface: File concepts – Access methods – File sharing – Protection. I/O systems: Overview – I/O hardware.	8	Chalk and talk, PPT, Seminar

Course Learning Outcomes

On the completion of the course, the student will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Levels
CLO 1	Describe the basic organization of computer systems.	Up to K2
CLO 2	Identify the significance of inter-process communication and scheduling.	Up to K3
CLO 3	Identify the deadlock mechanism to ensure the robustness.	Up to K3
CLO 4	Analyze the various Memory Management Techniques.	Up to K4
CLO 5	Analyze the concepts of disk scheduling and file system interface.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	1	2	1	1
CLO 2	2	3	1	3	2
CLO 3	2	2	1	2	2
CLO 4	2	2	1	1	1
CLO 5	2	1	3	2	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	-	-	1	1
CLO 2	2	3	-	2	1	3
CLO 3	2	2	-	2	1	2
CLO 4	2	2	-	1	1	2
CLO 5	3	3	2	3	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print - Model for Operating System
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or r Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questi ons	K- Level	No. of Questions	K- Level		
CIA I	CLO 1	Up to K2	2	K1& K2	1	K1	2(K1&K1)	2(K2)
	CLO 2	Up to K3	2	K1& K2	2	K2	2(K2&K2)	1(K3)
CIA II	CLO 3	Up to K3	2	K1 & K2	1	K2	2(K3&K3)	1(K3)
	CLO 4	Up to K4	2	K1 & K2	2	K2	2(K4&K4)	2(K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each Section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	2	10	-	14	23.33	83
K2	2	4	10	20	36	60	
K3	-	-	-	10	10	16.67	17
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	-	-	-	2	3.33	16
K2	2	6	-	-	8	13.33	
K3	-	-	10	30	40	66.67	67
K4	-	-	10	-	10	16.67	17
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print - Model for Operating System
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S.NO	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No Of Questions	K - Level	No Of Questions	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K2	2(K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1 & K2	1	K2	2(K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
5	CLO 5	Up to K4	2	K1 & K2	1	K1	2(K3&K3)	1(K4)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
VI	Major Core - 12	20U6FMC12	Software Engineering	5	5	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the concept of software projects.
- To get familiarity with software development life cycle.
- To make aware of software cost estimation.
- To gain knowledge in software design and testing.
- To impart the knowledge of software maintenance.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introduction: Definitions- Some Size Factors: Total Effort Devoted to Software, Distribution of Effort, project size Categories, How Programmers Spend their time -Quality and Productivity factors-Managerial issues.	15	K2	1
II	Planning a Software Project: Defining the problem: Goals and Requirements –Developing a solution strategy. Planning the development process: The phased Life-cycle Model, Milestones, Documents, and Reviews, The Cost Model, The Prototype Life-Cycle Model, Successive versions- planning an organizational structure-other planning Activities.	15	K3	2
III	Software Cost Estimation: Software cost factors-Software cost estimation techniques-Staffing level estimation –Software requirements definition-The Software requirements specification-Formal Specification techniques.	15	K3	3
IV	Software Design and Testing: Fundamental design concepts-Modules and modularization criteria-Design notations – Testing : Unit Testing – Black-Box Testing – White-Box Testing – Integration Testing – System Testing.	15	K4	4
V	Software Maintenance: Enhancing Maintainability during development - Managerial aspects of software maintenance-Configuration management - Source-code metrics - other Maintenance tools and Techniques.	15	K3	5

Book(s) for Study

1. Software Engineering concepts”- Richard Fairley TATA McGraw-Hill Edition
2. “Fundamentals of Software Engineering” – Rajib Mall, 4th Edition, Prentice Hall of India, 2008.

Chapters

Unit-I: 1.1, 1.2, 1.3,1.4

Unit-II: 2.1, 2.2, 2.3, 2.4, 2.5

Unit-III: 3.1, 3.2, 3.3, 4.1, 4.2

Unit-IV: Text Book 1: 5.1, 5.2, 5.3

Text Book 2: 10.5, 10.6.2, 10.6.3,10.7.1, 10.8,10.10,10.12.1, 10.12.2, 10.13

Unit-V: 9.1, 9.2, 9.3, 9, .4, 9.5

Books for Reference

1. “Software engineering design”, H.C.shooman, MGH.
2. “Software Engineering”, Roger.S.Pressman, MGH, 7th Edition.

Web Resources

1. http://www.eecs.ucf.edu/~turgut/COURSES/EEL6883_SEII_Spr07/PaperPresentations/Fairley-Rook-p261.ppt
2. <http://ddegjust.ac.in/tudymaterial/mca-5/mca-303.pdf>
3. https://azslide.com/download/introduction-and-overview_59c751e11723dd318cb148a8.html
4. <http://forum.apprendre-a-dessiner.org/uploads/pdf.php?article=software-engineering-concepts-by-richard-fairley-ppt-free-download-pdf>

Rationale for Nature of the course

Apply the principles of software engineering to design, development, maintenance, testing, and evaluation of software in IT sector.

Activity on Knowledge and Skill Development

Case studies for requirement specifications and cost estimation.

Activity on Employability

Practice to perform testing and Bug fixing.

Pedagogy

Chalk and talk, E-Content, PPT, Assignment, Seminar, Group discussion.

Course Designer(s) Name

1. Mrs. K. Imaya
2. Mr. N. Radhakrishnan

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	Definitions- Some Size Factors: Total Effort Devoted to Software, Distribution of Effort.	5	Chalk and talk
	Project size Categories, How Programmers Spend their time- Managerial issues.	5	Chalk and talk & Quiz
	Quality and Productivity Factors.	5	Chalk and talk & GD
II	Defining the problem: Goals and Requirements –Developing a solution strategy.	5	Chalk and talk
	Planning the development process: The phased Life-cycle Model, Milestones, Documents, and Reviews, The Cost Model	5	Chalk and talk, Quiz
	The Prototype Life-Cycle Model, Successive versions- planning an organizational structure-other planning Activities.	5	Chalk and talk & E-Content
III	Software cost factors-Software cost estimation techniques.	5	Chalk and talk
	Staffing level estimation –Software requirements definition.	5	Chalk and talk & Quiz
	The Software requirements specification-Formal Specification techniques.	5	Chalk and talk & GD
IV	Fundamental design concepts-Design Notations.	5	Chalk and talk & E-Content
	Modules and modularization criteria.	5	Chalk and talk
	Testing: Unit Testing – Black-Box Testing – White-Box Testing – Integration Testing – System Testing.	5	Chalk and talk , Quiz
V	Enhancing Maintainability during development.	5	Chalk and talk
	Managerial aspects of software maintenance-Configuration management.	5	PPT & Assignment
	Source-code metrics - other Maintenance tools and Techniques.	5	Chalk and talk & Seminar

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Levels
CLO 1	Discuss on project size, quality and productivity factors.	Up to K2
CLO 2	Identify the goals and requirement, development process and planning activities.	Up to K3
CLO 3	Utilize the techniques of software cost estimation, staffing level estimation and formal specification.	Up to K3
CLO 4	Analyze the concept of design notations and Testing strategies.	Up to K4
CLO 5	Identify the significance of Maintenance of software.	Up to K3

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	1	1	1	1
CLO 2	1	2	1	2	3
CLO 3	1	2	3	2	3
CLO 4	1	3	3	2	3
CLO 5	1	1	3	2	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	-	-	1	1
CLO 2	2	3	1	1	2	1
CLO 3	2	3	1	2	2	1
CLO 4	2	3	1	2	2	1
CLO 5	2	2	-	1	2	1

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for – Software Engineering (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K1)	1 (K2)
	CLO 2	Up to K3	2	K1 & K2	2	K2	2 (K3&K3)	2 (K3)
CIA II	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K2&K2)	2 (K3)
	CLO 4	Up to K4	2	K1 & K2	2	K2	2 (K4&K4)	1 (K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	2	10	-	14	23.33	50
K2	2	4	-	10	16	26.66	
K3	-	-	10	20	30	50	50
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	-	-	-	2	3.34	34
K2	2	6	10	-	18	30	
K3	-	-	-	20	20	33.33	33
K4	-	-	10	10	20	33.33	33
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print - Model for Software Engineering
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K - Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1 (K3)
3	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K2&K2)	1 (K3)
4	CLO 4	Up to K4	2	K1 & K2	1	K2	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K3	2	K1 & K2	1	K1	2 (K3&K3)	1 (K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS:III B.Sc Information Technology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	EXT	Total
VI	Major Core-Practical-7	20U6FMP7	Programming in PHP Lab	2	3	40	60	100

Nature of the Course			
Knowledge and skill		Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	

Course Objectives

- To acquire knowledge on the origin of PHP programming and train them to develop PHP script.
- To familiarize the concept of Operators, Arrays, Decision making and looping Statements.
- To understand the concepts of Functions and its types.
- Be familiar with File Concepts and implementing HTML forms.
- To learn the concept of Database Connectivity.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	DATA TYPES AND OPERATORS 1. Write a PHP program to print the table of a number. 2. Write a PHP program to find if the given number is leap year or not. 3. Write a PHP program to print Fibonacci Series.	9	K2	1
II	ARRAYS 4. Write a PHP Program to sort the Numbers in Ascending Order. 5. Write a PHP Program to join the array elements into a String. 6. Write a PHP Program to remove duplicated values in a array.	9	K3	2
III	FUNCTIONS 7. Write a PHP program to implement Include Function. 8. Write a PHP program to implement User Defined Function. 9. Write a PHP Program to implement String Handling Function.	9	K4	3
IV	FILES AND FORM ELEMENTS 10. Write a PHP Program to print personal details using File. 11. Write a PHP program to perform File Operations. 12. Write a PHP program to check whether the given string is palindrome or not using Form Elements	9	K3	4

V	DATABASE CONNECTIVITY 13. Write a PHP Code to make database Connection, Create Database, Create Table in MySQL. 14. Write a PHP Code to Insert, Delete, Update, Select the data from database using MySQL. 15. Write a PHP Code to design a form which upload and display image.	9	K4	5

Book(s) for Study

1. "PHP 5.1 for beginners", Ivan Bayross, Sharnam Shah, First Edition, SPD publishers.
2. "Beginning Php and Mysql", W.Jason Gilmore, Fourth Edition, Springer publishers.

Books for Reference

1. "Build your own database driven web site using PHP & MySQL" - Kevin Yank 2011, 4th Edition, sitepoint.
2. "Straight to the point PHP" - Dinesh Maidasani, First Edition, Firewall media.
3. "SAMS Teach yourself PHP4 in 24 hours" - Matt Zandstra.

Web Resources

1. <https://stackify.com/learn-php-tutorials/>
2. <https://www.arpatech.com/blog/top-20-websites-learn-php-programming/>
3. <https://medium.com/javarevisited/top-10-free-courses-to-learn-php-and-mysql-for-web-development-e96e69982675>

Rationale for Nature of the Course

Open source, Powerful, Efficient Server Side Scripting Language used to create dynamic and Interactive Webpages.

Activities on Skill Oriented

Practice to write programs, Bug fixing and to design dynamic webpages.

Activities on Employability

Creating dynamic web pages and bug fixing.

Pedagogy

Chalk and Talk, PPT, Assignment, Group discussion, Interaction and Demonstration, Seminar and Quiz

Course Designer(s) Name

1. Mrs. S.Brindha
2. Mrs. K.R.Ramadevi

Lesson Plan

Unit	Topics to be Covered	Allotted Hours	Mode
I	1. Write a PHP program to print the table of a number. 2. Write a PHP program to find if the given number is leap year or not. 3. Write a PHP program to print Fibonacci Series.	9	Demo & Practical Session
II	4. Write a PHP Program to sort the Numbers in Ascending Order. 5. Write a PHP Program to join the array elements into a String. 6. Write a PHP Program to remove duplicated values in an array.	9	Demo & Practical Session
III	7. Write a PHP program to implement Include Function. 8. Write a PHP program to implement User Defined Function. 9. Write a PHP Program to implement String Handling Function.	9	Demo & Practical Session
IV	10. Write a PHP Program to print personal details using File. 11. Write a PHP program to perform File Operations. 12. Write a PHP program to check whether the given string is palindrome or not using Form Elements.	9	Demo & Practical Session
V	13. Write a PHP Code to make database Connection, Create Database, Create Table in MySQL. 14. Write a PHP Code to Insert, Delete, Update, Select the data from database using MySQL. 15. Write a PHP Code to design a form which upload and display image.	9	Demo & Practical Session

Course Learning Outcomes

On the completion of the course, the student will be able to

CLOs	COURSE LEARNING OUTCOMES	K-Level
CLO 1	Write the programs by implementing Variable, Constant, Data types and Operators in PHP	Up to K2
CLO 2	Develop the code by making use of the concept of Arrays, Looping and Conditional statements.	Up to K3
CLO 3	Devise programs using functions.	Up to K4
CLO 4	Develop the code with file operations and HTML Form Elements.	Up to K3
CLO 5	Connect MySQL with PHP by applying the concept of Database Connectivity.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	2	1	1
CLO 2	2	2	2	1	1
CLO 3	1	2	1	1	2
CLO 4	1	3	2	2	3
CLO 5	1	2	1	2	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSO

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	3	1	2	2
CLO 2	2	1	3	1	2	2
CLO 3	2	2	3	1	3	2
CLO 4	3	2	3	3	3	3
CLO 5	3	3	3	2	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Core Practical-8	20U6FMPR	Project & Viva-voce – Lab	2	3	60	40	100

Nature of the Course			
Knowledge and skill		Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	✓

Course Objectives

- Work with others and on one's own to pursue a goal.
- Increase, develop and apply computer knowledge.
- Gain project management skill and get experience at meeting deadlines.
- Apply all the concepts studied in the curriculum.
- Decide and agree with peers what work moves all toward a goal.

During the sixth semester, students shall undertake a project and submit the Project Report on the Platforms like the following.

Front Ends:	Back Ends:
Visual Basic • VB is an event driven and component integrated programming language, make it suitable to develop user friendly projects. • The VB-IDE has been highly optimized to support rapid application development • VB features provide graphical, integrated data access to any ODBC or OLE DB data source. Java • Java is a fully object-oriented language and platform-independent. • It can be used to transfer and execution of programs by remote computers on the local machines through the internet. • Java supports multithreaded programming, Exception handling , Swings and Servlets- make it suitable for typical project requirements PHP • PHP is an open-source, interpreted, and object-oriented scripting language that can be executed at the server-side.	Microsoft Access • MS Access is a relational database application included in the Microsoft Office Suite, which allows users to enter, manage, and construct reports on a larger scale. • MS Access is most suitable for those who need to quickly organize a large amount of data. • MS Access stores different data sets known as Tables that are potentially related, which, when combined together, increases data flexibility. Microsoft SQL Server • MS SQL server has come up with higher-end integration of modules such as Azure SQL Database, Azure SQL Data Warehouse and Hadoop Distributed File System (HDFS), all packed together to provide a single, integrated solution.

• PHP is well suited for web development. • PHP scripting language offers a lot of resources, such as commands, functions, and codes. • The ease of use, easy integration, cost efficiency, and easy access makes PHP one of the most popular server-side programming languages. . Dot Net • .NET provides a framework that facilitates designing and developing applications that are portable, scalable, and robust, and that can be executed in a distributed environment. • All .NET applications run under a common execution environment, called the Common Language Runtime. • The .NET IDE (integrated development environment) provides an easy and rich debugging support. • It is suitable to develop applications for web, Windows, phone. Python • Python is an open-source, fully object-oriented Programming language and available at free of cost. • Python is an interpreted language. It comes with the IDLE (Interactive Development Environment). This is an interpreter and follows the REPL structure (Read-Evaluate-Print-Loop). • The standard library is large and has many packages and modules with common and important functionality.	• MS SQL Server is built with an aim to take the Artificial Intelligence (AI), a step forward, by integrating Big Data with the Database services. My SQL • MySQL is one of the most popular languages for accessing and managing the records in the table. MySQL is open-source and free software. • MySQL consists of a solid data security layer that protects sensitive data from intruders. • MySQL follows the working of a client/server architecture. There is a database server (MySQL) and arbitrarily many clients (application programs). Oracle • Oracle products are scalable and secure, with high performance ability, compared to other databases available in the market. • It is a multi-model relational database management system, mainly designed for enterprise grid computing and data warehousing. • Its layout complete recovery features to recover data from almost all kinds of failures. • Implementing authorization and editing user actions can prevent unauthorized access and allow distinct access to the users.

COURSE LEARNING OUTCOMES:**On the completion of the course the student will be able to**

CLOs	COURSE LEARNING OUTCOMES	K - Levels
CLO1	Understanding end user requirements and Gain knowledge.	Up to K2
CLO2	Apply knowledge of computing and mathematics to the appropriate discipline.	Up to K3
CLO3	Developing the functions effectively on teams to accomplish shared computing design, evaluation, or implementation goals.	Up to K3
CLO4	Focus on appropriate techniques, skills, and tools necessary for computing practice.	Up to K4
CLO-5	Identify the need for and ability to engage in continuing professional development	Up to K3

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	3	3	3	3	3	3
CLO 2	3	3	3	3	3	3
CLO 3	3	3	3	3	3	3
CLO 4	3	3	3	3	3	3
CLO 5	3	3	3	3	3	3

(3– Advanced Application, 2– Intermediate Level, 1- Basic Level)**Mapping of CLOs with PSOs**

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	3	3	3	3	3	3
CLO 2	3	3	3	3	3	3
CLO 3	3	3	3	3	3	3
CLO 4	3	3	3	3	3	3
CLO 5	3	3	3	3	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Evaluation Pattern: Project Report

Internal		External	
60->40 Marks by Guide; 20 Marks by Department		40	
Guide Evaluation		External Evaluation	
10 Marks	Students Ability & Interest	10 Marks	Report
10 Marks	Regularity & Punctuality	30 Marks	Presentation, Quality of work and Viva- voce
20 Marks	Quality of work & Presentation		
Department Evaluation			
10 Marks	Presentation using ICT tools		
10 Marks	Quality & Publication/ Presentation in Seminar/ Conferences		

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.sc Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
VI	Major Elective -II	20U6FME2	Python Programming	3	4	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To introduce the fundamentals of Python and impart the knowledge of Lists, Tuples, Set and Directories.
- To learn about the concept of Control Structures and Functions.
- To understand the concept of Modules.
- To explore the object-oriented programming aspects of python with help of built-in modules.
- To implement the concept of File handling and Database Connectivity.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Rapid Introduction to Procedural Programming: Creating and Running Python Programs – Data Types: Identifiers and Keywords – Integral Types – Floating-Point Types – Strings. Collection Data Types: Sequence Types – Set Types – Mapping Types – Iterating and Copying Collections.	12	K2	1
II	Control Structures and Functions: Control Structures – Conditional Branching – Looping - Exception Handling – Catching and Raising Exceptions – Custom Exceptions - Custom Functions – Names and DocStrings – Argument and Parameter Unpacking – Accessing Variables in the Global Scope – Lambda Functions.	12	K3	2
III	Modules: Modules and Packages – Packages – Custom Modules – Overview of Python's Standard Library – String Handling – Command-Line Programming – Mathematics and Numbers – Times and Dates – Algorithms and Collection Data Types – File Formats, Encoding and Data Persistence – File Formats, Encodings and Data Persistence - File, Directory and Processing Handling.	12	K3	3
IV	Object-Oriented Programming: The Object-Oriented Approach – Object-Oriented Concepts and Terminology – Custom Classes – Attributes and Methods – Inheritance and Polymorphism – Using Properties to Control Attributes Access – Creating Complete Fully Integrated Data Types –	12	K4	4

	Custom Collection Classes – Creating Classes that Aggregate Collections – Creating Collection classes using Aggregation – Creating collection classes using Inheritance.			
V	File Handling: Writing and Reading Binary data – Pickles with optional compression – Raw binary data with optional compression – Writing and Parsing text files – Writing Text – Parsing text – Parsing text using regular expressions – Writing and Parsing XML files – Element Trees – DOM – Manually writing XML – Parsing XML with SAX – Random access binary files - A Generic BinaryRecordFile Class. Database Programming: DBM Databases – SQL Databases.	12	K4	5

Book(s) for Study

“Programming in Python 3: A Complete introduction to the Python Language”, Mark Summerfield Addison-Wesley Professional, 2009.

Chapters

Unit I: 1, 2, 3
Unit II: 4
Unit III: 5
Unit IV: 6
Unit V: 7, 12

Books for Reference

1. Think Python: How to Think Like a Computer Scientist”, Allen B. Downey, 2nd edition, Updated for Python 3, Shroff/O ‘Reilly Publishers, 2016
2. “An Introduction to Python – Revised and updated for Python 3.2”, Guido van Rossum and Fred L. Drake Jr, — Network Theory Ltd., 2011
3. “Core Python Applications Programming”, Wesley J Chun, Prentice Hall, 2012.
4. “The Complete Reference”, Martin C. Brown, PYTHON McGraw-Hill, 2001

Web Resources

1. https://www.tutorialspoint.com/python/python_tutorial.pdf
2. <https://www.softwaretestinghelp.com/python/python-control-statements/>
3. <https://www.geeksforgeeks.org/file-handling-python/>
4. <https://www.w3schools.in/python-tutorial/network-programming/>

Rationale for Nature of the course

Develop wide variety of applications including web applications, software and Game development, Network programming, GUI, Scientific and Numeric applications.

Activities on Knowledge and Skill

Practice to write programs, Bug fixing.

Activities on Employability

Practice to write programs, Bug fixing and to Develop various Applications

Pedagogy

Chalk and talk, PPT, Assignment, Seminar, Group discussion, Interaction, Debugging and Demonstration, E-Content.

Course Designer Names

1. Mrs.S. Sasikala
2. Mrs. K.R. Ramadevi

Lesson Plan

Unit	Topics	Hours	Mode
I	Rapid Introduction to Procedural Programming: Creating and Running Python Programs	4	Chalk and talk, Quiz
	Data Types: Identifiers and Keywords – Integral Types – Floating-Point Types – Strings	4	Chalk and talk, GD
	Collection Data Types: Sequence Types – Set Types – Mapping Types – Iterating and Copying Collections.	4	Chalk and talk
II	Control Structures and Functions: Control Structures – Conditional Branching – Looping	4	Chalk and talk, Interaction
	Exception Handling – Catching and Raising Exceptions – Custom Exceptions - Custom Functions – Names and DocStrings. Argument and Parameter Unpacking – Accessing Variables in the Global Scope – Lambda Functions.	4	Chalk and talk, Quiz
		4	Chalk and talk, PPT
III	Modules: Modules and Packages – Packages – Custom Modules – Overview of Python's Standard Library – String Handling.	4	Chalk and talk, E-Content
	Command-Line Programming – Mathematics and Numbers – Times and Dates – Algorithms and Collection Data Types.	4	Chalk and talk, Demonstration
	File Formats, Encoding and Data Persistence – File Formats, Encodings and Data Persistence - File, Directory and Processing Handling.	4	Chalk and talk, Debugging
IV	Object-Oriented Programming: The Object-Oriented Approach – Object-Oriented Concepts and Terminology – Custom Classes – Attributes and Methods.	4	Chalk and talk PPT, GD
	Inheritance and Polymorphism – Using Properties to Control Attributes Access – Creating Complete Fully Integrated Data Types – Custom Collection Classes.	4	Chalk and talk
	Creating Classes that Aggregate Collections – Creating Collection classes using Aggregation – Creating collection classes using Inheritance.	4	Chalk and talk, E-Content,

V	File Handling: Writing and Reading Binary data – Pickles with optional compression – Raw binary data with optional compression – Writing and Parsing text files – Writing Text – Parsing text – Parsing text using regular expressions – Writing and Parsing XML files – Element Trees – DOM – Manually writing XML – Parsing XML with SAX – Random access binary files - A Generic Binary Record File Class.	6	Chalk and talk, Seminar
	Database Programming: DBM Databases – SQL Databases.	6	Chalk and talk, Assignment

Course Learning outcomes

On the completion of the course, the student will be able to

CLOs	Course Learning Outcomes	K – Levels
CLO 1	Describe the fundamentals of Python and impart the knowledge of Lists, Tuples, Set and Directories.	Up to K2
CLO 2	Utilize the concepts of Control Structures and Functions to develop a Python program.	Up to K3
CLO 3	Make use of Modules and Packages.	Up to K3
CLO 4	Devise programs using OOPS concept.	Up to K4
CLO 5	Focus on File handling and Database.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	1	2	2
CLO 2	2	3	2	2	2
CLO 3	2	3	3	2	1
CLO 4	2	3	3	2	2
CLO 5	2	2	2	2	2

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	1	1	2	2
CLO 2	2	1	1	1	2	2
CLO 3	2	2	1	1	3	2
CLO 4	3	3	3	1	3	3
CLO 5	3	3	3	1	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print - Model for Python Programming (CIA I & II)
Articulation Mapping - K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
CIA I	CLO 1	Up to K2	2	K1 & K2	1	K1	2(K1&K1)	1(K2)
	CLO 2	Up to K3	2	K1& K2	2	K1	2(K2&K2)	2(K3)
CIA II	CLO 3	Up to K3	2	K1& K2	1	K2	2(K3&K3)	1(K3)
	CLO 4	Up to K4	2	K1 & K2	2	K2	2(K3&K3)	2(K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	2	10	-	14	23.33	67
K2	2	4	10	10	26	43.33	
K3	-	-	-	20	20	33.33	33
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	-	-	-	2	3.33	17
K2	2	6	-	-	8	13.34	
K3	-	-	20	10	30	50	50
K4	-	-	-	20	20	33.33	33
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print - Model for Python Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S.NO	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2(K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1 & K2	1	K2	2(K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1 & K2	1	K2	2(K3&K3)	1(K4)
5	CLO 5	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
VI	Major Elective-II	20U6FME2	Android Programming	3	4	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the importance of activity lifecycle and usage of various layouts.
- To impart the knowledge to apply styles and themes.
- To explore the App architecture with fragments.
- To learn the concept of storage and manipulation of data.
- To familiarize with android applications using touch screens and sensors and the Flutter concepts.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Activities: Introduction-Declaring an activity-Starting a new activity with an intent object-Switching between activities-Passing data to another activity-Returning a result from an activity-Saving an activity's state-Storing persistent activity data-Understanding the activity lifecycle. Layouts: Introduction-Defining and inflating a layout-Using RelativeLayout-Using LinearLayout-Creating tables – TableLayout and GridLayout-Using ListView, GridView, and Adapters-Changing layout properties during runtime-Optimizing layouts with the Hierarchy Viewer.	12	K3	1
II	Views, Widgets, and Styles: Introduction-Inserting a widget into a layout-Using graphics to show button state-Creating a widget at runtime-Creating a custom component-Appling a style to a View-Turning a style into a theme-Selecting theme based on the Android version. Menus: Introduction-Creating an Options menu-Modifying menus and menu items during runtime-Enabling Contextual Action Mode for a view-Using Contextual Batch Mode with a ListView-Creating a pop-up menu.	12	K2	2

III	Exploring Fragments, AppWidgets, and the System UI: Introduction-Creating and using a Fragment-Adding and removing Fragments during runtime-Passing data between Fragments-Creating a shortcut on the Home screen-Creating a Home screen widget-Adding search to the Action Bar-Showing your app full screen.	12	K4	3
IV	Working with Data: Introduction-Storing simple data-Read and write a text file to internal storage-Read and write a text file to external storage-Including resource files in your project-Creating and using a SQLite database-Access data in the background using a Loader.	12	K4	4
V	Using the Touchscreen and Sensors: Introduction- Listening for click and long press events-Recognizing tap and other common gestures- Pinch-to-Zoom with Multi-touch gestures- Swipe-to-Refresh-Listing available sensors-Reading sensor data- Reading device orientation. Flutter: Introduction- Installation-Creating Simple Application in Android Studio-Introduction to DART Programming-Introduction to Widgets-Introduction to Layouts.	12	K3	5

Book(s) for Study

1. “Android Application Development Cookbook”, Rick Boyer, Kyle Mew, Second Edition, 2016 Packet Publishing.
2. Web Resource: https://www.tutorialspoint.com/flutter/flutter_tutorial.pdf

Chapters

Unit– I: 1, 2
Unit– II: 3, 4
Unit– III: 5
Unit– IV: 6
Unit– V: 8 , Web resource: 1, 2, 3, 5, 6, 7

Books for Reference

1. “Android Programming-Unleashed” - B.M.Harwani -Pearson Education 2013.
2. “Android Programming for Beginners” - John Horton -First Edition -Packet Publishing.
3. “Android Programming: The Big Nerd Ranch Guide” -Bill Phillips and Chris Stewart - Third Edition, O’Reilly Media Publishers.

Web Resources

1. https://www.tutorialspoint.com/android/android_overview.htm
2. https://www.tutorialspoint.com/android/android_activities.htm
3. <https://www.vogella.com/tutorials/AndroidWidgets/article.html>
4. <https://developer.android.com/guide/topics/ui/menus>
5. <https://www.section.io/engineering-education/all-about-fragments-in-android-applications/>
6. <https://www.geeksforgeeks.org/how-to-create-and-add-data-to-sqlite-database-in-android/>

Rationale for Nature of the course

Mobile app development services can utilize android with much greater ease than any other platform.

Activities on Knowledge and Skill

Practice to develop apps, Bug fixing

Activities on Employability

Practice to develop apps using different layouts.

Pedagogy

Chalk and talk, E-Content, PPT, Assignment, Seminar, Group discussion, Interaction and Demonstration.

Course Designer Names

1. Ms S.Saranya
2. Mrs. R.Lakshapriya

Lesson Plan

Unit	Topics	Hours	Mode
I	Introduction- Declaring an activity- Starting a new activity with an intent object- Switching between activities-Passing data to another activity.	3	Chalk & Talk
	Returning a result from an activity- Saving an activity's state- Storing persistent activity data- Understanding the activity lifecycle.	3	Chalk & Talk, PPT
	Introduction- Defining and inflating a layout- Using RelativeLayout- Using LinearLayout- Creating tables – TableLayout and GridLayout.	3	Chalk & Talk ,Interaction& Demonstration
	Using ListView, GridView, and Adapters- Changing layout properties during runtime- Optimizing layouts with the Hierarchy Viewer.	3	Chalk & Talk & Quiz
II	Introduction- Inserting a widget into a layout- Using graphics to show button state- Creating a widget at runtime- Creating a custom component.	3	Interaction and Demonstration.
	Applying a style to a View-Turning a style into a theme- Selecting theme based on the Android version.	3	Chalk & Talk & Interaction and Demonstration
	Introduction- Creating an Options menu- Modifying menus and menu items during runtime- Enabling Contextual Action Mode for a view- Using Contextual Batch Mode with a ListView- Creating a pop-up menu.	6	Chalk & Talk, Quiz & PPT

III	Introduction- Creating and using a Fragment- Adding and removing Fragments during runtime- Passing data between Fragments.	5	Chalk & Talk
	Creating a shortcut on the Home screen- Creating a Home screen widget- Adding search to the Action Bar- Showing your app full screen.	7	Chalk & Talk,GD & Quiz
IV	Introduction- Storing simple data- Read and write a text file to internal storage- Read and write a text file to external storage-	5	Chalk & Talk & Quiz
	Including resource files in your project- Creating and using a SQLite database- Access data in the background using a Loader.	7	Chalk & Talk & E-Content
V	Introduction- Listening for click and long press events- Recognizing tap and other common gestures- Pinch-to-Zoom with Multi-touch gestures	4	Chalk & Talk, Seminars
	Swipe-to-Refresh-Listing available sensors-Reading sensor data- Reading device orientation.	2	Chalk & Talk, Assignments
	Flutter: Introduction- Installation-Creating Simple Application in Android Studio-Introduction to DART Programming-Introduction to Widgets-Introduction to Layouts.	6	Chalk & Talk, PPT

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Levels
CLO 1	Develop Android applications related to layouts and interfacing multiple activities.	Up to K3
CLO 2	Demonstrate the design concepts of user interface using components, views and menus.	Up to K2
CLO 3	Focus the importance of fragments.	Up to K4
CLO 4	Focus the significance of SQLite database to develop Android Applications.	Up to K4
CLO 5	Build interactive applications using Flutter.	Up to K3

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	1	2	2
CLO 2	2	3	2	2	2
CLO 3	2	3	3	2	1
CLO 4	2	3	3	2	2
CLO 5	2	2	2	2	2

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	1	1	2	2
CLO 2	2	1	1	1	2	2
CLO 3	2	2	1	1	3	2
CLO 4	3	3	3	1	3	3
CLO 5	3	3	3	1	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print - Model for Android Programming (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CIA I	CLO 1	Up to K3	2	K1 & K2	1	K1	2 (K2&K2)	1 (K3)
	CLO 2	Up to K2	2	K1 & K2	2	K2	2 (K1&K1)	2 (K2)
CIA II	CLO 3	Up to K4	2	K1 & K2	1	K2	2 (K3&K3)	1 (K4)
	CLO 4	Up to K4	2	K1 & K2	2	K1	2 (K4&K4)	2 (K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for each Section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	2	10	-	14	23.33	83
K2	2	4	10	20	36	60	
K3	-	-	-	10	10	16.67	17
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	-	-	6	10	17
K2	2	2	-	-	4	6.7	
K3	-	-	10	20	30	50	50
K4	-	-	10	10	20	33.3	33
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print - Model for Android Programming
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K - Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
1	CLO 1	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1 (K3)
2	CLO 2	Up to K2	2	K1& K2	1	K2	2 (K1&K1)	1 (K2)
3	CLO 3	Up to K4	2	K1 & K2	1	K2	2 (K3&K3)	1 (K4)
4	CLO 4	Up to K4	2	K1 & K2	1	K1	2 (K4&K4)	1 (K3)
5	CLO 5	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1 (K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS:III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
VI	Major Elective – II	20U6FME2	Software Testing	3	4	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To study fundamental concepts in Testing.
- To make aware of testing strategies of Black-box, White-box and Integration testing.
- To familiarize with System and Acceptance Testing.
- To understand the significance of Performance Testing.
- To impart knowledge in test plan, Testing Tools, Execution and Reporting.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Software Development Life Cycle models: Phases of Software project – Quality, Quality Assurance, Quality control – Testing, Verification and Validation – Process Model to represent Different Phases - Life Cycle models. White-Box Testing: Static Testing – Structural Testing –Challenges in White-Box Testing.	12	K2	1
II	Black-Box Testing: What is Black-Box Testing? - Why Black-Box Testing? – When to do Black-Box Testing? – How to do Black-Box Testing? – Challenges in White Box Testing. Integration Testing: Integration Testing as Type of Testing – Integration Testing as a Phase of Testing –Scenario Testing – Defect Bash.	12	K3	2
III	System and Acceptance Testing: system Testing Overview – Why System testing is done? – Functional versus Non-functional Testing - Functional testing - Non-functional Testing – Acceptance Testing – Summary of Testing Phases.	12	K3	3
IV	Performance Testing: Factors governing Performance Testing – Methodology of Performance Testing – tools for Performance Testing – Process for Performance Testing – Challenges. Regression Testing: What is Regression Testing? – Types of Regression Testing – When to do Regression Testing – How to do Regression Testing – Best Practices in Regression Testing.	12	K4	4
V	Test Planning, Management, Execution and Reporting: Test Planning – Test Management – Test Process – Test Reporting –Best Practices. Testing Tools: Jmeter – Jmeter overview – JDBC Test	12	K4	5

Book(s) for Study

1. “Software Testing Principles and Practices”, Srinivasan Desikan & Gopalswamy Ramesh Pearson Education.
2. “Software Testing Tools – Covering WinRunner, Silk Test, LoadRunner, Jmeter, TestDirector & QTP with Case studies” – Dr.K.V.K.K.Prasad, Dream Tech Press, Reprint Edition 2009.

Chapters

Unit – I: 2.1-2.5, 3.1-3.4
Unit – II: 4.1-4.4, 5.1-5.5
Unit – III: 6.1-6.7
Unit – IV: 7.1-7.6, 8.1-8.5
Unit – V: Text Book1: 15.1-15.6
Text Book2: 8.1, 8.2

Books for Reference

1. “Software Testing Principles, Techniques and Tools”, Limaye M.G., Second Reprint, TMH Publishers, 2010.
2. “Foundations of Software Testing”, Aditya P.Mathur, 2nd Edition, Pearson Education, 2013.
3. “Effective Methods of Software Testing”, William E. Perry, 3rded, Wiley India.
4. “Software Testing”, Renu Rajani, Pradeep Oak, 2007, TMH

Web Resources

1. https://www.tutorialspoint.com/software_testing/index.htm
2. <https://www.guru99.com/software-testing-introduction-importance.html>
3. <https://www.softwaretestinghelp.com/>

Rationale for Nature of the Course

Testing has been done to cover various areas like functionality, compatibility with the OS, hardware and different types of browsers, performance testing to test the performance of the application.

Activities on Knowledge and Skill

Practice to Choose general testing strategies and techniques and to develop the skills for designing and implementing testing software.

Pedagogy

Chalk and Talk, PPT, Assignment, Group discussion, Interaction, Seminar and Quiz.

Course Designer Names

1. Mrs. S.Brindha
2. Mr. K.Rajasaravanakumar

Lesson Plan

Unit	Topics to be Covered	Allotted Hours	Mode
I	Software Development Life Cycle models: Phases of Software project – Quality, Quality Assurance, Quality control	4	Chalk and Talk
	Testing, Verification and Validation – Process Model to represent Different Phases - Life Cycle models	4	Chalk and Talk & GD
	White-Box Testing: Static Testing – Structural Testing –Challenges in White-Box Testing.	4	Chalk and Talk & Quiz
II	Black-Box Testing: What is Black-Box Testing? - Why Black-Box Testing? – When to do Black-Box Testing? – How to do Black-Box Testing?	4	Chalk and Talk & PPT
	Challenges in White Box Testing - Integration Testing: Integration Testing as Type of Testing.	4	Chalk and Talk
	Integration Testing as a Phase of Testing –Scenario Testing – Defect Bash	4	Chalk and Talk , Quiz
III	System and Acceptance Testing: system Testing Overview – Why System testing is done	4	PPT
	Functional versus Non-functional Testing - Functional testing - Non-functional Testing	4	Chalk and Talk
	Acceptance Testing – Summary of Testing Phases	4	Chalk and Talk& Quiz
IV	Factors governing Performance Testing – Methodology of Performance Testing – tools for Performance Testing	4	Chalk and Talk &Quiz
	Process for Performance Testing – Challenges. Regression Testing: What is Regression Testing? – Types of Regression Testing	4	Chalk and Talk &Interaction
	When to do Regression Testing – How to do Regression Testing – Best Practices in Regression Testing.	4	Chalk and Talk &PPT
V	Test Planning, Management, Execution and Reporting: Test Planning – Test Management.	4	Chalk and Talk &Assignment
	Test Process-Test Reporting –Best Practices.	4	Chalk and Talk &Assignment
	Testing Tools: Jmeter – Jmeter overview – JDBC Test	4	Chalk and Talk & Seminar

Course Learning Outcomes

On the completion of the course, the student will be able to

CLOs	COURSE LEARNING OUTCOMES	K-Level
CLO 1	Describe the basic concepts and the processes of software testing.	Up to K2
CLO 2	Develop test cases from the given requirements using Black box testing techniques.	Up to K3
CLO 3	Identify the test cases of system, acceptance testing.	Up to K3
CLO 4	Illustrate the testing strategies of performance and regression testing.	Up to K4
CLO 5	Examine the test adequacy criteria to complete the testing process using Testing tools.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	2	2	1	2	2
CLO 2	2	3	2	2	2
CLO 3	2	3	3	2	1
CLO 4	2	3	3	2	2
CLO 5	2	2	2	2	2

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSO

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	1	1	2	2
CLO 2	2	1	1	1	2	2
CLO 3	2	2	1	1	3	2
CLO 4	3	3	3	1	3	3
CLO 5	3	3	3	1	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print - Model for Software Testing (CIA I & II)
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
CIA I	CLO1	Up to K2	2	K1 & K2	1	K1	2(K1&K1)	2(K2)
	CLO2	Up to K3	2	K1 & K2	2	K1	2(K3&K3)	1(K3)
CIA II	CLO3	Up to K3	2	K1 & K2	1	K2	2(K2&K2)	2(K3)
	CLO4	Up to K4	2	K1 & K2	2	K2	2(K4&K4)	1(K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	6	10	-	18	30	67
K2	2	-	-	20	22	36.67	
K3	-	-	10	10	20	33.33	33
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	-	-	-	2	3.33	33
K2	2	6	10	-	18	30	
K3	-	-	-	30	30	50	50
K4	-	-	10	-	10	16.67	17
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print Model for Software Testing
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Unit	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K -Level		
1	CLO1	Up to K2	2	K1 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K1 & K2	1	K1	2(K3&K3)	1(K3)
3	CLO3	Up to K3	2	K1 & K2	1	K2	2(K2&K2)	1(K3)
4	CLO4	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
5	CLO5	Up to K4	2	K1 & K2	1	K2	2(K3&K3)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels *

K Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
VI	MAJOR-ELECTIVE –III	20U6FME3	DATA MINING	2	3	25	75	100

Nature of the Course			
Knowledge and Skill	✓	Employability Oriented	
Skill Oriented		Entrepreneurship oriented	

Course Objectives

- To understand basic data mining task and techniques.
- To impart the knowledge on classification models and algorithms.
- To implement clustering algorithm for specific problem.
- To characterize the various patterns of association rule techniques.
- To develop skills for solving practical problems in Web Mining.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introduction to Data Mining Introduction: Basic Data Mining Tasks – Data Mining versus Knowledge discovery in databases – Data mining issues – Data Mining metrics – Social implications of Data mining - Data Mining from a database perspective. Data Mining Techniques: Introduction – A Statistical perspective on data mining - Similarity measures – Decision trees – Neural networks – Genetic algorithms.	9	K2	1
II	Classification Introduction – Statically based algorithms – Distance based algorithms – Decision tree based algorithm – Rule based algorithms.	9	K4	2
III	Clustering Introduction – Similarity and Distance measures – Outliers – Hierarchical algorithms – Partition algorithms – Clustering large database.	9	K3	3
IV	Association Rules Introduction – Large Item sets – Basic algorithms – Parallel and distributed algorithms – Incremental rules – Advanced association rule techniques.	9	K3	4
V	Web Mining Introduction – Web content mining - Web Structure Mining – Web usage mining.	9	K4	5

Book(s) for Study

“DATA MINING – Introductory and Advanced Topics “- Margaret H.Dunham – Pearson I edition - 2014.

Chapters

Unit – I: 1.1 - 1.6, 3.1 - 3.6.

Unit – II: 4.1- 4.4, 4.6

Unit – III: 5.1 -5.6

Unit – IV: 6.1 -6.4, 6.6, 6.7

Unit – V: 7.1 -7.4

Books for Reference

1. “Data Mining Concepts and Techniques”, Jiawei Han, Micheline Kamber, Jian Pei., Third Edition, Elsevier Publications.
2. “Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management” Berry, Gordon S. Linoff, John Wiley & Sons Inc publishers, 3 rd Edition, 2011.
3. ‘Data Mining And Data Warehousing”, S.K Mouriya, Shalu Gupta , Narosa Book Distributors Pvt Ltd (1 January 2012).

Web Resources

1. https://www.vssut.ac.in/lecture_notes/lecture1428550844.pdf
2. <http://cvr.ac.in/cse/stud/NOTES/DWDM/DWDM.pdf>
3. <https://docs.google.com/presentation/d/1jOswwrbcGxMrqD03R2QrueNKAqT7k6WQ/edit?usp=sharing&ouid=112170218320765536599&rtpof=true&sd=true>
4. https://docs.google.com/presentation/d/19pKXF9R2n_w__IdtW10dfQ08VRolnVt6/edit?usp=sharing&ouid=112170218320765536599&rtpof=true&sd=true
5. https://docs.google.com/presentation/d/1J1uDT5YGs4EluMy_sv9ApQO4uuxkCvns/edit?usp=sharing&ouid=112170218320765536599&rtpof=true&sd=true

Rationale for Nature of the Course

Helps to develop logic and structured data mining algorithms to solve different real time applications.

Activities on Knowledge and Skill

Case studies to solve many real time problems, by giving assignments and seminars.

Pedagogy

Chalk and talk, PPT, Assignment, Seminar, Problem solving, Group discussion and Quiz

Course Designer Names

1. Mrs. R.Lakshapriya
2. Mrs. S.Sasikala

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	Introduction: Basic Data Mining Tasks – Data Mining versus Knowledge discovery in databases – Data mining issues – Data Mining metrics – Social implications of Data mining - Data Mining from a database perspective.	5	Chalk and talk & Quiz
	Data Mining Techniques: Introduction – A Statistical perspective on data mining - Similarity measures – Decision trees – Neural networks – Genetic algorithms.	4	Chalk and talk & GD
II	Classification: Introduction – Statically based algorithms – Distance based algorithms.	4	Chalk and talk, Quiz & Problem Solving
	Decision tree based algorithm – Rule based algorithms.	5	PPT
III	Clustering: Introduction – Similarity and Distance measures – Outliers.	3	Chalk and talk
	Hierarchical algorithms – Partition algorithms.	3	Chalk and talk & QUIZ
	Clustering large database.	3	Chalk and talk & GD
IV	Association Rule: Introduction – Large Itemsets – Basic algorithms – Parallel and distributed algorithms – Incremental rules.	4	Problem solving, Chalk and talk
	Advanced association rule techniques.	5	Chalk and talk, Quiz & GD
V	Web Mining: Introduction – Web content mining.	3	Chalk and talk
	Web Structure Mining-Web usage mining.	6	Assignment Seminar& GD

Course Learning outcomes

On the completion of the course, the student will be able to

CLO	COURSE LEARNING OUTCOMES	K – Levels
CLO 1	Describe the key processes of data mining and knowledge discovery process.	Up to K2
CLO 2	Analyze the various methods of Classification Algorithms.	Up to K4
CLO 3	Apply clustering techniques to solve problems in a mathematical way.	Up to K3
CLO 4	Make use of frequent pattern and correlation techniques to solve real time problems.	Up to K3
CLO 5	Compare various types of web mining techniques.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	1	2	1	2	2
CLO 2	1	3	1	2	3
CLO 3	1	3	1	2	3
CLO 4	1	3	1	2	3
CLO 5	2	3	2	2	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	2	1	3	2
CLO 2	2	3	2	2	3	3
CLO 3	2	3	2	1	3	3
CLO 4	2	3	2	2	3	2
CLO 5	2	2	2	3	1	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)

Formative - Blue Print - Model for Data Mining (CIA I & II)

Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	2 (K2)
	CLO 2	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1 (K4)
CIA II	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K2&K2)	2 (K3)
	CLO 4	Up to K3	2	K1 & K2	2	K2	2 (K3&K3)	1 (K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for eachSection		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consoli - dated %
K1	2	2	10	-	14	23.33	66
K2	2	4	-	20	26	43.33	
K3	-	-	10	-	10	16.66	17
K4	-	-	-	10	10	16.66	17
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consoli - dated %
K1	2	-	-	-	2	3.33	33
K2	2	6	10	-	18	30	
K3	-	-	10	30	40	66.66	67
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print - Model for Data Mining
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K - Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	1 (K4)
3	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K2&K2)	1 (K3)
4	CLO 4	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1 (K3)
5	CLO 5	Up to K4	2	K1 & K2	1	K1	2 (K4&K4)	1 (K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section–wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without Choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
VI	Major Elective – III	20U6FME3	Network Security	2	3	25	75	100
Nature of the Course								
Knowledge and skill			✓	Employability oriented			✓	
Skill oriented				Entrepreneurship oriented				

Course Objectives

- To learn the need for network security and security approaches.
- To understand the concept of transferring authentic data by using several algorithms.
- To study about message authentication and hash functions
- To enrich the knowledge on different types of Internet Security Protocols.
- To educate the concept of System Security.

Course Content

Unit	Content	Hrs	K – Level	CLO
I	Computer and Network Security Concepts: Computer security Concepts-the OSI Security Architecture-Security Attacks-Security Services-Security Mechanism-Fundamentals Security Design Principles-Attack Surfaces and Attack Trees-A Model for Network Security-Symmetric cipher Model-Substitution Techniques-Transposition Techniques.	9	K2	1
II	Traditional Block Cipher Structure: The Data Encryption Standard-Block Cipher Design Principles-AES Structure-AES Transformation Function. Block Cipher Operations: Multiple Encryption and Triple DES-Electronic Codebook-Cipher Block Chaining model-Cipher Feedback Mode-Output Feedback Mode-Principles of Public-Key Cryptosystems-The-RSA Algorithm	9	K3	2
III	Key Management: Diffie-Hellman Key Exchange-Cryptographic Hash Functions: Applications of Cryptographic Hash Functions-Two simple Hash Functions-Requirements and Security-Hash Functions Based on Cipher Block Chaining-Secure Hash Algorithm(SHA). Message Authentication Code: Message Authentication Requirements-Message Authentication Functions-Requirements for Message Authentication codes –Security of MACs-Digital Signatures	9	K4	3
IV	Network And Internet Security: Network Access control : Network Access Control-Extensible Authentication Protocol –Transport-Level-Security-Web Security Considerations-Transport Layer Security-HTTPs-Security Shell(SSH)-Electronic Mail Security-IP Security	9	K3	4
V	System Security: Malicious Software –Intruders-Firewalls-Legal and Ethical Issues	9	K3	5

Book(s) for Study

“Cryptography and Network Security” Principles and Practices, William Stallings, Seventh edition, PHI Education Asia

Chapters

Unit-I: 1.1-1.8,3.1-3.3

Unit-II: 4.1,4.2,4.5,6.2,6.3,7.1-7.5,9.1,9.2

Unit-III: 10.1,11.1-11.5,12.1,-12.4,13.1

Unit-IV:16.1,16.2,17.1-17.4,19.1-19.10,20.1-20.6

UnitV: 21.1-21.11,22.1-22.3,23.1-23.5,24.1-24.5

Books for Reference

1. Cryptography and Network Security, Atul Kahate, 2nd Edition, TMH.
2. Cryptography and Network Security, Behrouz A.Forouzan, TMH.
3. Network Security: The Complete Reference, Roberta Bragg, Mark Rhodes- Ousley, Keith Strassberg -2004,MC-Graw Hill education

Web Resources

1. www.vssut.ac.in/lecture_notes/lecture1428550736
2. www.geeksforgeeks.org/introduction-of-firewall-in-computer-network
3. www.geeksforgeeks.org/difference-between-rsa-algorithm-and-dsa
4. www.tutorialspoint.com/cryptography/cryptography_hash_functions.html

Rationale for Nature of the course

Maintains data confidentiality, integrity, Availability by overcoming risk, threats, vulnerability following security policies standards and guidelines.

Activities on Knowledge and Skill

Practice to write algorithms for encryption and decryption, update issues in cybercrime.

Activities on Employability

Practice to write algorithms for encryption and decryption, update issues in cybercrime.

Pedagogy

Chalk and talk, E-Content, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction and Demonstration.

Course Designer Names

1. Mrs K.VairaMeenakshi
2. Mr.M.Ashok kumar

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	Computer and Network Security Concepts: Computer security Concepts-the OSI Security Architecture Security Attacks-Security Services-Security Mechanism-Fundamentals Security Design Principles-Attack Surfaces and Attack Trees A Model for Network Security-Symmetric cipher Model-Substitution Techniques-Transposition Techniques.	3	Chalk and Talk
		3	PPT& Quiz
		3	Interaction and Demonstration
II	Traditional Block Cipher Structure- The Data Encryption Standard - Block Cipher Design Principles - AES Structure AES Transformation Function Block Cipher Operations: Multiple Encryption and Triple DES - Electronic Codebook- Cipher Block Chaining model-Cipher Feedback Mode- Output Feedback Mode- Principles of Public Key Cryptosystems- The-RSA Algorithm	4	Chalk and Talk & Quiz
		5	Problem solving &PPT
III	Key Management: Diffie-Hellman Key Exchange-Cryptographic Hash Functions: Applications of Cryptographic Hash Functions - Two simple Hash Functions Requirements and Security-Hash Functions Based on Cipher Block Chaining-Secure Hash Algorithm(SHA) Message Authentication Code: Message Authentication Requirements-Message Authentication Functions-Requirements for Message Authentication codes –Security of MACs-Digital Signatures	3	Chalk and Talk & PPT
		3	Seminar & Quiz
		3	GD
IV	Network And Internet Security: Network Access control : Network Access Control-Extensible Authentication Protocol – Transport-Level-Security Web Security Considerations- Transport Layer Security-HTTPs-Security Shell (SSH)- Electronic Mail Security-IP Security	4	Chalk & Talk & Quiz
		5	E-Content & Seminar
V	System Security: Malicious Software-Intruders Firewalls-Legal and Ethical Issues	4	E-Content & Assignment
		5	GD

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Levels
CLO 1	Describe the concept of OSI Architecture and classify the Security Models.	Up to K2
CLO 2	Utilize the concept of AES, DSA, RSA algorithm in data Security	Up to K3
CLO 3	Examine how the data is authenticated using Hash Function	Up to K4
CLO 4	Make use of Security Protocols to enable secured Transmission.	Up to K3
CLO 5	Identify various Firewall Techniques.	Up to K3

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO 1	1	2	1	2	2
CLO 2	1	3	1	2	3
CLO 3	1	3	1	2	3
CLO 4	1	3	1	2	3
CLO 5	2	3	2	2	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	2	1	3	2
CLO 2	2	3	2	2	3	3
CLO 3	2	3	2	1	3	3
CLO 4	2	3	2	2	3	2
CLO 5	2	2	2	3	1	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Network Security (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K1)	2 (K2)
	CLO 2	Up to K3	2	K1 & K2	2	K2	2 (K2&K2)	1(K3)
CIA II	CLO 3	Up to K4	2	K1 & K2	1	K2	2 (K4&K4)	1 (K4)
	CLO 4	Up to K3	2	K1 & K2	2	K1	2 (K3&K3)	2(K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for each Section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	2	10	-	14	23.33	83
K2	2	4	10	20	36	60	
K3	-	-	-	10	10	16.67	17
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	-	-	6	10	17
K2	2	2	-	-	4	6.7	
K3	-	-	10	20	30	50	50
K4	-	-	10	10	20	33.3	33
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for Network Security
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K - Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questi ons	K – Level	No. of Questions	K - Level		
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K1& K2	1	K2	2 (K2&K2)	1 (K3)
3	CLO 3	Up to K4	2	K1 & K2	1	K2	2 (K4&K4)	1 (K4)
4	CLO 4	Up to K3	2	K1 & K2	1	K1	2 (K3&K3)	1 (K3)
5	CLO 5	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1 (K3)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidence

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (NoChoice)	Section B (No choice)	Section C (Either/or)	Section D(Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF INFORMATION TECHNOLOGY				CLASS: III B.Sc. Information Technology				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	EXT	Total
VI	Major Elective - III	20U6FME3	Cloud Computing	2	3	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To know the basic concepts of Cloud Computing.
- To get familiarity with the architecture and types of cloud.
- To impart knowledge of Cloud storage techniques and Virtualization.
- To understand various tools and techniques used in security and services.
- To be familiar with cloud computing applications.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introduction to Cloud Computing: Cloud computing basics – History of cloud computing – Importance of cloud computing in the current era – Characteristics of cloud computing. Move to Cloud Computing: Pros and cons of Cloud computing – Nature of the Cloud – Technologies in Cloud computing – Migrating into the Cloud – Seven-step model.	9	K2	1
II	Types of Cloud: Public and private Cloud – Cloud infrastructure – Cloud application architecture. Working of Cloud computing: Trends in computing – Cloud service models – Cloud deployment models – Pros and cons of Cloud computing. Cloud Architecture: Cloud computing logical architecture – Developing holistic Cloud computing reference model – Cloud system architecture – Cloud deployment model.	9	K3	2
III	Virtualization-Foundations: Definition of virtualization – Types of virtualization – Virtualization application – Pitfalls of virtualization. Virtualization and Cloud computing: Anatomy of Cloud infrastructure – Virtual infrastructure – CPU virtualization – Network and storage virtualization. Cloud storage: What is Cloud storage? Overview of Cloud storage – Data management for Cloud storage – Data-intensive technologies for Cloud computing.	9	K4	3
IV	Cloud services: Cloud types and services – Software as a Service(SaaS) – Platform as a Service(PaaS) – Infrastructure as a Service(IaaS) – Other Cloud services. Cloud computing and security- Risks in Cloud computing: Introduction – Risk	9	K4	4

	management – Cloud impact – Enterprise wide risk management – Types of risk in Cloud computing. Data security in Cloud: Introduction – Current state – Cloud, Digital persona and data security – Content level security.			
V	Cloud computing tools-Tools and technologies for Cloud: Cloud computing platform – Tools for building Cloud – Programming in Cloud. Microsoft Cloud services: Windows Azure platform. Google Cloud applications: Google applications utilizing Cloud – Google app engine. Amazon Cloud services: Understanding Amazon Web components and services – Elastic compute Cloud – Amazon storage system – Amazon database services. Cloud applications: Cloud-based solutions – Cloud computing services – Cloud software for Private Banking – Cloud software for Fund Management.	9	K3	5

Book(s) for Study

“Cloud Computing – A Practical Approach for Learning and Implementation”, A. Srinivasan and J. Suresh, Pearson India Publications, 2014.

Chapters

Unit I- 1, 2

Unit II – 3, 4, 6

Unit III – 8, 10, 12

Unit IV – 16, 18, 19

Unit V – 24.5 – 24.7, 29, 30, 31, 32

Books for Reference

1. “Cloud Computing: Principles and Paradigms”, Rajkumar Buyya, James Broberg, Thamarai Selvi, Wiley India Publications, 2013.
2. “Cloud Computing: From Beginning to End”, Ray J Rafaels, 2015.
3. “Cloud Computing, A Practical Approach”, Toby Velte, Anthony Velte, Robert Elsenpeter, MCH, 2017.

Web Resources

1. <http://www.mb.net/resources/cloud-computing-resources.aspx>
2. <http://www.mastertheboss.com/cloud-computing/in-the-cloud-computing-a-beginners-tutorial>
3. <http://www.southcattle.com/technologies/cloudcomputing/index.aspx>

Rationale for Nature of the course

A new cost-efficient computing paradigm in which information and computer power can be accessed from a web browser by customers.

Activities on Knowledge and Skill

Practice to write assignment, to demonstrate cloud services and conduct group discussion.

Pedagogy

Chalk and talk, Materials, PPT, Assignment, Seminar, Group Discussion and Quiz.

Course Designer Names

1. Mrs. S. Rajalakshmi
2. Mrs. R. Tamilselvi

Lesson Plan

Unit	Topics to be Covered	Hours	Mode
I	Introduction to Cloud Computing: Cloud computing basics – History of cloud computing – Importance of cloud computing in the current era – Characteristics of cloud computing.	5	Chalks and Talk, PPT, Quiz
	Move to Cloud Computing: Pros and cons of Cloud computing – Nature of the Cloud – Technologies in Cloud computing – Migrating into the Cloud – Seven-step model.	4	Chalk and Talk, Group Discussion
II	Types of Cloud: Public and private Cloud – Cloud infrastructure – Cloud application architecture. Working of Cloud computing: Trends in computing – Cloud service models – Cloud deployment models – Pros and cons of Cloud computing.	5	Chalk and Talk, Material
	Cloud Architecture: Cloud computing logical architecture – Developing holistic Cloud computing reference model – Cloud system architecture – Cloud deployment model.	4	Chalk and Talk, Quiz
III	Virtualization-Foundations: Definition of virtualization – Types of virtualization – Virtualization application – Pitfalls of virtualization. Virtualization and Cloud computing: Anatomy of Cloud infrastructure – Virtual infrastructure – CPU virtualization – Network and storage virtualization.	5	Chalk and Talk, PPT
	Cloud storage: What is Cloud storage? Overview of Cloud storage – Data management for Cloud storage – Data-intensive technologies for Cloud computing.	4	Chalk and Talk, Quiz
IV	Cloud services: Cloud types and services – Software as a Service(SaaS) – Platform as a Service(PaaS) – Infrastructure as a Service(IaaS) – Other Cloud services.	4	Chalk and Talk, Group discussion
	Cloud computing and security- Risks in Cloud computing: Introduction – Risk management – Cloud impact – Enterprise wide risk management – Types of risk in Cloud computing. Data security in Cloud: Introduction – Current state – Cloud, Digital persona and data security – Content level security.	5	Chalk and Talk, Quiz

V	Cloud computing tools-Tools and technologies for Cloud: Cloud computing platform – Tools for building Cloud – Programming in Cloud. Microsoft Cloud services: Windows Azure platform. Google Cloud applications: Google applications utilizing Cloud – Google app engine. Amazon Cloud services: Understanding Amazon Web components and services – Elastic compute Cloud – Amazon storage system – Amazon database services. Cloud applications: Cloud-based solutions – Cloud computing services – Cloud software for Private Banking – Cloud software for Fund Management.	3	Chalk and Talk, Group Discussion, Assignment
		6	Chalk and Talk, Seminar

Course Learning Outcomes

On the completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Level
CLO 1	Describe the characteristics and type of Clouds.	Up to K2
CLO 2	Identify the significance of reference models and architecture.	Up to K3
CLO 3	Focus on virtualization and storage methods.	Up to K4
CLO 4	Classify various services and security methods.	Up to K4
CLO 5	Collect the opportunities and applications of Cloud platform.	Up to K3

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5
CLO 1	1	2	1	2	2
CLO 2	1	3	1	2	3
CLO 3	1	3	1	2	3
CLO 4	1	3	1	2	3
CLO 5	2	3	2	2	3

(3– Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO 1	2	1	2	1	3	2
CLO 2	2	3	2	2	3	3
CLO 3	2	3	2	1	3	3
CLO 4	2	3	2	2	3	2
CLO 5	2	2	2	3	1	3

(3– Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Cloud Computing (CIA I & II)
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	SectionA		Section B		Section C (Either/or Choice)	Section C (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
CIA I	CLO 1	Up to K2	2	K1 & K2	1	K1	2(K1&K1)	2(K2)
	CLO 2	Up to K3	2	K1 & K2	2	K2	2(K3&K3)	1(K3)
CIA II	CLO 3	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	2(K3)
	CLO 4	Up to K4	2	K1 & K2	2	K1	2(K2&K2)	1(K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each question		1		2		5	10
	Total Marks for each section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	2	10	-	14	23.34	67
K2	2	4	-	20	26	43.33	
K3	-	-	10	10	20	33.33	33
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K- Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	-	-	6	10	33
K2	2	2	10	-	14	23.34	
K3	-		-	20	20	33.33	34
K4	-		10	10	20	33.33	33
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative -Blue Print - Model for Cloud Computing
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Unit	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No of Questions	K - Level	No of Questions	K - Level		
1	CLO 1	Up to K2	2	K1 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1 & K2	1	K2	2(K3&K3)	1(K3)
3	CLO 3	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
4	CLO 4	Up to K4	2	K1 & K2	1	K1	2(K2&K2)	1(K4)
5	CLO 5	Up to K3	2	K1 & K2	1	K2	2(K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100	100%



The Madura College (Autonomous), Madurai-625011
(Self Financed Stream)
Department of Information Technology
Curriculum Structure for B.Sc. Statistics (Allied Papers)

Sem.	Course Type	Subject Code	Course title	Contact hours/ week	Credits
III	Allied - III	20U3SAC3	Advanced Excel Techniques	4	4
	Allied - III	20U3SAP1	Advanced Excel Techniques Lab	2	1
	Total			6	5
IV	Allied – IV	20U4SAC4	Programming in C++	4	4
	Allied - IV	20U4SAP2	Programming in C++ Lab	2	1
	Total			6	5

DEPARTMENT OF STATISTICS				CLASS: II B.Sc. Statistics				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Allied - III	20U3SAC3	Advanced Excel Techniques	4	4	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	✓

Course Objectives

- To learn the basic concepts of MS Excel.
- To familiarize with Cell ranges, Tables and Alignment for Printing.
- To implement various types of Formulas.
- To understand the use of Data Validation.
- To familiarize the concepts of pivot table and ToolPak.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Introducing Excel: Identifying What Excel Is Good For - Seeing What's New in Excel 2013 - Understanding Workbooks and Worksheets - Moving Around a Worksheet - Using the Ribbon - Using Shortcut Menus - Customizing Your Quick Access Toolbar - Working with Dialog Boxes - Using Task Panes - Creating Your First Excel Workbook. Entering and Editing Worksheet Data: Exploring Data Types - Entering Text and Values into Your Worksheets - Entering Dates and Times into Your Worksheets - Modifying Cell Contents - Applying Number Formatting. Essential Worksheet Operations: Learning the Fundamentals of Excel Worksheets - Controlling the Worksheet View - Working with Rows and Columns.	12	K2	1
II	Working with Cells and Ranges: Understanding Cells and Ranges - Copying or Moving Ranges - Using Names to Work with Ranges - Adding Comments to Cells. Introducing Tables: What Is a Table? - Creating a Table - Changing the Look of a Table - Working with Tables - Navigating in a table. Printing Your Work: Basic Printing - Changing Your Page View - Adjusting Common Page Setup Settings - Adding a Header or Footer to Your Reports - Copying Page Setup Settings across Sheets - Preventing Certain Cells from Being Printed - Preventing Objects from Being Printed - Creating Custom Views of Your Worksheet.	12	K3	2

III	Introducing Formulas and Functions: Understanding Formula Basics - Entering Formulas into Your Worksheets - Entering formulas manually - Editing Formulas - Using Cell References in Formulas - Using Formulas in Tables- Correcting Common Formula Errors - Using Advanced Naming Techniques - Working with Formulas. Creating Formulas That Count and Sum: Counting and Summing Worksheet Cells - Basic Counting Formulas - Advanced Counting Formulas - Summing Formulas - Conditional Sums Using a Single Criterion - Conditional Sums Using Multiple Criteria . Creating Formulas That Look Up Values: Introducing Lookup Formulas - Functions Relevant to Lookups - Basic Lookup Formulas - Specialized Lookup Formulas.	12	K4	3
IV	Introducing Array Formulas: Understanding Array Formulas - Creating an Array Constant -Understanding the Dimensions of an Array - Naming Array Constants - Working with Array Formulas - Using Multicell Array Formulas - Creating an array from values in a range Creating an array - Using Single-Cell Array Formulas. Performing Magic with Array Formulas: Working with Single-Cell Array Formulas - Working with Multicell Array Formulas - Returning only positive values from a range. Visualizing Data Using Conditional Formatting: About Conditional Formatting - Specifying Conditional Formatting - Formatting types you can apply - Conditional Formats That Use Graphics - Creating Formula-Based Rules Working with Conditional Formats. Using Data Validation: About Data Validation - Specifying Validation Criteria - Types of Validation Criteria You Can Apply - Creating a Drop-Down List - Using Formulas for Data Validation Rules Understanding Cell References - Data Validation Formula Examples.	12	K3	4
V	Introducing Pivot Tables: About Pivot Tables - Creating a Pivot Table Automatically Creating a Pivot Table Manually - More Pivot Table Examples - Learning More Analyzing Data with Pivot Tables: Working with Non-Numeric Data - Grouping Pivot Table Items - Creating a Frequency Distribution - Creating a Calculated Field or Calculated Item - Filtering Pivot Tables with Slicers - Filtering Pivot Tables with a Timeline - Referencing Cells within a Pivot Table - Creating Pivot Charts - A pivot chart example - More about pivot charts - Another Pivot Table Example - Producing a Report with a Pivot Table - Using the Data Model - Learning More about Pivot Tables -. Performing Spreadsheet What-If Analysis: A What-If Example - Types of What-If Analyses - Performing manual what-if analysis - Analyzing Data with the Analysis ToolPak: The Analysis ToolPak: An Overview - Installing the Analysis ToolPak Add-in - Using the Analysis Tools - Introducing the Analysis ToolPak Tools.	12	K4	5

Book(s) for Study

1. Microsoft Excel 2013 Bible “The Comprehensive Tutorial Resource”, John Walkenbach – John Wiley & Sons, Inc.

Chapters

Unit I: 1, 2, 3

Unit II: 4, 5, 9

Unit III: 10, 13, 14

Unit IV: 17, 18, 21, 26

Unit V: 33,34,35,37

Books for Reference

1. Head First Excel, Michael Milton, O’Reilly Publication.
2. Microsoft Office Excel 2007 Bible, John Walkenbach, Wiley – India Edition.
3. Plain Simple Microsoft Office Excel 2007 – Your easy, SEE-HOW guide to Excel! , Curtis D. Frye – PHI.

Web Resources

1. <https://docs.microsoft.com/en-us/learn/certifications/courses/55270>
2. https://www.tutorialspoint.com/advanced_excel/advanced_excel_external_data_connection.htm.
3. <https://www.ablebits.com/office-addins-blog/2015/06/10/excel-date-functions/>
4. https://www.tutorialspoint.com/advanced_excel/index.htm

Rationale for Nature of the course

The most used spreadsheet program in many business activities, educational training and personal data organization.

Activities on Knowledge and Skill

By giving enough practices on Data Management with Interaction & Demonstration.

Activities on Employability

By Practicing Business Process Outsourcing and Knowledge Process Outsourcing according to the requirements.

Activities on Entrepreneurship

Developing Payrolls, managing data and perform statistical analysis.

Pedagogy

Chalk and Talk, Materials, PPT, Assignment, Seminar, Quiz, Problem Solving, Group Discussion, Interaction, and Demonstration.

Course Designer Names

1. Mr. K.Rajasaravanakumar
2. Mr. M. Ashok Kumar

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	Introducing Excel: Identifying What Excel Is Good For - Seeing What's New in Excel 2013 - Understanding Workbooks and Worksheets - Moving Around a Worksheet - Using the Ribbon - Using Shortcut Menus - Customizing Your Quick Access Toolbar - Working with Dialog Boxes - Using Task Panes - Creating Your First Excel Workbook.	2	Chalk and talk & Quiz
	Entering and Editing Worksheet Data: Exploring Data Types - Entering Text and Values into Your Worksheets - Entering Dates and Times into Your Worksheets - Modifying Cell Contents - Applying Number Formatting.	5	Chalk and talk
	Essential Worksheet Operations: Learning the Fundamentals of Excel Worksheets - Controlling the Worksheet View - Working with Rows and Columns	5	Materials, PPT, Assignment
II	Working with Cells and Ranges: Understanding Cells and Ranges - Copying or Moving Ranges - Using Names to Work with Ranges - Adding Comments to Cells.	4	Chalk and talk & Quiz
	Introducing Tables: What Is a Table? - Creating a Table - Changing the Look of a Table - Working with Tables - Navigating in a table.	4	Chalk and talk, Group Discussion
	Printing Your Work: Basic Printing - Changing Your Page View - Adjusting Common Page Setup Settings - Adding a Header or Footer to Your Reports - Copying Page Setup Settings across Sheets - Preventing Certain Cells from Being Printed - Preventing Objects from Being Printed - Creating Custom Views of Your Worksheet.	4	Chalk and talk & Quiz
III	Introducing Formulas and Functions: Understanding Formula Basics - Entering Formulas into Your Worksheets - Entering formulas manually - Editing Formulas - Using Cell References in Formulas - Using Formulas in Tables - Correcting Common Formula Errors - Using Advanced Naming Techniques - Working with Formulas .	4	Interaction, and Demonstration & Quiz
	Creating Formulas That Count and Sum: Counting and Summing Worksheet Cells - Basic Counting Formulas - Advanced Counting Formulas - Summing Formulas - Conditional Sums Using a	4	PPT, As Problem Solving, Assignment

	Single Criterion - Conditional Sums Using Multiple Criteria . Creating Formulas That Look Up Values: Introducing Lookup Formulas - Functions Relevant to Lookups - Basic Lookup Formulas - Specialized Lookup Formulas.	4	Problem Solving, Interaction and Demonstration.
IV	Introducing Array Formulas: Understanding Array Formulas - Creating an Array Constant Understanding the Dimensions of an Array - Naming Array Constants - Working with Array Formulas - Using Multicell Array Formulas - Creating an array from values in a range Creating an array - Using Single-Cell Array Formulas.	3	Chalk and talk & Quiz
	Performing Magic with Array Formulas: Working with Single-Cell Array Formulas - Working with Multicell Array Formulas - Returning only positive values from a range.	3	Chalk and talk, Group Discussion, Quiz ,Problem Solving,
	Visualizing Data Using Conditional Formatting: About Conditional Formatting - Specifying Conditional Formatting - Formatting types you can apply - Conditional Formats That Use Graphics - Creating Formula-Based Rules Working with Conditional Formats.	3	Interaction and Demonstration
	Using Data Validation: About Data Validation - Specifying Validation Criteria - Types of Validation Criteria You Can Apply - Creating a Drop-Down List - Using Formulas for Data Validation Rules Understanding Cell References - Data Validation Formula Examples.	3	Chalk and talk Group Discussion , Problem Solving
V	Introducing Pivot Tables About Pivot Tables - Creating a Pivot Table Automatically Creating a Pivot Table Manually - More Pivot Table Examples - Learning More	3	Chalk and talk, Group Discussion
	Analyzing Data with Pivot Tables: Working with Non-Numeric Data - Grouping Pivot Table Items - Creating a Frequency Distribution - Creating a Calculated Field or Calculated Item - Filtering Pivot Tables with Slicers - Filtering Pivot Tables with a Timeline - Referencing Cells within a Pivot Table - Creating Pivot Charts - A pivot chart example - More about pivot charts - Another Pivot Table Example - Producing a Report with a Pivot Table - Using the Data Model - Learning More about Pivot Tables.	3	Interaction, and Demonstration Group Discussion, Assignment

	Performing Spreadsheet What-If Analysis: A What-If Example - Types of What-If Analyses - Performing manual what-if analysis	3	Problem Solving, Group Discussion , Materials
	Analyzing Data with the Analysis ToolPak: The Analysis ToolPak: An Overview - Installing the Analysis ToolPak Add-in - Using the Analysis Tools - Introducing the Analysis ToolPak Tools.	3	PPT, Interaction, and Demonstration.

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Level
CLO1	Describe about the workbook, worksheet and its basic operations.	Up To K2
CLO2	Identify the significance of using cell ranges and tables.	Up To K3
CLO3	Focus on the importance of function and formulas.	Up To K4
CLO4	Apply various measures to analyze records and data objects with its validation.	Up To K3
CLO5	Correlate different types of pivot table.	Up To K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	2	1	1
CLO2	2	1	2	2	1
CLO3	2	3	3	3	2
CLO4	3	2	2	1	3
CLO5	3	3	3	2	3

(3- Advanced Application; 2- Intermediate Level; 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	3	1	2	2
CLO2	3	2	2	2	1	1
CLO3	3	3	2	2	3	3
CLO4	3	1	3	1	3	3
CLO5	2	1	3	1	2	2

(3- Advanced Application; 2- Intermediate Level; 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Blue Print for Formative Examination – Advanced Excel Technologies (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K1)	2 (K2)
	CLO 2	Up to K3	2	K1 & K2	2	K1	2 (K2&K2)	1 (K3)
CIA II	CLO 3	Up to K4	2	K1 & K2	1	K2	2 (K3&K3)	1 (K4)
	CLO 4	Up to K3	2	K1 & K2	2	K2	2 (K3&K3)	2 (K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for each Section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	6	10	-	18	30	83
K2	2	-	10	20	32	53.33	
K3	-	-	-	10	10	16.67	17
K4	-	-	-	-	-	-	-
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	-	-	-	2	3.33	16
K2	2	6	-	-	8	13.33	
K3	-	-	20	20	40	66.67	67
K4	-	-	-	10	10	16.67	17
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Blue Print for Summative Examination – Advanced Excel Technologies (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K – Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K - Level	No. of Questions	K - Level		
1	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1 & K1)	1(K2)
2	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2 & K2)	1(K3)
3	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3 & K3)	1(K4)
4	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3 & K3)	1(K3)
5	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4 & K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either / or Choice)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-		20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF STATISTICS				CLASS: II B.Sc. Statistics				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Allied - III	20U3SAP1	Advanced Excel Techniques Lab	1	2	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	✓

Course Objectives

- To learn the basic concepts of MS Excel.
- To familiarize with Cell ranges, Tables and Alignment for Printing.
- To implement various types of Formulas.
- To understand the use of Data Validation.
- To familiarize the concepts of pivot table and ToolPak.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	1. Create a worksheet to insert data with filter and sort option. 2. Create a worksheet to calculate result with at least two mathematical and statistical formulas. 3. Create a spreadsheet for using multiple windows to view the different sections of the work book at the same time.	6	K2	1
II	4. Create a worksheet to use the watch window and to monitor the value in one or more cell. 5. Create a worksheet to calculate the contiguous and noncontiguous ranges. 6. Create a worksheet to calculate the total and averages in two different worksheets. 7. Create a spreadsheet for finding the max and min values for the payroll.	6	K3	2
III	8. Creating a spreadsheet for adding header and footer to generate your report and with different alignment with at least twenty rows and columns. 9. Create a worksheet to demonstrate Conditional formatting on Library Book Details. 10. Create a worksheet to demonstrate Array Formulas on Student Mark Details. 11. Create a basic VLOOKUP FUNCTION to apply Freezing Pane. (Identify any FOUR Arguments of a VLOOKUP Function).	6	K4	3

	12. Create a PivotTable to use the PivotTable Builder, Change the PivotTable Results, Format and Update the PivotTable. 13. Create a spreadsheet consisting of field's id, name, mobile number, address, e-mail id. (id must accept both numbers and text and it should not exceed ten characters, name should not exceed more than 30 characters, mobile number with exact 10 digits, address does not exceed 100 characters, email id should accept only (.) and (@) symbols.			
IV	14. Create two worksheet i. Sheet1 consists of bank id, bank name, customer name, deposit, withdrawal. ii. Sheet2 consists of customer id, customer name, bank id and remaining balance. iii. Sheet3 need to show the output consists of customer id, customer name, bank name, bank id, deposit, withdrawal, and remaining 15. Create a worksheet to return the average of the absolute deviation of data points from their mean and their argument can be number or names, array or references that contain number. 16. Create the worksheet to generate pivot table with option for subtotal and grand total from the normalized data.	6	K3	4
V	17. Create a worksheet by using slicers to filter to pivot table by state, by month and by timeline. 18. Create a worksheet by using what-if analysis to calculate net profit and cross profit. 19. Create a worksheet to use the regression analysis with the input of X and Y range, confidential level and normal probability. 20. Create a worksheet by using T-Test tool for two sample paired means and two sample equal and unequal variance.	6	K4	5

Book(s) for Study

1. "Microsoft Excel 2013 Bible -The Comprehensive Tutorial Resource", John Walkenbach, John Wiley & Sons, Inc.

Chapters

Unit I: 1, 2, 3

Unit II: 4, 5, 9

Unit III: 10, 13, 14

Unit IV: 17, 18, 21, 26

Unit V: 33,34,35,37

Books for Reference

1. “Head First Excel”, Michael Milton, O’Reilly Publication.
2. “Microsoft Office Excel 2007 Bible”, John Walkenbach, Wiley, India Edition.
3. “Plain Simple Microsoft Office Excel 2007”, your easy, SEES-HOW guide to Excel!
Curtis D.Frye, PHI.

Web Resources

1. <https://docs.microsoft.com/en-us/learn/certifications/courses/55270>
2. https://www.tutorialspoint.com/advanced_excel/advanced_excel_external_data_connection.htm.
3. <https://www.ablebits.com/office-addins-blog/2015/06/10/excel-date-functions/>
4. https://www.tutorialspoint.com/advanced_excel/index.htm

Rationale for Nature of the course

The most used spreadsheet program in many business activities, educational training and personal data organization.

Activities on Knowledge and Skill

By giving enough practices on Data Management with Interaction & Demonstration.

Activities on Employability

By Practicing Business Process Outsourcing and Knowledge Process Outsourcing according to the requirements.

Activities on Entrepreneurship

Developing Payrolls, managing data and perform statistical analysis.

Pedagogy

Practical Session and Demonstration.

Course Designer Names

1. Mr. K.Rajasaravanakumar
2. Mr. M. AshokKumar

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	1. Create a worksheet to insert data with filter and sort option. 2. Create a worksheet to calculate result with at least two mathematical and statistical formulas. 3. Create a spreadsheet for using multiple windows to view the different sections of the work book at the same time.	6	Demo & Practical Session
II	4. Create a worksheet to use the watch window and to monitor the value in one or more cell. 5. Create a worksheet to calculate the contiguous and noncontiguous ranges. 6. Create a worksheet to calculate the total and averages in two difference worksheet. 7. Create a spreadsheet for finding the max and min values for the payroll.	6	Demo & Practical Session
III	8. Creating a spreadsheet for adding header and footer to generate your report and with different alignment with at least twenty rows and columns. 9. Create a worksheet to demonstrate Conditional formatting on Library Book Details. 10. Create a worksheet to demonstrate Array Formulas on Student Mark Details. 11. Create a basic VLOOKUP FUNCTION to apply Freezing Pane. (Identify any FOUR Arguments of a VLOOKUP Function). 12. Create a PivotTable to use the PivotTable Builder, Change the PivotTable Results, Format and Update the PivotTable. 13. Create a spreadsheet consisting of field's id, name, mobile number, address, e-mail id. (id must accept both numbers and text and it should not exceed ten characters, name should not exceed more than 30 characters, mobile number with exact 10 digits, address does not exceed 100 characters, email id should accept only (.) and (@) symbols.	6	Demo & Practical Session
IV	14. Create two worksheet i. Sheet1 consists of bank id, bank name, customer name, deposit, withdrawal. ii. Sheet2 consists of customer id, customer name, bank id and remaining balance. iii. Sheet3 need to show the output consists of customer id, customer name, bank name, bank id, deposit, withdrawal, and remaining 15. Create a worksheet to return the average of the absolute deviation of data points from their mean and their argument can be number or names, array or references that contain number.	6	Demo & Practical Session

	16. Create the worksheet to generate pivot table with option for subtotal and grand total from the normalized data.		
V	17. Create a worksheet by using slicers to filter to pivot table by state, by month and by timeline. 18. Create a worksheet by using what-if analysis to calculate net profit and cross profit. 19. Create a worksheet to use the regression analysis with the input of X and Y range, confidential level and normal probability. 20. Create a worksheet by using T-Test tool for two sample paired means and two sample equal and unequal variance.	6	Demo & Practical Session

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Level
CLO1	Describe about the workbook and worksheet and its basic operations.	Up to K2
CLO2	Identify the significance of using cell ranges and tables.	Up to K3
CLO3	Focus on the importance of function and formulas.	Up to K4
CLO4	Apply various measures to analyze records and data objects with its validation.	Up to K3
CLO5	Correlate different types of pivot table.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	2	1	1
CLO2	2	1	2	2	1
CLO3	2	3	3	3	2
CLO4	3	2	2	1	3
CLO5	3	3	3	2	3

(3- Advanced Application; 2- Intermediate Level; 1- Basic Level)

Mapping of CLOs with PSOs

CLOs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	3	1	2	2
CLO2	3	2	2	2	1	1
CLO3	3	3	2	2	3	3
CLO4	3	1	3	1	3	3
CLO5	2	1	3	1	2	2

(3- Advanced Application; 2- Intermediate Level; 1- Basic Level)

DEPARTMENT OF STATISTICS				CLASS: II B.Sc. Statistics				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Allied - IV	20U4SAC4	Programming in C++	4	4	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To introduce the C++ programming and its use in Object oriented environment.
- To familiarize with function, classes and objects.
- To learn how to implement types of Constructors and overloading.
- To demonstrate types of inheritance and I/O operations.
- To create & process data in files and know about exception handling.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Principles of Object-Oriented Programming: Basic Concepts of OOPs - Benefits of OOPs - Applications of OOPs. Beginning with C++: Applications of C++ - A simple C++ program - Structure of a C++ Program. Tokens, Expressions and Control Structures: Tokens – Keywords – Identifiers and constants – Basic Data types – Derived data types – User-defined data types – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ - Scope resolution operators – Member dereferencing operators – Memory management operators – Manipulators – Type cast operators – Expressions and their types – Implicit conversions – Operator precedence – Control structures.	12	K2	1
II	Functions in C++: Main function – Function prototyping – Call by reference – Return by reference - Inline functions – Default arguments – Const arguments – Recursion - Function overloading – Friend and virtual functions. Classes and Objects: Specifying a Class–Defining member functions–Making an outside function inline–Nesting of member functions – Private member functions – Arrays within a class – Memory allocation for Objects – Arrays of Objects - Friendly function–Object as function arguments–Returning Objects.	12	K4	2
III	Constructors and Destructors: Constructors – Parameterized constructor – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors - Destructors. Operator overloading: Defining operator overloading – Overloading unary operators – Overloading binary operators – Overloading binary	12	K3	3

	operators using friends – Manipulation of strings using operators – Rules for overloading operators.			
IV	Inheritance: Extending Classes: Defining derived classes – Single inheritance – Making a private member inheritable – Multilevel inheritance – Multiple inheritances – Hierarchical inheritance – Hybrid inheritance – Constructors in derived classes – Nesting of classes. Managing Console I/O Operations: C++ Stream classes – Unformatted I/O operations – Formatted console I/O operations - Managing output with manipulators.	12	K3	4
V	Working with Files: Classes of file stream operations – Opening and Closing files – Detecting end of file – More about open() file modes – File pointers and their manipulations – Sequential I/O operations – Error handling during file operations – Command line arguments. Exception Handling: Basics of Exception Handling– Exception Handling Mechanism – Throwing mechanisms – Catching mechanisms.	12	K4	5

Book(s) for Study

“Object Oriented Programming with C++”, E. Balagurusamy, 7^E, McGraw Hill Education (India) Private Limited, New Delhi, 2018.

Chapters

Unit I: 1.4, 1.5, 1.6, 1.8, 2.2, 2.6, 3.2-3.6, 3.11- 3.20, 3.22, 3.24, 3.25.
Unit II: 4.2 – 4.11, 5.3, 5.4, 5.6 – 5.10, 5.13 – 5.16.
Unit III: 6.2 – 6.8, 6.11, 7.2 – 7.6, 7.8.
Unit IV: 8.2 – 8.8, 8.11, 8.12, 10.3 – 10.6.
Unit V: 11.2 – 11.7, 11.9, 11.10, 13.2 – 13.5

Books for Reference

1. “C++ The Complete Reference”, Herbert Scheldt, MH, 1998.
2. “C++ How to Program” - Paul Deitel, Harvey Deitel - Ninth edition (2014) PHI
3. “Object Oriented Programming with ANSI & Turbo C ++” - Ashok N.Kamthane, , Pearson Education
4. “Object-Oriented Programming With C++”- Poornachandra Sarang - 2nd Edition, PHI

Web Resources

1. <https://www.learncpp.com/>
2. <https://hackr.io/tutorials/learn-c-plus-plus>
3. <https://www.programiz.com/cpp-programming/examples>

Rationale for Nature of the course

Supports different ways of programming like procedural, object oriented functional and so on.

Activities on Knowledge and Skill

Give practice to write programs, Debugging, group discussion according to the requirements.

Activities on Employability

Developing simple applications and games according to the requirements.

Pedagogy

Chalk and talk, Materials, PPT, Assignment, Quiz, Problem solving, Group discussion, and Demonstration.

Course Designer Names

1. Mr. N.RadhaKrishnan
2. Mr. M.AshokKumar

Lesson Plan

Unit	Topics	Allotted Hours	Mode
I	Basic Concepts of OOPs-Benefits of OOPs-Structure of a C++ Program - Tokens – Operators in C++ – inline functions – Function overloading.	6	Chalk and talk & Quiz
	Specifying a Class–Defining member functions–Making an outside function inline–Static data member–Static member function–friendly function–Object as function arguments–Returning Objects	6	Chalk and talk, Materials
II	Constructor and destructor- Parameterized Constructor – Multiple constructors in class–Constructors with default arguments – Dynamic initialization of objects –Copy Constructor–Destructor Defining operator overloading.	6	Chalk and talk & Quiz
	Overloading unary operators – Overloading binary operators – Overloading binary operators using friend function–Rules for overloading operators.	6	Chalk and talk, Problem solving
III	Defining Derived Class - Single inheritance – Making a private member inheritable – Multilevel inheritance.	6	Chalk and talk
	Multiple inheritance – hierarchical inheritance– hybrid inheritance	6	PPT & Quiz
IV	C++ Streams classes –Unformatted I/O operations – Managing output with manipulators.	6	Chalk and talk & Quiz
	Classes for file stream operations – Opening and Closing a file– Detecting End -of -file	6	Chalk and talk and Demonstration

V	Class Templates - Class Templates with Multiple Parameters–Function Template.	6	Chalk and talk
	Basics of Exception Handling– Exception Handling Mechanism.	6	Group Discussion & Assignment

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Level
CLO1	Describe the concepts of oops and its benefits.	Up To K2
CLO2	Classify the various types of function.	Up To K4
CLO3	Apply constructors and overloading concepts in real time environment.	Up To K3
CLO4	Construct the program using inheritance.	Up To K3
CLO5	Focus on the importance of Files and Exception handling.	Up To K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO1	2	1	2	1	1
CLO2	2	1	1	1	1
CLO3	2	1	-	2	2
CLO4	1	2	-	2	3
CLO5	1	2	1	2	3

(3- Advanced Application; 2- Intermediate Level; 1- Basic Level)

Mapping of CLOs with PSOs

CLOs/PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	-	3	-	2	1
CLO2	3	2	2	2	1	1
CLO3	3	3	2	-	2	2
CLO4	3	3	3	-	3	3
CLO5	2	2	3	2	3	3

(3- Advanced Application; 2- Intermediate Level; 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Blue Print for Formative Examination – Programming in C++ (CIA I & II)
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQ s		Short Answers			
			No. of Questions	K – Level	No. of Questions	K - Level		
CIA I	CLO 1	Up to K 2	2	K1 & K2	2	K1	2 (K1 & K1)	2(K2)
	CLO 2	Up to K 4	2	K1 & K2	1	K2	2 (K3& K3)	1(K4)
CIA II	CLO 3	Up to K 3	2	K1 & K2	2	K2	2 (K2& K2)	2(K3)
	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3 & K3)	1(K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		4		3		4	3
	No. of Questions to be answered		4		3		2	2
	Marks for each Question		1		2		5	10
	Total Marks for each Section		4		6		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K - Levels*

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	10	-	16	26.66	66
K2	2	2	-	20	24	40	
K3	-	-	10	-	10	16.66	17
K4	-	-	-	10	10	16.66	17
Total Marks	4	6	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without Choice	Consolidated %
K1	2	-	-	-	2	3.33	33
K2	2	6	10	-	18	30	
K3	-	-	10	30	40	66.67	67
K4	-	-	-	-	-	-	
Total Marks	4	6	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Blue Print for Summative Examination - Object Oriented Programming with C++
Articulation Mapping – K Levels with Course Learning Outcomes (CLOs)

Unit	CLOs	K – Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K - Level	No. of Questions	K - Level		
1	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1 & K1)	1(K2)
2	CLO 2	Up to K 4	2	K1 & K2	1	K2	2 (K3& K3)	1(K4)
3	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K2& K2)	1(K3)
4	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3 & K3)	1(K3)
5	CLO 5	Up to K 4	2	K1 & K2	1	K1	2 (K4 & K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels

K - Level	Section A (No Choice)	Section B (No Choice)	Section C (Either / or Choice)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.66	42
K4	-	-	10	10	20	16.66	16
Total Marks	10	10	50	50	120	100	100

DEPARTMENT OF STATISTICS				CLASS: II B.Sc. Statistics				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Allied - IV	20U4SAP2	Programming in C++ Lab	1	2	40	60	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To introduce the C++ programming and its use in Object oriented environment.
- To familiarize with function, classes and objects.
- To learn how to implement types of Constructors and overloading.
- To demonstrate types of inheritance and I/O operations.
- To create & process data in files and know about exception handling.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Principles of Object-Oriented Programming 1. Write a C++ program to find biggest of three distinct integers. 2. Write a C++ program to find Compound Interest for the given data. 3. Write a C++ program for Sum of first N Natural numbers.	6	K2	1
II	Functions, Classes and Objects 4. Write a C++ program for Simple Interest using Inline function. 5. Write a C++ program to find the area of geometric shapes using Function Overloading. 6. Write a C++ program to create a class for student to get and print details of N students. 7. Write a C++ program to swap private data members of two classes using Friend Function.	6	K4	2
III	Constructors and Operator Overloading 8. Write a C++ program to demonstrate Constructor Overloading. 9. Write a C++ program to find the inverse of a given matrix using unary operator overloading. 10. Write a C++ program to add two Date objects using binary plus operator overloading.	6	K3	3
IV	Inheritance and I/O Operations 11. Write a C++ program to read and print Book details using Multiple Inheritance.	6	K3	4

	12. Write a C++ program to demonstrate multilevel inheritance using Employee details. 13. Write a C++ program to implement I/O operations on characters.			
V	Files and Exception Handling 14. Write a C++ program to count words and lines of a text file. 15. Write a C++ program to handle a Divide by Zero Exception.	6	K4	5

Book(s) for Study

1. “Object Oriented Programming with C++” - E. Balagurusamy, 7th edition, McGraw Hill Education (India) Private Limited, New Delhi, 2018.

Books for Reference

1. “C++ - The Complete Reference “- Herbert Schildt, TMH, 1998.
2. “C++ How to Program”, Paul Deitel, Harvey Deitel, Ninth edition (2014) PHI.
3. “Object Oriented Programming, with ANSI & Turbo C ++” - Ashok N.Kamthane, Pearson Education.
4. “Object-Oriented Programming With C++” - Poornachandra Sarang, , 2nd Edition, PHI

Web Resources

1. <https://www.learncpp.com/>
2. <https://hackr.io/tutorials/learn-c-plus-plus>
3. <https://www.programiz.com/cpp-programming/examples>

Rationale for Nature of the course

Supports different ways of programming like procedural, object oriented functional and so on.

Activities on Knowledge and Skill

Give practice to write programs, Debugging, group discussion according to the requirements.

Activities on Employability

Developing simple applications and games according to the requirements.

Pedagogy

Projector Demonstration and Practical Session.

Course Designer Names

1. Mr. N.RadhaKrishnan
2. Mr. M.Ashok Kumar

Lesson Plan

Unit	Content	Hours	Mode
I	Principles of Object-Oriented Programming 1. Write a C++ program to find biggest of three distinct integers. 2. Write a C++ program to Compound Interest. 3. Write a C++ program for Sum of first N Natural numbers.	6	Demo & Practical session
II	Functions, Classes and Objects 4. Write a C++ program for Simple Interest using Inline function. 5. Write a C++ program to find the area of geometric shapes using Function Overloading. 6. Write a C++ program to create a class for student to get and print details of N students. 7. Write a C++ program to swap private data members of two classes using Friend Function.	6	Demo & Practical session
III	Constructors and Operator Overloading 8. Write a C++ program to demonstrate Constructor Overloading. 9. Write a C++ program to find the inverse of a given matrix using unary operator overloading. 10. Write a C++ program to add two Date objects using binary plus operator overloading.	6	Demo & Practical session
IV	Inheritance and I/O Operations 11. Write a C++ program to read and print Book details using Multiple Inheritance. 12. Write a C++ program to demonstrate multilevel inheritance using Employee details. 13. Write a C++ program to implement I/O operations on characters.	6	Demo & Practical session
V	Files and Exception Handling 14. Write a C++ program to count words and lines of a text file. 15. Write a C++ program to handle a Divide by Zero Exception.	6	Demo & Practical session

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K -Level
CLO1	Describe the concepts of oops and its benefits.	Up To K2
CLO2	Classify the various types of function.	Up To K4
CLO3	Apply constructors and overloading concepts in real time environment.	Up To K3
CLO4	Construct the program using inheritance.	Up To K3
CLO5	Focus on the importance of Files and Exception handling.	Up To K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5
CLO1	2	1	2	1	1
CLO2	2	1	1	1	1
CLO3	2	1	-	2	2
CLO4	1	2	-	2	3
CLO5	1	2	1	2	3

(3- Advanced Application; 2- Intermediate Level; 1- Basic Level)

Mapping of CLOs with PSOs

CLOs/PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	-	3	-	2	1
CLO2	3	2	2	2	1	1
CLO3	3	3	2	-	2	2
CLO4	3	3	3	-	3	3
CLO5	2	2	3	2	3	3

(3- Advanced Application; 2- Intermediate Level; 1- Basic Level)



The Madura College (Autonomous), Madurai – 625 011
PG Department of Computer Science
PG Programme Structure

Sem	Course Code	Title of the Course	Hrs	Credits	Nature of Course (Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision/New
					Empl	Ent	Skill	Local	National	Global	
I	21P1DMC1	Mathematical Foundations for Computer Science	5	4	✓		✓		✓		33.33
	21P1DMC2	Data Structures and Algorithms in C++	5	4			✓			✓	17.64
	21P1DMC3	Python Programming	5	4	✓		✓			✓	100
	21P1DME1	Advanced Computer Organization and Architecture	5	4			✓			✓	100
		Embedded Systems	5	4			✓			✓	100
		Object Oriented Analysis and Design	5	4			✓			✓	14.92
	21P1DMP1	Data Structures and Algorithms in C++ Lab	4	2	✓		✓			✓	100
	21P1DMP2	Python Programming Lab	4	2	✓		✓			✓	100
	21P1DNM1	Office Automation	2	2	✓		✓	✓			100
II	21P2DMC4	Operating System Concepts	5	4			✓			✓	64.15
	21P2DMC5	Advanced Computer Networks	5	4			✓			✓	32.35
	21P2DMC6	Computer Graphics	5	4			✓			✓	100
	21P2DME2	Compiler Design	5	4			✓			✓	100
		Android Programming	5	4			✓			✓	100
		WAP & XML	5	4	✓		✓			✓	No Revision
	21P2DMP3	Linux Programming Lab	4	2			✓			✓	100
	21P2DMP4	Computer Graphics Lab	4	2			✓			✓	100
	21P2DNM2	Basics of Internetworks	2	2		✓	✓			✓	52.5

Sem	Course Code	Title of the Course	Hrs	Credits	Nature of Course (Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision/New
					Empl	Ent	Skill	Local	National	Global	
III	21P3DMC7	Relational Database Management System	6	4	✓		✓			✓	69
	21P3DMC8	Advanced Java Programming	5	4	✓		✓			✓	62.82
	21P3DMC9	Advanced Software Engineering	5	4			✓			✓	80.7
	21P3DMDC	Internet of Things	6	4	✓		✓			✓	100
	21P3DMP5	Relational Database Management System Lab	4	2	✓		✓			✓	53.33
	21P3DMP6	Advanced Java Programming Lab	4	2	✓		✓			✓	82.35
	21P3DADD	Values and Ethics in Research	2	2			✓			✓	100
IV	21P4DMC10	Data Mining and Data Warehousing	6	4			✓			✓	42.1
	21P4DMC11	Dot Net Programming	5	4	✓		✓			✓	100
	21P4DMC12	PHP Programming	5	4	✓	✓	✓			✓	38.18
	21P4DME3	Cloud Computing	6	4			✓			✓	100
		Mobile Computing	6	4			✓			✓	100
		Block Chain Technology	6	4	✓		✓			✓	100
	21P4DMP7	Dot Net Programming Lab	4	2	✓		✓			✓	100
	21P4DMP8	PHP Programming Lab	4	2	✓	✓	✓			✓	100
	21P4DMPR	Project & Viva-Voce	-	6	✓	✓	✓			✓	

Emp- Employability; Ent- Entrepreneurship; Skill- Skill Development



The Madura College (Autonomous), Madurai – 625 011
(Self-Financed Stream)
PG Department of Computer Science
Curriculum Structure for M.Sc. Computer Science

Semester	Course Type	Course Code	Course Title	Contact Hours / Week	Credits
I	Major Core - 1	21P1DMC1	Mathematical Foundations for Computer Science	5	4
	Major Core - 2	21P1DMC2	Data Structures and Algorithms in C++	5	4
	Major Core – 3	21P1DMC3	Python Programming	5	4
	Elective - 1	21P1DME1	Advanced Computer Organization and Architecture / Embedded Systems / Object Oriented Analysis and Design	5	4
	Major Core Practical - 1	21P1DMP1	Data Structures and Algorithms in C++ Lab	4	2
	Major Core Practical - 2	21P1DMP2	Python Programming Lab	4	2
	Non-Major Elective - 1	21P1DNM1	Office Automation	2	2
	Total			30	22
II	Major Core –4	21P2DMC4	Operating System Concepts	5	4
	Major Core – 5	21P2DMC5	Advanced Computer Networks	5	4
	Major Core – 6	21P2DMC6	Computer Graphics	5	4
	Elective – 2	21P2DME2	Compiler Design / Android Programming / WAP & XML	5	4
	Major Core Practical – 3	21P2DMP3	Linux Programming Lab	4	2
	Major Core Practical – 4	21P2DMP4	Computer Graphics Lab	4	2
	Non-Major Elective– 2	21P2DNM2	Basics of Internetworks	2	2
	Total			30	22

Semester	Course Type	Course Code	Course Title	Contact Hours/ Week	Credits
III	Major Core – 7	21P3DMC7	Relational Database Management System	6	4
	Major Core – 8	21P3DMC8	Advanced Java Programming	5	4
	Major Core – 9	21P3DMC9	Advanced Software Engineering	5	4
	MDC	21P3DMDC	Internet of things	6	4
	Major Core Practical – 5	21P3DMP5	Relational Database Management System Lab	4	2
	Major Core Practical – 6	21P3DMP6	Advanced Java Programming Lab	4	2
	Add-on Course	21P3DADD	Values and Ethics in Research	2	2
	Total			30	22
IV	Major Core –10	21P4DMC10	Data Mining and Data Warehousing	6	4
	Major Core – 11	21P4DMC11	Dot Net Programming	5	4
	Major Core – 12	21P4DMC12	PHP programming	5	4
	Elective – 3	21P4DME3	Cloud Computing / Mobile Computing / Block Chain Technologies	6	4
	Major Core Practical – 7	21P4DMP7	Dot Net Programming Lab	4	2
	Major Core Practical – 8	21P4DMP8	PHP Lab	4	2
	Project	21P4DMPR	Project & viva-voce	-	6
	Total			30	26

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext	Total
III	Major Core - 7	21P3DMC7	Relational Database Management System	4	6	25	75	100

Nature of the course			
Knowledge and skill		Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	

Course Objectives

- To learn about the E-R model and Functional Dependencies.
- To familiarize in basic and advanced Queries.
- To understand the various data structures like Object Oriented and indexing.
- To ensure the serializability and concurrency in transaction management system.
- To impart knowledge in NoSQL with Interface.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Database Design Using the E-R Model: Overview of the Design Process - The Entity-Relationship Model - Complex Attributes - Mapping Cardinalities - Primary Key - Removing Redundant Attributes in Entity Sets - Reducing E-R Diagrams to Relational Schemas - Extended E-R Features - Entity-Relationship Design Issues - Alternative Notations for Modeling Data. Relational Database Design: Features of Good Relational Designs - Decomposition Using Functional Dependencies - Normal Forms - Functional-Dependency Theory - Algorithms for Decomposition Using Functional Dependencies - Decomposition Using Multivalued Dependencies - More Normal Forms - Atomic Domains and First Normal Form.	18	K4	1
II	Intermediate SQL: Join Expressions - Views - Transactions - Integrity Constraints - SQL Data Types and Schemas - Index Definition in SQL - Authorization. Advanced SQL: Functions and Procedures - Triggers - Recursive Queries - Advanced Aggregation Features.	18	K3	2
III	Complex Data Types: Semi-structured Data - Object Orientation - Textual Data - Spatial Data. Indexing: Basic Concepts - Ordered Indices - B+-Tree Index Files - B+-Tree Extensions - Hash Indices - Multiple-Key Access - Creation of Indices - Bitmap Indices - Indexing of Spatial and Temporal Data.	18	K4	3
IV	Transactions: Transaction Concept - A Simple Transaction Model - Storage Structure - Transaction -Atomicity and Durability - Transaction Isolation - Serializability - Transaction Isolation and Atomicity -	18	K2	4

	Transaction Isolation Levels - Implementation of Isolation Levels - Transactions as SQL Statements. Concurrency Control: - Lock-Based Protocols - Deadlock Handling - Multiple Granularity - Insert Operations, Delete Operations, and Predicate Reads - Timestamp-Based Protocols -Validation-Based Protocols.			
V	NoSql: what it is and why you need it – definition And introduction - context and a bit of history - big data - Scalability - definition and introduction - sorted ordered Column-oriented stores -key/value stores – document Databases - graph databases. Hello NoSql: getting Initial hands-on experience: first impressions - Examining two simple examples - a simple set of persistent Preferences data - storing car make and model data – working With language bindings - mongodb’s drivers - a first look at Thrift. Interfacing and interacting with NoSql: - If no sql, then what? - storing and accessing data – storing Data in and accessing data from mongodb – querying Mongodb - storing data in and accessing data from apache Cassandra - querying apache Cassandra - language bindings For nosql data stores - language bindings for java – language Bindings for python - language bindings for php.	18	K3	5

Books for Study

1. “Database System Concepts”, Abraham Silberschatz, Henry F Korth, S Sudarshan, 7th edition, McGraw-Hill International Edition , 2019.
2. “Professional NoSQL”, Shashank Tiwari, John Wiley & Sons

Chapters

Book 1:

UNIT I: 6.1 – 6.10. 7.1 – 7.8
UNIT II: 4, 5.2 – 5.8
UNIT III: 8, 14.1 – 14.7, 14.9, 14.10
UNIT IV: 17, 18.1 – 18.6

Book 2:

UNIT V: 1, 2, 3 (MongoDB, Apache Cassandra, Java, Python, PHP)

Books for Reference

1. “Fundamental of Database Systems” - Ramez Elmasri, Shamkant B Navathe, Pearson, 7th edition 2016.
2. “An Introduction to Database Systems” - C.J. Date, A. Kannan, S.Swamynathan, 8th Edition, Pearson Education Reprint 2016.
3. “Database Systems a practical approach to Design, Implementation and Management “ - Thomas Connolly, Carolyn Begg., Pearson Education, 2014.
4. “Database Management Systems” – Raghu Ramakrishnan & Johannes Gehrke, McGraw Hill International Edition – Third Edition – 2003.

Web Resources

1. <http://www.rdmseducation.com/>
2. <https://www.ibm.com/analytics/relational-database>
3. <https://www.oreilly.com/library/view/web-database-applications/0596005431/ch01.html>

Rationale for Nature of the course

Helps to provide a strong foundation in advanced database concepts like complex database, concurrency control and recovery system from an industry perspective.

Activities on Skill Oriented

By providing practice to write queries and present seminars in relevant topics.

Activities on Employability

By practicing Data Analyses and Database Designing.

Pedagogy

Chalk and talk, E-Content, PPT, Assignment, Seminar, Group Discussion, Demonstration and Interaction, Problem Solving.

Course Designer(s) Name

1. Mr. K.Rajasaravanakumar
2. Mrs. S. Rajalakshmi

Lesson Plan

UNIT	Topics to be covered	Hours	Mode
I	Database Design Using the E-R Model: Overview of the Design Process - The Entity-Relationship Model - Complex Attributes - Mapping Cardinalities - Primary Key - Removing Redundant Attributes in Entity Sets - Reducing E-R Diagrams to Relational Schemas - Extended E-R Features - Entity-Relationship Design Issues - Alternative Notations for Modeling Data.	9	Chalk and talk, Quiz,
	Relational Database Design: Features of Good Relational Designs - Decomposition Using Functional Dependencies - Normal Forms - Functional-Dependency Theory - Algorithms for Decomposition Using Functional Dependencies - Decomposition Using Multivalued Dependencies - More Normal Forms - Atomic Domains and First Normal Form.	9	Chalk and talk, Interaction, Quiz
II	Intermediate SQL: Join Expressions - Views - Transactions - Integrity Constraints - SQL Data Types and Schemas - Index Definition in SQL - Authorization.	9	Chalk and talk, Quiz Problem Solving
	Advanced SQL: Functions and Procedures - Triggers - Recursive Queries - Advanced Aggregation Features.	9	Chalk and talk, Quiz Demonstration and Interaction
III	Complex Data Types: Semi-structured Data - Object Orientation -Textual Data - Spatial Data.	8	Chalk and talk, PPT, Quiz, E-Content
	Indexing: Basic Concepts - Ordered Indices - B+-Tree Index Files - B+-Tree Extensions - Hash Indices -Multiple-Key Access - Creation of Indices - Bitmap Indices - Indexing of Spatial and Temporal Data.	10	Chalk and talk, Quiz

IV	Transactions: Transaction Concept - A Simple Transaction Model - Storage Structure - Transaction -Atomicity and Durability - Transaction Isolation - Serializability - Transaction Isolation and Atomicity - Transaction Isolation Levels - Implementation of Isolation Levels - Transactions as SQL Statements.	7	Chalk and talk, PPT, Quiz
	Concurrency Control: - Lock-Based Protocols - Deadlock Handling - Multiple Granularity - Insert Operations, Delete Operations, and Predicate Reads - Timestamp-Based Protocols -Validation-Based Protocols.	11	Chalk and talk,Quiz, E-Content
V	Nosql: what it is and why you need it – definition And introduction -context and a bit of history - big data - Scalability - definition and introduction - sorted ordered Column-oriented stores -key/value stores – document Databases - graph databases.	6	Chalk and talk, PPT, Assignment
	Hello Nosql: getting Initial hands-on experience - first impressions - Examining two simple examples - a simple set of persistent Preferences data - storing car make and model data – working With language bindings - mongodb’s drivers - a first look at Thrift.	6	Chalk and talk, Seminar
	Interfacing and interacting with Nosql - If no sql, then what? - storing and accessing data – storing Data in and accessing data from mongodb – querying Mongodb - storing data in and accessing data from apache Cassandra - querying apache cassandra - language bindings For nosql data stores - language bindings for java – language Bindings for python - language bindings for php.	6	Chalk and talk, PPT

COURSE LEARNING OUTCOMES

On the completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Level
CLO 1	Analyze the concept of E-R Model and Functional Dependency.	Up to K4
CLO 2	Utilize the Triggers and functions to perform various database operations.	Up to K3
CLO 3	Focus on the performance of a database by using indexing techniques.	Up to K4
CLO 4	Describe the significance of transaction facilities.	Up to K2
CLO 5	Identify the importance of NoSQL in relation with SQL.	Up to K3

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	2	2	2	2	2	1
CLO 2	3	3	3	3	3	2
CLO 3	3	3	2	3	2	1
CLO 4	2	1	1	2	1	1
CLO 5	2	2	3	3	2	1

(3– Advanced Application, 2– Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Relational Database Management System
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
CIA I	CLO 1	Up to K4	2	K3	2(K4&K4)	1(K4)
	CLO 2	Up to K3	3	K1	2(K3&K3)	2(K3)
CIA II	CLO 3	Up to K4	2	K2	2(K4&K4)	2(K4)
	CLO 4	Up to K2	3	K2	2(K1&K1)	1(K2)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		10		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% Of Marks without choice	Consolidated %
K1	6	-	-	6	10	10
K2	-	-	-	-	-	
K3	4	10	20	34	56.67	57
K4	-	10	10	20	33.33	33
Total Marks	10	20	30	60	100	100
K Levels	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% Of Marks without choice	Consolidated
K1	-	10	-	10	16.67	50
K2	10	-	10	20	33.33	
K3	-	-	-	-	-	-
K4	-	10	20	30	50	50
Total Marks	10	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for Relational Database Management System
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

UNITS	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No of Questions	K - Level	No of Questions	K - Level		
1	CLO1	Up to K4	2	K3& K4	1	K3	2(K4&K4)	1(K4)
2	CLO2	Up to K3	2	K2& K3	1	K1	2(K3&K3)	1(K3)
3	CLO3	Up to K4	2	K3& K4	1	K2	2(K4&K4)	1(K4)
4	CLO4	Up to K2	2	K2& K1	1	K2	2(K1&K1)	1(K2)
5	CLO5	Up to K3	2	K1& K3	1	K1	2(K2&K2)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1–Remembering and recalling facts with specific answers
- K2–Basic understanding of facts and stating main ideas with general answers
- K3–Applicationoriented–SolvingProblems
- K4–Examining,analyzing,presentationandmakeinferenceswithevidences

Distribution of Section – wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without Choice	Consolidated %
K1	2	4	10	-	16	13.33	35
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
Total Marks	10	10	50	50	120	100	100

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext	Total
III	Major Core - 8	21P3DMC8	Advanced Java Programming	4	5	25	75	100

Nature of the course

Knowledge and Skill		Employability Oriented	✓
Skill Oriented	✓	Entrepreneurship Oriented	

Course Objectives

- To impart knowledge in Inheritance, Exception Handling and Multithreading.
- To learn about the AWT and the creation of GUI using Swing Classes.
- To create dynamic web pages using Servlet and know the distributed object model using RMI.
- To implement the Networking packages and communicate with Relational Databases.
- To create dynamic web pages using JSP tags.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	The Java Language: Inheritance: Inheritance Basics – Creating a Multilevel Hierarchy – Method Overriding. Exception Handling: Exception Handling Fundamentals – Exception Types – Using try and catch – Multiple catch Clauses – Nested try Statements. Multithreaded Programming: The Java Thread Model – The Main Thread – Creating a Thread – Creating Multiple Threads.	15	K2	1
II	Introducing the AWT: Working with Windows, Graphics and Text: AWT Classes – Window Fundamentals – Working with frame windows – Introducing Graphics – Working with Fonts. Introducing Swing – Two Key Swing features – The MVC connection – Components and Containers – The Swing packages – Event Handling- Creating a Swing Applet – Painting in Swing. Exploring Swing: JLabel and ImageIcon – JTabbedPane – JScrollPane – Jlist – JComboBox- Trees – JTable.	15	K4	2
III	Introducing Servlets: The Life Cycle of a Servlet – Servlet Development Options – Using Tomcat – A Simple Servlet – The Servlet API – The javax.servlet Package – Reading Servlet Parameters – The javax.servlet.http Package – Handling HTTP Requests and Responses – Using Cookies – Session Tracking. Regular Expressions and Other Packages: Remote Method Invocation.	15	K3	3

IV	Networking: InetAddress – Socket Programming – Datagram – URL. JDBC: JDBC and ODBC – Using a JDBC – DriverManager–Creating Connection – Connection Interface–Creating Statements – Statement Interface–Executing Statements – PreparedStatement Interface – CallableStatement Interface – ResultSet Interface.	15	K3	4
V	JavaServer Pages: An Overview of JSP – Implicit Objects – Directives – Scripting Elements. JavaMail: JavaMail Overview – Sending Emails with JavaMail – Sending Emails with Apache Commons Email – Using Gmail’s SMTP Server – WebMail. Introducing to Spring MVC: Downloading Spring Framework – Benefits of Spring MVC – Spring MVC DispatcherServlet – The Controller Interface – Your first Spring MVC Application – The View Resolver – Annotation-based Controllers – Writing Request-Handling Methods – Using An Annotation-Based Controller.	15	K4	5

Books for Study

1. “Java the Complete Reference”, Herbert Schildt, McGraw Hill Education, 9th Edition, New York, 2017.
2. “Programming in Java2” Dr. K. Somasundaram, Eight Jaico Impression 2009.
3. “Servlet & JSP” – A Tutorial, Budi Kurniawan Second Edition, Brainy Software Publications.

Chapters

Book 1:

Unit I: 8, 10, 11

Unit II : 25, 31, 32

Unit III: 30, 38

Book 2:

Unit IV: 20, 21

Book 3:

Unit V: 4, 16, 23

Books for Reference

1. “Advanced Java Programming” - Uttam K.Roy, Oxford University Press, 2017.
2. “Black Book, Core and Advanced Java” - DreamTech Press, 2017
3. Core Java Volume II – Advanced Features - 8th Edition – Prentice Hall

Web Resources

1. <https://www.tutorialspoint.com/jsp/index.htm>
2. <https://www.javatpoint.com/java-jdbc>
3. https://www.tutorialspoint.com/java/java_networking.htm

Rationale for Nature of the course

Develop wide variety of applications including web applications, software and Game development, Network programming, GUI, Scientific and Numeric applications.

Activities on Skill Development

By providing practice to write coding and present seminars in relevant topics.

Activities on Employability

Practice to develop Games, Apps and dynamic Web pages.

Pedagogy

Chalk and talk, E-Content, PPT, Assignment, Seminar, Group Discussion, Problem Solving, Demonstration, Interaction and Quiz

Course Designer(s) Name

1. Mrs. S. Sasikala
2. Mrs.K.VairaMeenakshi

Lesson Plan

UNIT	Topics to be covered	Hours	Mode
I	The Java Language: Inheritance: Inheritance Basics – Creating a Multilevel Hierarchy – Method Overriding.	3	Chalk and talk, Problem Solving
	Exception Handling: Exception Handling Fundamentals – Exception Types – Using try and catch – Multiple catch Clauses – Nested try Statements.	5	Chalk and talk, Interaction
	Multithreaded Programming: The Java Thread Model – The Main Thread – Creating a Thread – Creating Multiple Threads.	7	Chalk and talk, Quiz
II	Working with Windows, Graphics and Text: AWT Classes – Window Fundamentals – Working with frame windows – Introducing Graphics – Working with color – Setting the Paint Mode – Working with Fonts.	5	Chalk and talk
	Introducing GUI Programming with Swing: Introducing Swing – Two Key Swing features – The MVC connection – Components and Containers – The Swing packages – Event Handling- Creating a Swing Applet – Painting in Swing.	4	PPT, Group discussion
	Exploring Swing: JLabel and ImageIcon – JTabbedPane – JScrollPane – Jlist – JComboBox-Trees – Jtable.	6	Interaction, Quiz
III	Introducing Servlets The Life Cycle of a Servlet – Servlet Development Options – Using Tomcat – A Simple Servlet – The Servlet API – The javax.servlet Package – Reading Servlet Parameters – The javax.servlet.http Package – Handling HTTP Requests and Responses – Using Cookies – Session Tracking.	10	Demonstration, PPT, Quiz
	Regular Expressions and Other Packages: Remote Method Invocation.	5	E content, Chalk and talk

IV	Networking: InetAddress – Socket Programming – Datagram – URL.	7	PPT, Quiz,
	JDBC: JDBC and ODBC – Using a JDBC – DriverManager–Creating Connection – Connection Interface–Creating Statements – Statement Interface–Executing Statements – PreparedStatement Interface – CallableStatement Interface – ResultSet Interface.	8	Chalk and talk, Demonstration
V	JavaServer Pages: An Overview of JSP – Implicit Objects – Directives – Scripting Elements.	4	Chalk and talk, PPT, Seminar
	JavaMail: JavaMail Overview – Sending Emails with JavaMail – Sending Emails with Apache Commons Email – Using Gmail’s SMTP Server – WebMail.	6	E content, Demonstration
	Introducing to Spring MVC: Downloading Spring Framework – Benefits of Spring MVC – Spring MVC DispatcherServlet – The Controller Interface – Your first Spring MVC Application – The View Resolver – Annotation-based Controllers – Writing Request-Handling Methods – Using An Annotation-Based Controller.	5	Chalk and talk, Assignment

COURSE LEARNING OUTCOMES

On the completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Level
CLO 1	Illustrate the concept of Inheritance, Exception Handling and Multithreading.	Up to K2
CLO 2	Focus on the concept of AWT and creation of GUI screens using Swing Classes.	Up to K4
CLO 3	Build the Web Applications using Servlets and Distributed object model using RMI.	Up to K3
CLO 4	Develop the Web programming on client side and server side using JDBC.	Up to K3
CLO 5	Discover the dynamic web pages using JSP.	Up to K4

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	1	1	1	1	1	2
CLO 2	1	1	1	3	1	2
CLO 3	1	3	3	1	3	3
CLO 4	2	1	2	1	2	3
CLO 5	3	3	3	1	2	1

(3– Advanced Application, 2– Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Advanced Java Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
CIA I	CLO 1	Up to K2	3	K1	2(K1&K1)	2(K2)
	CLO 2	Up to K4	2	K2	2(K4&K4)	1(K4)
CIA II	CLO 3	Up to K3	2	K1	2(K2&K2)	2(K3)
	CLO 4	Up to K3	3	K2	2(K3&K3)	1(K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		10		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% Of Marks without choice	Consolidated %
K1	6	10	-	16	26.67	67
K2	4	-	20	24	40	
K3	-	-	-	-	-	-
K4	-	10	10	20	33.33	33
Total Marks	10	20	30	60	100	100
K Levels	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% Of Marks without choice	Consolidated
K1	4	-	-	4	6.66	33
K2	6	10	-	16	26.67	
K3	-	10	30	40	66.67	67
K4	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for Advanced Java Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

UNITS	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No of Questions	K - Level	No of Questions	K - Level		
1	CLO1	Up to K2	2	K1& K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K4	2	K3& K4	1	K2	2(K4&K4)	1(K4)
3	CLO3	Up to K3	2	K2& K3	1	K1	2(K2&K2)	1(K3)
4	CLO4	Up to K3	2	K2& K3	1	K2	2(K3&K3)	1(K3)
5	CLO5	Up to K4	2	K3& K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D(Open Choice)	Total Marks	% of Marks	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
Total Marks	10	10	50	50	120	100	100

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
III	Major Core - 9	21P3DMC9	Advanced Software Engineering	4	5	25	75	100

Nature of the Course

Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the concept of Software development Process.
- To learn the concept of Requirements Modeling.
- To impart the knowledge in Design techniques.
- To be familiar with the Quality assurance and testing.
- To focus on software process improvement.

Course Content

UNIT	CONTENT	Hrs	K-Level	CLO
I	The Nature of Software: The Nature of Software – The Changing Nature of Software. Software Engineering: The Software Process - Software Engineering Practice. Software Process Structure: A Generic Process Model – Defining a Framework Activity – Identifying a Task Set – Process Patterns – Process Assessment and Improvement. Process Models: Prescriptive Process Models – Specialized Process Models – The Unified Process – Personal and Team Process Models – Process Technology – Product and Process. Agile Development: What is Agility? – Agility and the cost of change – What is an Agile Process? – Extreme Programming – Other Agile Process Model – A Tool set for the Agile Process.	15	K2	1
II	Requirements Modeling: Scenario-Based Methods: Requirements Analysis – Scenario-Based Modeling – UML Models that supplement the Use Case. Class-Based Methods: Identifying Analysis classes – Specifying Attributes – Defining operations – Class-responsibility-collaborator Modeling – Associations and Dependencies – Analysis Packages. Behavior, Patterns and Web/Mobile Apps: Creating a Behavioral Model – Identifying Events with Use Case – State Representations – Patterns for Requirements Modeling – Requirements Modeling for Web and Mobile Apps.	15	K3	2

III	Design Concepts: Design within the context of Software Engineering – The Design Process – Design Concepts – The Design Model. Architectural Design: Software Architecture, Architectural Styles, Architectural Considerations. Component – Level Design: What is a Component? – Designing Class-Based components – Component-Based Development.	15	K3	3
IV	Software Quality Assurance: Background Issues – Elements of Software Quality Assurance – SQA Processes and product Characteristics – SQA Tasks, Goals and Metrics – Formal approaches to SQA – Statistical SQA – Software Reliability – The ISO 9000 Quality Standards – The SQA Plan. Software Testing Strategies: A Strategic Approach to Software Testing – Strategic Issues – Test Strategies for Conventional Software – Test Strategies for Object-Oriented Software – Test Strategies for WebApps – Test Strategies for MobileApps – Validation Testing – System Testing – The Art of Debugging. Testing Conventional Applications: Software Testing Fundamentals - Internal and External views of Testing - White Box Testing - Basis Path Testing - Control Structure Testing - Black-Box Testing.	15	K4	4
V	Advanced Topics: Software Process Improvement: What is SPI? – The SPI Process – The CMMI – The People CMM – Other SPI Frameworks – SPI Return on Investment – SPI Trends. Emerging Trends in Software Engineering: Technology Evolution – Prospects for a True Engineering Discipline – Observing Software Engineering Trends – Identifying Soft Trends – Technology Directions – Tools Related Trends.	15	K4	5

Book for Study

Software Engineering - A practitioner's approach - By Roger S.Pressman -8th Edition
- McGraw Hill International editions.

Chapters

Unit – I: 1.1, 1.2, 2.2, 2.3, 3, 4, 5
Unit – II: 9, 10, 11
Unit – III: 12, 13.1, 13.3, 13.4, 14.1, 14.2, 14.7
Unit – IV: 21, 22, 23.1 - 23.6
Unit – V: 37, 38

Books for Reference

1. “Software Engineering concepts”- Richard Fairley, TATA McGraw-Hill Edition.
2. “Software Engineering” - Roger.S.Pressman-MGH-IVED.
3. “Software Engineering”-Ian Sommerville-8th Edition- Pearson Publications.

Web Resources

1. <https://www.mbit.edu.in/wp-content/uploads/2020/05/Mcgraw-Hill-Software-Engineering-A-Practitioners-Approach-Pressman-5Th-Ed2001BookmarkedCover.pdf>
2. https://books.google.com/books/about/Software_Engineering.html?id=VDzzQgAACAAJ
3. <https://www.mheducation.co.in/computer-science-engineering/software-engineering>
4. <https://www.abeebooks.com/9780078022128/Software-Engineering-Practitioners-Approach-Roger-0078022126/plp>

Rationale for Nature of the course

Apply the principles of software engineering to the design, development, maintenance, testing, and evaluation of software.

Activity on Knowledge and Skill Development

Case studies in project specification, software design, Assignments and Seminar

Pedagogy

Chalk and talk, PPT, Assignment, Seminar, Problem solving, Group Discussion and Quiz.

Course Designer(s) Name

3. Mrs. K. Iyaya
4. Mr. N. Radhakrishnan

Lesson Plan

Unit	Topics	Hours	Mode
I	The Nature of Software: The Nature of Software – The Changing Nature of Software. Software Engineering: The Software Process - Software Engineering Practice.	5	Chalk and talk
	Software Process Structure: A Generic Process Model – Defining a Framework Activity – Identifying a Task Set – Process Patterns – Process Assessment and Improvement.	5	Chalk and talk
	Process Models: Prescriptive Process Models – Specialized Process Models – The Unified Process – Personal and Team Process Models – Process Technology – Product and Process. Agile Development: What is Agility? – Agility and the cost of change – What is an Agile Process? – Extreme Programming – Other Agile Process Model – A Tool set for the Agile Process.	5	Quiz& Group Discussion
II	Requirements Modeling: Scenario-Based Methods: Requirements Analysis – Scenario-Based Modeling – UML Models that supplement the Use Case.	5	Chalk and talk
	Class-Based Methods: Identifying Analysis classes – Specifying Attributes – Defining operations – Class-responsibility-collaborator Modeling – Associations and Dependencies – Analysis Packages.	5	Chalk and talk & Quiz

	Behavior, Patterns and Web/Mobile Apps: Creating a Behavioral Model – Identifying Events with Use Case – State Representations – Patterns for Requirements Modeling – Requirements Modeling for Web and Mobile Apps.	5	Chalk and talk& Group Discussion
III	Design Concepts: Design within the context of Software Engineering – The Design Process – Design Concepts – The Design Model.	5	Chalk and talk
	Architectural Design: Software Architecture, Architectural Styles, Architectural Considerations.	5	Chalk and talk & QUIZ
	Component – Level Design: What is a Component? – Designing Class-Based components – Component-Based Development.	5	Chalk and talk& Group Discussion
IV	Software Quality Assurance: Background Issues – Elements of Software Quality Assurance – SQA Processes and product Characteristics – SQA Tasks, Goals and Metrics – Formal approaches to SQA – Statistical SQA – Software Reliability – The ISO 9000 Quality Standards – The SQA Plan.	5	Chalk and talk
	Software Testing Strategies: A Strategic Approach to Software Testing – Strategic Issues – Test Strategies for Conventional Software – Test Strategies for Object-Oriented Software – Test Strategies for WebApps – Test Strategies for MobileApps – Validation Testing – System Testing – The Art of Debugging.	5	Chalk and talk & Quiz
	Testing Conventional Applications: Software Testing Fundamentals - Internal and External views of Testing - White Box Testing - Basis Path Testing - Control Structure Testing - Black-Box Testing.	5	Chalk and talk& Group Discussion
V	Advanced Topics: Software Process Improvement: What is SPI? – The SPI Process – The CMMI – The People CMM – Other SPI Frameworks – SPI Return on Investment – SPI Trends.	7	Chalk and talk Seminar
	Emerging Trends in Software Engineering: Technology Evolution – Prospects for a True Engineering Discipline – Observing Software Engineering Trends – Identifying Soft Trends – Technology Directions – Tools Related Trends.Trends – Technology Directions – Tools Related Trends.	8	PPT, Group Discussion, Assignment

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLOs	Course Learning Outcomes	K - Levels
CLO 1	Discuss the concept of the software process and agile development	Up to K2
CLO 2	Identify various Requirements modelling	Up to K3
CLO 3	Make use of various software design concepts.	Up to K3
CLO 4	Analyze the software Quality assurance and Testing strategies.	Up to K4
CLO 5	Focus on software process improvements and emerging trends in software engineering.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	2	1	1	2	1	1
CLO 2	2	2	2	2	2	2
CLO 3	2	2	3	2	3	3
CLO 4	3	2	2	3	3	3
CLO 5	2	2	2	3	3	3

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Blue Print for the Formative Examination – Advanced Software Engineering
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K - Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1	2 (K1&K1)	2 (K2)
	CLO 2	Up to K3	3	K1	2 (K2&K2)	1 (K3)
CIA II	CLO 3	Up to K3	2	K2	2 (K3&K3)	2 (K3)
	CLO 4	Up to K4	3	K2	2 (K4&K4)	1 (K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		10		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K – Levels*

K - Level	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	10	10	-	20	33.33	83
K2	-	10	20	30	50	
K3	-	-	10	10	16.67	17
K4	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	-	-	-	-	-	17
K2	10	-	-	10	16.67	
K3	-	10	20	30	50	50
K4	-	10	10	20	33.33	33
Total Marks	10	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Blue Print for the Summative Examination – Advanced Software Engineering
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

UNIT	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K-Level		
1	CLO1	Up to K2	2	K1& K1	1	K1	2 (K1&K1)	1 (K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2 (K2&K2)	1 (K3)
3	CLO3	Up to K3	2	K2 & K3	1	K2	2 (K3&K3)	1 (K3)
4	CLO4	Up to K4	2	K3& K4	1	K2	2 (K4&K4)	1 (K4)
5	CLO5	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analysing, presentation and make inferences with evidences
- K5 – Ability to integrate ideas from one situation to newer situations.

Distribution of Section–wise Marks with K – Levels*

K – Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
K5	-	-	-	-	-	-	-
Total Marks	10	10	50	50	120	100	100

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	MDC	21P3DMDC	Internet of Things	4	6	25	75	100

Nature of Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To learn the fundamentals of IoT.
- To impart knowledge in IoT Protocols.
- To familiarize the concept of IoT Cloud-Based Services and various IoT Industrial Applications.
- To understand the working principles of Sensors to connect everything and bring intelligence to every end point.
- To impart knowledge on set of mathematical models for the analysis and design of service process for which there is contention for shared resources.

Unit	Content	Hrs	K – Level	CLO
I	FUNDAMENTALS OF IOT- what is IOT: Genesis of IOT-IOT and Digitization-IOT Impact-Convergence of IT and OT-IOT Challenges. IOT Network Architecture and Design: Comparing IOT Architectures-A simplified IOT Architecture-The Core IOT Functional stack.	18	K2	1
II	IoT PROTOCOLS - Connecting Smart Objects: Communications Criteria Data and Analytics for IoT: An Introduction to Data Analytics for IoT - Machine Learning - Big Data Analytics Tools and Technology - Edge Streaming Analytics - Network Analytics.	18	K2	2
III	Data Collection, Storage and Computing Using a Cloud Platform : Introduction-Cloud Computing Paradigm for Data Collection, Storage and Computing-Everything as a Services and Cloud Service Models-IoT Cloud-Based Services Using the Xively, Nimbits and Other Platforms.	18	K2	3

	IoT Case Studies: IoT/IIoT Applications in the Premises, Supply-Chain and Customer Monitoring-IoT Applications for Smart Homes, Cities, Environment-Monitoring and Agriculture.			
IV	Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks: Introduction – Sensor Technology-Examples of Sensors- Actuator. Prototyping the embedded Devices for IoT and M2M: Embedded Hardware Units.	18	K2	4
V	Simple Markovian Queueing Models: Birth–Death Processes – Single–Server Queues - Multiple server queues – Choosing the Number of Servers – Queues with Truncation – Erlang’s Loss Formula – Queues with Unlimited Service – Finite-Source Queues – State-Dependent Service – Queues with Impatience.	18	K2	5

Book for Study

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
2. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
3. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., “Fundamentals of Queueing Theory”, JOHN WILEY & SONS, INC., PUBLICATION, 4th Edition 2008.

Chapters

Book-1

Unit-I: 1, 2

Unit-II: 4, 7

Book-2

Unit –III: 6.1 - 6.4, 12.3, 12.5

Unit-IV: 7.1,7.2,7.4,8.2.3

Book -3

Unit V: 2.1 – 2.10

Reference Book

1. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit2).
2. “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Jan Hoeller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O’Reilly Media, 2011.

Web Resources

1. https://www.tutorialspoint.com/internet_of_things/index.htm
2. https://www.google.co.in/books/edition/Internet_of_Things_A_Hands_On_Approach/JPKGBAAAQBAJ?hl=en&gbpv=1&pg=PA8&printsec=frontcoverInternet_of_things
3. <https://www.networkworld.com/article/3207535/what-is-iot-the-internet-of-things-explained.html>
4. <https://www.youtube.com/watch?v=r9mZ42xmWfE>
5. <https://www.youtube.com/watch?v=3uldUBhzCAQ>
6. <https://www.ntirawen.com/2019/03/actuator-in-iot.html>
7. <https://www.electronicsspecifier.com/products/micros/what-is-an-embedded-system>
8. https://www.halvorsen.blog/documents/teaching/courses/syslab/iot_automation.php?usp=sf_link

Rationale for Nature of the course

- Internet of Things can create information about the connected objects, analyze it, and make decisions.

Activity on Knowledge and Skill Development

- Seminar on recent trends on Internet of Things
- Assignment on case studies.
- Group discussion on Data Collection, Storage and Computing Using a Cloud Platform

Pedagogy

- Chalk and talk, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction, Quiz and Demonstration.

Course Designer Names

1. Mrs. K.Vairameenakshi
2. Mrs. S.Sasikala
3. Dr. M. Revathi
4. Mr. P. Nataraj

Lesson Plan

Unit	Topics to be covered	Hours	Mode
I	Fundamentals Of Iot- what is IOT: Genesis of IOT-IOT and Digitization-IOT Impact-Convergence of IT and OT-IOT Challenges.	8	Chalk and Talk,
	IOT Network Architecture and Design: Comparing IOT Architectures-A simplified IOT Architecture-The Core IOT Functional stack.	10	Interaction, PPT, GD, Quiz
II	Iot Protocols - Connecting Smart Objects: Communications Criteria.	4	Chalk and Talk
	Data and Analytics for IoT: An Introduction to Data Analytics for IoT - Machine Learning.	7	Chalk and Talk ,PPT
	Big Data Analytics Tools and Technology - Edge Streaming Analytics - Network Analytics.	7	Interaction, Quiz
III	Data Collection, Storage and Computing Using a Cloud Platform : Introduction-Cloud Computing Paradigm for Data Collection, Storage and Computing-Everything as a Services and Cloud Service Models-IoT Cloud-Based Services Using the Xively, Nimbits and Other Platforms.	9	Chalk and Talk
	IoT Case Studies: IoT/IIot Applications in the Premises, Supply-Chain and Customer Monitoring-IoT Applications for Smart Homes, Cities, Environment-Monitoring and Agriculture.	9	GD, Quiz, interaction
IV	Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks: Introduction – Sensor Technology-Examples of Sensors- Actuator.	10	Chalk and Talk, PPT
	Prototyping the embedded Devices for IoT and M2M: Embedded Hardware Units.	8	Quiz, Interaction and Demonstration
V	Simple Markovian Queueing Models: Birth–Death Processes – Single–Server Queues	6	Chalk and Talk, Problem solving
	Multiple server queues – Choosing the Number of Servers	6	Group discussion, Interaction,
	Queues with Truncation – Erlang’s Loss Formula	6	Assignment & Seminar
	Queues with Unlimited Service – Finite-Source Queues – State-Dependent Service – Queues with Impatience.		

Course Learning Outcomes

On the completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Levels
CLO 1	Describe the basics of IoT.	K2
CLO 2	Classify the various protocols.	K2
CLO 3	Outline Data analytics and supporting service and real time application.	K2
CLO 4	Describe the principles of Sensors and Actuators.	K2
CLO 5	Illustrate Simple Markovian Queueing Models.	K2

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	3	2	1	2	3	1
CLO 2	3	2	1	2	3	1
CLO 3	3	2	1	2	3	1
CLO 4	3	2	1	1	2	1
CLO 5	3	3	2	2	2	1

(3 – Advanced Applications, 2 – Intermediate Level, 1 – Basic Level)

Learning Outcome Based Education & Assessment (LOBE)

Formative - Blue Print – Model for Internet of Things

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No of Questions	K - Level		
1	CLOX	Up to K2	2	K1	2(K2&K2)	2(K2)
2	CLOY	Up to K2	1	K1	2(K2&K2)	1(K2)
No. of Questions to be asked			3		4	3
No. of Questions to be answered			3		2	2
Marks for each question			2		7	10
Total Marks for each section			6		14	20

- CLO3 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels (CIA I & II)

K - Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Total Marks	% of Marks without choice	Consolidated %
K1	6	-	-	6	9.37	100
K2	-	28	30	58	90.63	
Total Marks	6	28	30	64	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for Internet of Things
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S.No	CLOs	K- Level	Section A		Section B		Section C (Open Choice)
			Short Answers		(Either/or Choice)		
			No of Questions	K - Level	No of Questions	K - Level	
1	CLO1	Up to K2	1	K1	1	K2& K2	1(K2)
2	CLO2	Up to K2	1	K1	1	K2& K2	1(K2)
3	CLO3	Up to K2	1	K1	1	K2& K2	1(K2)
4	CLO4	Up to K2	1	K1	1	K2& K2	1(K2)
5	CLO5	Up to K2	1	K1	1	K2& K2	1(K2)
No. of Questions to be asked			5		10		5
No. of Questions to be answered			5		5		3
Marks for each question			2		7		10
Total Marks for each section			10		35		30

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

Distribution of Section – wise Marks with K Levels *

K Levels	Section A Short Answers	Section B (Either/or Choice)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	10	-	-	10	7.69	8
K2	-	70	50	120	92.31	92
Total Marks	10	70	50	130	100	100%

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
III	Major Core Practical- 5	21P3DMP5	Relational Database Management System Lab	2	4	40	60	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To learn about the simple and moderate queries.
- To familiarize advanced Queries.
- To understand the Join queries and basic PL/SQL Blocks.
- To acquire knowledge in implementing Triggers.
- To impart knowledge in Exceptions and Packages of PL/SQL.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	1. Create table for bank with attributes Accno, Accname, Address, balance, bname and insert five records. Execute the following queries. - List account holder name(s) whose name start with letter 'S'. - Display the number of persons has account in "SBI". - Display the records in descending order by balance. - Display the customer details who have second highest balance. - Find the Branch that has the smallest deposit. 2. Create the student table with the attributes Student_id, First_name, Last_name, Gender, Dob, Address, City, State, ZipCode. Execute the following queries. - Display Students Id whose age is greater than 20. - Display the Students First_name, Address whose birthday falls in the month of January. - Display all information of the youngest male student from the Student table. - Delete all students who are residing not in Tamil Nadu. - Find the students whose First_name is same as his/her City.	12	K4	1

	3. Create this library database with suitable records. member(<u>memb no</u>, name) book(<u>isbn</u>, title, authors, publisher) borrowed(<u>memb no</u>, <u>isbn</u>, date) Write and execute the following queries in SQL. - Write an SQL DDL definition of this database. Identify referential-integrity constraints that should hold, and include them in the DDL definition. - Find the member number and name of each member who has borrowed at least one book published by “McGraw-Hill”. - Find the member number and name of each member who has borrowed every book published by “McGraw-Hill”. - For each publisher, find the member number and name of each member who has borrowed more than five books of that publisher. - Find the average number of books borrowed per member. Take into account that if a member does not borrow any books, then that member does not appear in the borrowed relation at all, but that member still counts in the average.			
II	4. Create this company database with suitable records. employee (<u>ID</u>, person name, street, city) works (<u>ID</u>, company name, salary) company (<u>company name</u>, city) manages (<u>ID</u>, manager id) Write and execute the following queries in SQL. - Write an SQL DDL definition of this database. Identify referential-integrity constraints that should hold, and include them in the DDL definition. - Find the ID, name, and city of residence of each employee who works for “First Bank Corporation”. - Find the ID, name, and city of residence of the employees Ram and John. - Find the ID of each employee who earns more than every employee of “Small Bank Corporation”. - Assume that companies may be located in several cities. Find the name of each company that is located in every city in which “Small Bank Corporation” is located. - Find the name of each company whose employees earn a higher salary, on average, than the average salary at “First Bank Corporation”. - Modify the database so that the employee whose ID is '12345' now lives in “Newtown”. - Give each manager of “First Bank Corporation” a 10 percent raise unless the salary becomes greater than \$100000; in such cases, give only a 3 percent raise.	12	K3	2

	i) Find ID and name of each employee who earns more than the average salary of all employees of her or his company. j) Give all managers of “First Bank Corporation” a 10 percent raise.			
III	5. Create table for student, marks and project with their relevant fields. Execute the following queries. a) Using Inner join display student details and marks. b) Using left outer join display student details and marks. c) Using Right outer join display student and their project details. d) Using full Outer join display student and their project details. 6. Write a block to find the N th Maximum of salary in the company database.	12	K4	1
IV	7. Write a database trigger to avoid the transaction on a table during Saturdays and Sundays as well as before 10 and after 17.30. 8. Write a database trigger that prevents the user from updating the Salary field in the database whose job is ‘manager’. 9. Consider the Company Database, with an additional attribute Date of Birth in employee table and Write a database trigger that prevents the user from inserting a record into Employee table, when their Age is not between eighteen and Fifty Eight. 10. Consider that the view is created with isbn, title, Number of times borrowed and <i>materialized</i> ; that is, the view is computed and stored in the Library database. Write triggers to <i>maintain</i> the view, that is, to keep it up-to-date on insertions, deletions and modifications.	12	K3	1
V	11. Write a Block to demonstrate any Three Built-in Exceptions. 12. Create a user-defined exception for the built-in exceptions ‘NO DATA FOUND’ and ‘TOO MANY ROWS’ 13. Create a procedure to display the details of given employee. If no value is given, List the details of all the Employees. 14. Create a function to find the city which has most number of employees in Company Database. 15. Create a package, which has function and procedure to find the book(s) which referenced by the most number of times and most active member(s) who in the Library Database.	12	K2	1

Book for Study

“Database System Concepts”, Abraham Silberschatz, Henry F Korth , S Sudarshan, 7th edition , McGraw-Hill International Edition , 2019

Books for Reference

1. “Fundamental of Database Systems” - Ramez Elmasri, Shamkant B Navathe, Pearson, 7th edition 2016.
2. “An Introduction to Database Systems” - C.J. Date, A. Kannan, S.Swamynathan, 8th Edition, Pearson Education Reprint 2016.
3. “Database Systems a practical approach to Design, Implementation and Management “ - Thomas Connolly, Carolyn Begg., Pearson Education, 2014.
4. “Database Management Systems” – Raghu Ramakrishnan & Johannes Gehrke, McGraw Hill International Edition – Third Edition – 2003.

Web Resources

5. <https://www.w3schools.com/sql/>
6. <https://towardsdatascience.com/practical-sql-create-and-query-a-relational-database-8bac84d78703>
7. <https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm>
8. https://docs.oracle.com/cd/B19306_01/server.102/b14200/statements_6009.htm

Rationale for Nature of the course

Helps to provide a strong foundation in advanced database concepts like complex database, concurrency control and recovery system from an industry perspective.

Activities on Skill Oriented

By providing practice to write queries and present seminars in relevant topics.

Activities on Employability

By practicing Data Analyses and Database Designing.

Pedagogy

Projector, Demonstration and Practical Session.

Course Designer(s) Name

1. Mr.K.Rajasaravanakumar
2. Mrs. S. Rajalakshmi

Lesson Plan

Unit	Topics	Hours	Mode
I	1. Create table for bank with attributes Accno, Acname, Address, balance, bname and insert five records. Execute the following queries. a) List account holder name(s) whose name start with letter ‘S’. b) Display the number of persons has account in “SBI”. c) Display the records in descending order by balance. d) Display the customer details who have second highest balance. e) Find the Branch that has the smallest deposite.	12	Demo & Practical Session

	2. Create the student table with the attributes Student_id, First_name, Last_name, Gender, Dob, Address, City, State, ZipCode. Execute the following queries. - Display Students Id whose age is greater than 20. - Display the Students First_name, Address whose birthday falls in the month of January. - Display all information of the youngest male student from the Student table. - Delete all students who are residing not in Tamil Nadu. - Find the students whose First_name is same as his/her City. 3. Create this library database with suitable records. member(<u>memb no</u>, name) book(<u>isbn</u>, title, authors, publisher) borrowed(<u>memb no</u>, <u>isbn</u>, date) Write and execute the following queries in SQL. - Write an SQL DDL definition of this database. Identify referential-integrity constraints that should hold, and include them in the DDL definition. - Find the member number and name of each member who has borrowed at least one book published by “McGraw-Hill”. - Find the member number and name of each member who has borrowed every book published by “McGraw-Hill”. - For each publisher, find the member number and name of each member who has borrowed more than five books of that publisher. - Find the average number of books borrowed per member. Take into account that if a member does not borrow any books, then that member does not appear in the borrowed relation at all, but that member still counts in the average.		
II	4. Create this company database with suitable records. employee (<u>ID</u>, person name, street, city) works (<u>ID</u>, company name, salary) company (<u>company name</u>, city) manages (<u>ID</u>, manager id) Write and execute the following queries in SQL. - Write an SQL DDL definition of this database. Identify referential-integrity constraints that should hold, and include them in the DDL definition. - Find the ID, name, and city of residence of each employee who works for “First Bank Corporation”.	12	Demo & Practical Session

	c) Find the ID, name, and city of residence of the employees Ram and John. d) Find the ID of each employee who earns more than every employee of “Small Bank Corporation”. e) Assume that companies may be located in several cities. Find the name of each company that is located in every city in which “Small Bank Corporation” is located. f) Find the name of each company whose employees earn a higher salary, on average, than the average salary at “First Bank Corporation”. g) Modify the database so that the employee whose ID is '12345' now lives in “Newtown”. h) Give each manager of “First Bank Corporation” a 10 percent raise unless the salary becomes greater than \$100000; in such cases, give only a 3 percent raise. i) Find ID and name of each employee who earns more than the average salary of all employees of her or his company. j) Give all managers of “First Bank Corporation” a 10 percent raise.		
III	5. Create table for student, marks and project with their relevant fields. Execute the following queries. a) Using Inner join display student details and marks. b) Using left outer join display student details and marks. c) Using Right outer join display student and their project details. d) Using full Outer join display student and their project details. 6. Write a block to find the Nth Maximum of salary in the company database.	12	Demo & Practical Session
IV	7. Write a database trigger to avoid the transaction on a table during Saturdays and Sundays as well as before 10 and after 17.30. 8. Write a database trigger that prevents the user from updating the Salary field in the database whose job is ‘manager’. 9. Consider the Company Database, with an additional attribute Date of Birth in employee table and Write a database trigger that prevents the user from inserting a record into Employee table, when their Age is not between eighteen and Fifty Eight. 10. Consider that the view is created with isbn, title, Number of times borrowed and <i>materialized</i>; that is, the view is computed and stored in the Library database. Write triggers to <i>maintain</i> the view, that is, to keep it up-to-date on insertions, deletions and modifications.	12	Demo & Practical Session

V	11. Write a Block to demonstrate any Three Built-in Exceptions. 12. Create a user-defined exception for the built-in exceptions 'NO DATA FOUND' and 'TOO MANY ROWS' 13. Create a procedure to display the details of given employee. If no value is given, List the details of all the Employees. 14. Create a function to find the city which has most number of employees in Company Database. 15. Create a package, which has function and procedure to find the book(s) which referenced by the most number of times and most active member(s) who in the Library Database.	12	Demo & Practical Session

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLOs	Course Learning Outcomes	K - Levels
CLO 1	Analyze the concept of simple and moderate queries.	Up to K4
CLO 2	Utilize the various clauses of advanced Queries.	Up to K3
CLO 3	Focus on the performance of Join queries and basic PL/SQL Blocks.	Up to K4
CLO 4	Identify the significance in the implementation of Triggers.	Up to K3
CLO 5	Describe the concepts of Exceptions and Packages of PL/SQL.	Up to K2

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5	P06
CLO 1	2	2	2	2	2	1
CLO 2	3	3	3	3	3	2
CLO 3	3	3	2	3	2	1
CLO 4	2	1	1	2	1	1
CLO 5	1	1	2	1	2	2

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext	Total
III	Major Core Practical - 6	21P3DMP6	ADVANCED JAVA PROGRAMMING LAB	2	4	40	60	100

Nature of Course			
Knowledge and skill		Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	

Course Objectives

- To impart knowledge in Inheritance, Exception Handling and Multithreading.
- To learn about the AWT and the creation of GUI using Swing Classes.
- To create dynamic web pages using Servlet and know the distributed object model using RMI.
- To implement the Networking packages and communicate with Relational Databases.
- To create dynamic web pages using JSP tags.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	1. To Write a program to demonstrate Hierarchical Inheritance. 2. To Write a program to creates three child threads. 3. To Write a Program to demonstrate multi-catch block.	12	K2	1
II	4. To Write a Program to illustrates the use of getFont() and setFont() method in Graphics class. 5. To Write a Program to develop a Swing Application using various Swing Component classes.	12	K4	2
III	6. To develop a Servlet to handle the HTTP Requests and Responses using GET and POST method. 7. To develop a Servlet that illustrates the usage of Cookies. 8. To develop a Servlet to illustrates how to use Session State. 9. To Write a Java Program to demonstrate Client/Server Application using RMI.	12	K3	3
IV	10. To Write a Program for create an Echo-Server using TCP Socket. 11. To write a program creates a datagram socket. 12. To Write a Program to execute select query using JDBC. 13. To Write a Program to Update Student details using JDBC.	12	K3	4

V	14. JSP Program to validate username and password 15. To Write a Program to generate a Bean for calculate the area of a circle provided its radius value taken as input from a HTML form, after clicking the “Submit” button the control will be transferred to a JSP page which will call the Bean 16. To Write a JSP program to demonstrate various Implicit Objects. 17. To Write a JSP program to upload file into server.	12	K4	5

Books for Study

1. “Java The Complete Reference“ -Herbert Schildt, , McGraw Hill Education, 9thEdition, New York, 2017
2. “JavaServer Pages” - Hans Bergsten, 3rd Edition O'Reilly Publications.
3. “Programming in Java2”- Dr. K. Somasundaram, Eighth Jaico Impression 2009,

Books for Reference

1. “Advanced Java Programming“ -Uttam K.Roy, , Oxford University Press, 2017.
2. “Black Book, Core and Advanced Java” - Dreamtech Press, 2017
3. “Core Java Volume II – Advanced Features” - 8th Edition – Prentice Hall

Web Resources

1. <https://www.tutorialspoint.com/jsp/index.htm>
2. <https://www.javatpoint.com/java-jdbc>
3. https://www.tutorialspoint.com/java/java_networking.htm

Rationale for Nature of the course

Develop wide variety of applications such as web applications, software and Game development, Network programming, GUI, Scientific and Numeric applications.

Activities on Skill

By providing practice to write coding and present seminars in relevant topics.

Activities on Employability

Practice to develop Games, Apps and dynamic Web pages.

Pedagogy

Demonstration and Practical Session.

Course Designer(s) Name

1. Mrs. S. Sasikala
2. Mrs. K.VairaMeenakshi

Lesson Plan

UNIT	Topics to be Covered	Hours	Mode
I	1. To Write a program to demonstrate Hierarchical Inheritance. 2. To Write a program to demonstrate multi-threads. 3. To Write a Program to demonstrate multi-catch block.	12	Demo & Practical Session
II	4. To Write a Program to illustrates the use of getFont() and setFont() method in Graphics class. 5. To Write a Program to develop a Swing Application using various Swing Component classes.	12	Demo & Practical Session
III	6. To develop a Servlet to handle the HTTP Requests and Responses using GET and POST method. 7. To develop a Servlet that illustrates the usage of Cookies. 8. To develop a Servlet to illustrates how to use Session State. 9. To Write a Java Program to demonstrate Client/Server Application using RMI.	12	Demo & Practical Session
IV	10. To Write a Program for create an Echo-Server using TCP Socket. 11. To write a Program creates a datagram socket. 12. To Write a Program to execute select query using JDBC. 13. To Write a Program to Update Student details using JDBC.	12	Demo & Practical Session
V	14. JSP Program to validate username and password 15. To Write a Program to generate a Bean for calculate the area of a circle provided its radius value taken as input from a HTML form, After clicking the “Submit” button the control will be transferred to a JSP page which will call the Bean. 16. To Write a JSP program to demonstrate various Implicit Objects. 17. To Write a JSP program to upload file into server.	12	Demo & Practical Session

COURSE LEARNING OUTCOMES

On the completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Level
CLO 1	Illustrate the concept of Inheritance, Exception Handling and Multithreading.	Up to K2
CLO 2	Focus on the concept of AWT and creation of GUI screens using Swing Classes.	Up to K4
CLO 3	Build the Web Applications using Servlets and Distributed object model using RMI.	Up to K3
CLO 4	Develop the Web programming on client side and server side using JDBC.	Up to K3
CLO 5	Discover the dynamic web pages using JSP.	Up to K4

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	2	1	1	3	1	2
CLO 2	1	1	1	3	1	2
CLO 3	1	3	3	1	3	3
CLO 4	2	1	2	1	2	3
CLO 5	3	3	3	1	2	1

(3– Advanced Application, 2– Intermediate Level, 1- Basic Level)

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Add – on Course	21P3DADD	Values and Ethics in Research	2	2	50	50	100

Course Objectives

- To learn about ethical principles
- To create awareness on the research concepts.
- To understand the overall process of designing a research study.
- To acquire knowledge in various sampling techniques.
- To familiarize in thesis writing.

Course Content

UNIT	CONTENT	HOURS
I	Introduction: Why we did this research – Research methodology – How this report could be used – The difference between Ethics and Law. Ethical Principles for Scientific Research: Duty to Society – Beneficence – Conflict of Interest – Informed Consent – Integrity – Nondiscrimination – Nonexploitation – Privacy and Confidentiality – Professional Competence – Professional Discipline.	6
II	Research Methodology: Introduction-Meaning of Research-Objectives of Research-Motivation in Research-Types of Research-Research Approaches-significance of Research-Research Methods versus Methodology-Research and Scientific Method-importance of Knowing How Research is Done-Research Process-Criteria of Good Research. Defining the Research Problem -What is a Research Problem-Selecting the problem-Necessity of Defining the problem-Technique involved in Defining a Problem.	6
III	Research Design: Meaning of Research Design-Need for Research Design-Features of a Good Design-important concepts Relating to Research Design-Different Research Designs-Basic Principles of Experimental Designs.	6
IV	Sampling Design: Census and sample survey-Implications of a Sample Design –Steps in Sample Design-criteria of Selecting a Sampling Procedure-Characteristics of a Good Sample Design-Different Types of Sample Designs-How to Select a Random Sample?-Random Sample from an infinite Universe-Complex Random Sampling Designs. Methods of Data Collection : Collection of Primary Data-Observation Method-Interview Method-Collection of Data Through Questionnaires-Collection of Data Through Schedules-Difference Between Questionnaires and Schedules-Some Other Methods of Data Collection-Collection of Secondary Data-Selection of Appropriate Method for Data collection.	6
V	Thesis Writing: Introduction-Standardizing of writing-Thesis by articles-Free Style Writing – Pros & Cons- Writing at the Tertiary Level-Planning the Thesis-Footnotes-Tables and Figures.	6

Books for Study

1. “Ethics in Scientific Research”, Cortney Weinbaum, Eric Landree, Marjory S. Blumenthal, Tepring Piquado, Carlos Ignacio Gutierrez, Rand Corporation, 2019.
2. “Research Methodology Methods & Techniques”, C. R. Kothari, 2nd edition, New Age International Publishers, 2009.
3. “Thesis & Assignment Writing”, Anderson, Berny H. Dujrston, H.Pode, 4th edition, Wiley Publications, New Delhi, 2008.

Chapters

Book 1:

Unit I: 1, 2

Book 2:

Unit II: 1, 2

Unit III: 3

Unit IV: 4, 6

Book 3:

Unit V: 1, 3, 8, 9

&https://www.researchgate.net/publication/342154115_HOW_TO_WRITE_YOUR_THESIS.

Books for Reference

1. Research Methodology: A step by step Guide for Beginners, Ranjith Kumar, Sage Publications, 2014.
2. How to Write a Thesis, Umberto Eco, The MIT Press, 2015.
3. Operations Research an Introduction by Hamdy A. Taha, PHI, 8th edition.

Web Resources

1. <https://www.discoverphds.com/blog/types-of-research>.
2. <https://www.coursehero.com/file/p4c7oact/Random-sample-from-an-infinite-universe-So-far-we-have-talked-about-random/>
3. <https://www.acsce.edu.in/acsce/wp-content/uploads/2020/03/Operation-Research-17CS653-Module5.pdf>
4. <https://www.enago.com/academy/how-to-plan-a-research-thesis/>

Pedagogy

Chalk and talk, Materials, PPT, Assignment, Seminar, Group discussion, Quiz.

Course Designer(s) Name

1. Mrs. S. Rajalakshmi
2. Mrs. K.Vairameenakshi

Blue Print Model for Add-On Course Internal Assessment

Distribution of Section – wise Marks

Section	Components	Marks
Section A	Project / Assignment / Quiz	15
Section B	Modeling / Creativity	15
Section C	Innovation in Experiment	20
	Total	50

Blue Print – Model for Add-On Course External Examination

Distribution of Section – wise Marks

Description	Section A MCQs	Section B (Open Choice)	Total
No. of Questions to be asked	10	7	
No. of Questions to be answered	10	4	
Marks for each question	1	10	
Total Marks for each section	10	40	50

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major Core -10	21P4DMC10	Data Mining and Data Warehousing	4	6	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the various functionalities and application.
- To be familiar with the concepts of data warehousing and OLAP.
- To learn the concepts of mining frequent pattern and classification.
- To impart the knowledge of cluster analysis methods.
- To utilize data mining techniques in various real applications.

Unit	Content	Hrs	K-Level	CLO
I	Introduction: What Is Data Mining-What Kinds of Data Can Be Mined? Data Pre-processing: An overview-Data Cleaning-Data Integration-Data Reduction-Data Transformation and Data Discretization.	18	K3	1
II	Data Warehouse: Basic Concepts - Data Warehouse Modeling: Data Cube and OLAP - Data Warehouse Design and Usage - Data Warehouse Implementation - Data Generalization by Attribute-Oriented Induction.	18	K2	2
III	Mining Frequent Patterns and Classification: Basic Concepts - Frequent Item set Mining Methods. Advanced Pattern Mining: Pattern Mining in Multilevel, Multidimensional Space - Constraint - Based Frequent Pattern Mining. Classification: Basic Concepts: Basic Concepts - Decision Tree Induction - Bayes Classification Methods - Rule-Based Classification. Classification: Advanced Methods: Classification by Back propagation.	18	K3	3
IV	Cluster Analysis Basic Concepts and Methods: Cluster Analysis - Partitioning Methods - Hierarchical Methods (Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, BIRCH) - Density Based Methods (DBSCAN, OPTICS) - Grid Based Methods - Evaluation of Clustering.	18	K4	4
V	Data Mining Trends and Research Frontiers: Mining Complex Data Types-Data Mining Applications-Data Mining and Society - Data Mining Trends.	18	K4	5

Book for Study

“Data Mining Concepts and Techniques” - Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann Publisher, 2012.

Chapters

Unit I: 1.2, 1.3, 3

Unit II: 4

Unit III: 6.1, 6.2, 7.2, 7.3, 8.1, 8.2, 8.3, 8.4, 9.2

Unit IV : 10

Unit V : 13.1, 13.3, 13.4, 13.5

Books for Reference

1. "Insight into Data mining Theory and Practice". K.P. Soman, Shyam Diwakar and V. Ajay, Easter Economy Edition, Prentice Hall of India, 2006.
2. "Introduction to Data Mining with Case Studies". G. K. Gupta, Easter Economy Edition, Prentice Hall of India, 2006.
3. "Introduction to Data Mining" Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education, 2007.
4. "Modern Data Warehousing, Mining and Visualization, Marakas". George M, Pearson Education, 2011.

Web Resources

1. https://en.wikipedia.org/wiki/Data_warehouse
2. https://www.researchgate.net/publication/288177442_Advanced_Pattern_Mining
3. <https://www.upgrad.com/blog/cluster-analysis-data-mining/>
4. <https://www.geeksforgeeks.org/classification-of-data-mining-systems/>

Rationale for Nature of the course

Helps to improve speed and efficiency of accessing data, derive insights that will guide the business and marketing strategies.

Activities on knowledge and skill

Give practice to write Assignments, conduct Group Discussions, workout case studies for a given scenario.

Pedagogy

Chalk and talk Materials, PPT, Case studies, Assignment, Seminar, Group Discussion, Interaction and Quiz.

Course Designer(s) Name

1. Mrs.R.TamilSelvi
2. Mrs.R.Lakshapriya

Lesson Plan

Unit	Topics to be covered	Hrs	Mode
I	Data Mining And Data Preprocessing Introduction: What Is Data Mining-What Kinds of Data Can Be Mined?	9	Chalk and talk
	Data Pre-processing: An overview-Data Cleaning-Data Integration-Data Reduction-Data Transformation and Data Discretization.	9	Chalk and talk, GD, Quiz
II	Data Warehouse: Basic Concepts - Data Warehouse Modeling: Data Cube and OLAP	9	Chalk and talk
	Data Warehouse Design and Usage Data Warehouse Implementation - Data Generalization by Attribute - Oriented Induction.	9	Chalk and talk, Quiz
III	Mining Frequent Patterns And Classification: Basic Concepts - Frequent Item set Mining Methods. Advanced Pattern Mining: Pattern Mining in Multilevel, Multidimensional Space - Constraint - Based Frequent Pattern Mining.	9	Chalk and talk
	Classification: Basic Concepts: Basic Concepts - Decision Tree Induction - Bayes Classification Methods - Rule-Based Classification. Classification: Advanced Methods: Classification by Back propagation.	9	Chalk and talk, Quiz
IV	Cluster Analysis Basic Concepts And Methods: Cluster Analysis - Partitioning Methods - Hierarchical Methods (Agglomerative versus Divisive Hierarchical Clustering.	10	Chalk and talk, PPT, case study & Interaction
	Distance Measures in Algorithmic Methods, BIRCH) - Density Based Methods (DBSCAN, OPTICS) - Grid Based Methods - Evaluation of Clustering.	8	Chalk and talk, GD, Quiz
V	Data Mining Trends and Research Frontiers: Mining Complex Data types-Data Mining Applications.	9	Chalk and talk, Assignment
	Data Mining and Society - Data Mining Trends.	9	GD, PPT, Seminar

Course Learning Outcomes

On the completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K – Level
CLO 1	Identify the significance of data preprocessing.	Up to K3
CLO 2	Describe the concepts of data warehousing.	Up to K2
CLO 3	Make use of various pattern mining and classification algorithms.	Up to K3
CLO 4	Correlate various clustering methods.	Up to K4
CLO 5	Focus on the data mining techniques in various real time applications.	Up to K4

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	2	2	2	2	2	3
CLO 2	1	1	2	1	1	1
CLO 3	1	1	2	3	1	2
CLO 4	3	3	2	2	3	1
CLO 5	3	3	2	2	3	2

(3– Advanced Application, 2– Intermediate Level, 1- BasicLevel)

Learning Outcome Based Education & Assessment (LOBE)

Formative - Blue Print – Model for Data Mining and Data Warehousing
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
CIA I	CLO 1	Up to K3	3	K1	2(K2&K2)	1(K3)
	CLO 2	Up to K2	2	K1	2(K1&K1)	2(K2)
CIA II	CLO 3	Up to K3	2	K2	2(K3&K3)	2(K3)
	CLO 4	Up to K4	3	K2	2(K4&K4)	1(K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		10		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	10	10	-	20	33.33	83
K2	-	10	20	30	50	
K3	-	-	10	10	16.67	17
K4	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100
K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	-	-	-	-	-	17
K2	10	-	-	10	16.67	
K3	-	10	20	30	50	50
K4	-	10	10	20	33.33	33
Total Marks	10	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for Data Mining and Data Warehousing
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

UNIT	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No of Questions	K - Level	No of Questions	K - Level		
1	CLO1	Up to K3	2	K2& K3	1	K1	2(K2&K2)	1(K3)
2	CLO2	Up to K2	2	K1 & K1	1	K1	2(K1&K1)	1(K2)
3	CLO3	Up to K3	2	K2& K3	1	K2	2(K3&K3)	1(K3)
4	CLO4	Up to K4	2	K3 & K4	1	K2	2(K4&K4)	1(K4)
5	CLO5	Up to K4	2	K3 & K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
Total Marks	10	10	50	50	120	100	100

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
IV	Major Core -11	21P4DMC11	Dot Net Programming	4	5	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To make them aware of ASP.NET MVC.
- To understand the concept of Controllers and Actions.
- To impart the knowledge in Data Models and HTML Helpers.
- Be familiar with the Model Binder and Validation.
- To learn and create the application using Database access.

Course Content

UNI	CONTENT	Hrs	K-Level	CLO
I	Building ASP.NET MVC Applications: An Introduction to ASP.NET MVC: Software Design Principles -Software Design Patterns- Writing Unit Tests for Your Code – What is ASP.net MCV– The architecture of an ASP .Net MVC Application – Understanding the sample ASP.Net MVC Application. Building a Simple ASP.NET MVC Application: Starting with a Blank Slate -Creating the Database Creating the Model- Creating the Controller - Creating the Views.	15	K2	1
II	Understanding Controllers And Actions: Creating Controller-Returning Action Results-Controlling How Actions Are Invoked – Handling Unknown Actions-Testing Controllers and Actions. Understanding Views: Creating A View-Using View Data-Typed And Untyped Views.	15	K3	2
III	Understanding Models: Creating a Data Model. Understanding HTML Helpers: Using the Standard HTML Helpers- Creating Custom HTML Helpers- Creating a Datagrid Helper.	15	K3	3
IV	Understanding Model Binder: Using the Default Model Binder - Using the Bind Attribute -Using Bind with Classes-Using the Form Collection Model Binder-Using the HTTP Posted File Base Model Binder-Creating a Custom Model Binder. Validating Form Data: Understanding the Model State - Pre Binding And Post Binding Validations- Validating With The Service Layer-Validating With IDataErrorInfo Interface-Testing Validation.	15	K4	4

V	Database Access: Creating the Unleashed Blog Project -Creating Our First Test-Creating New Blog Entries-Refactoring to Use the Repository Pattern. Understanding View Master pages and View User Controls: Understanding View Master pages - View User Controls. Working with ASP.NET4.5: Working with the OData protocol - New features in the .NET Framework 4.x - Introducing the new features in ASP.NET 4.5 -Working with the ASP.NET Web API.	15	K4	5

Books for Study

1. “Asp.Net MVC Framework”-Stephen Walther 2010- SAMS publications.
2. “ASP .Net Web API build RESTful Web Applications and Services on the .net Framework”- Joydip Kanjilal – 2013 –PACKT Publications.

Chapters

Book 1:

Unit – I: 1, 2
Unit – II : 3, 4
Unit – III: 5, 6
Unit – IV: 7, 8
Unit – V: 17, 10

Book 2:

Unit - V: 5.

Books for Reference

1. Visual Basic .NET and the .NET platform, An Advanced Guide” – Andrew Troelsen – 2002 – Apress,Berkeley Publications.
2. “Programming Visual Basic .NET” – Dave Grundgeiger - 2002 – O’Reilly Publishers.
3. “Teach Yourself Visual Basic .NET in 21 days” Duncan Mackenzie and Kent Sharkey – 2001- SAMS publications
4. “Introducing Microsoft .NET “ -David S. Platt — Microsoft Press, U.S. -2001.

Web Resources

1. [https://dotnet.microsoft.com/en-us/apps/aspnet/mvc`](https://dotnet.microsoft.com/en-us/apps/aspnet/mvc)
2. <https://archive.org/details/introducingmicro00plat>
3. <https://www.javatpoint.com/asp-net-mvc>
4. <https://dotnettutorials.net/course/asp-dot-net-mvc-tutorials>

Rationale for Nature of the course

Helps to develop GUI based applications and connect them to handle functions provided in the modules.

Activities on Knowledge and Skill

Practice to write programs, Framework creation and bug fixing.

Activities on Employability oriented

Practice to develop Mini projects on variety of applications using Frameworks.

Pedagogy

Chalk and talk, E-content, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction and Demonstration, Quiz

Course Designer(s) Name

1. Mr. M.Ashok Kumar
2. Mrs. S.Brindha

Lesson Plan

Unit	Topics	Hours	Mode
I	An Introduction to ASP.NET MVC: Software Design Principles - Software Design Patterns- Writing Unit Tests for Your Code – What is ASP.net MCV.	8	Chalk and talk
	The architecture of an ASP .Net MVC Application – Understanding the sample ASP.Net MVC Application. Building a Simple ASP.NET MVC Application: Starting with a Blank Slate -Creating the Database Creating the Model- Creating the Controller - Creating the Views.	7	Chalk and talk& Quiz, Group Discussion
II	Creating Controller-Returning Action Results-Controlling How Actions Are Invoked.	5	Chalk and talk& PPT
	Handling Unknown Actions-Testing Controllers and Actions. Understanding	5	Chalk and talk& Quiz
	Views: Creating A View-Using View Data-Typed And Untyped Views.	5	Chalk and talk
III	Understanding Models: Creating a Data Model.	5	Chalk and talk
	Understanding HTML Helpers: Using the Standard HTML Helpers.	5	Chalk and talk & Quiz
	Creating Custom HTML Helpers- Creating a Datagrid Helper.	5	Chalk and talk & Problem solving
IV	Using the Default Model Binder - Using the Bind Attribute - Using Bind with Classes-Using the Form Collection Model Binder.	5	Chalk and talk & Demonstration
	Using the HTTP Posted File Base Model Binder-Creating a Custom Model Binder.	5	Interaction & PPT
	Validating Form Data: Understanding the Model State - Pre Binding And Post Binding Validations- Validating With The Service Layer-Validating With IDataErrorInfo Interface-Testing Validation.	5	Chalk and talk & Quiz

V	Creating the Unleashed Blog Project -Creating Our First Test.	5	Chalk and talk
	Creating New Blog Entries-Refactoring to Use the Repository Pattern.	5	PPT& Assignment
	Understanding View Master pages and View User Controls: Understanding View Master pages - View User Controls.	5	Seminar & E-content

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLOs	Course Learning Outcomes	K - Levels
CLO 1	Discuss the concept to build ASP.NET MVC Applications.	Up to K2
CLO 2	Utilize the concept of Controllers and Actions.	Up to K3
CLO 3	Identify the Data Models and HTML Helpers.	Up to K3
CLO 4	Analyze the Model Binder and Validation techniques.	Up to K4
CLO 5	Classify the concept of Database access and understanding view Master pages and User controls.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	2	2	2	1	2	1
CLO 2	2	2	1	1	2	1
CLO 3	2	1	3	1	2	1
CLO 4	3	1	3	1	2	1
CLO 5	3	2	3	2	3	1

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Blue Print for the Formative Examination – Dot Net Programming
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K - Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1	2 (K1&K1)	2 (K2)
	CLO 2	Up to K3	3	K1	2 (K2&K2)	1 (K3)
CIA II	CLO 3	Up to K3	2	K2	2 (K3&K3)	2 (K3)
	CLO 4	Up to K4	3	K2	2 (K4&K4)	1 (K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		10		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

**Distribution of Section-wise Marks with
K – Levels***

K - Level	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	10	10	-	20	33.33	83
K2	-	10	20	30	50	
K3	-	-	10	10	16.67	17
K4	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	-	-	-	-	-	17
K2	10	-	-	10	16.67	
K3	-	10	20	30	50	50
K4	-	10	10	20	33.33	33
Total Marks	10	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Blue Print for the Summative Examination – Dot Net Programming
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

UNIT	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K-Level		
1	CLO1	Up to K2	2	K1& K1	1	K1	2 (K1&K1)	1 (K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2 (K2&K2)	1 (K3)
3	CLO3	Up to K3	2	K2 & K3	1	K2	2 (K3&K3)	1 (K3)
4	CLO4	Up to K4	2	K3& K4	1	K2	2 (K4&K4)	1 (K4)
5	CLO5	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analysing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K – Levels*

K – Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	10	-	16	13.34	13
K2	2	4	10	10	26	21.66	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
K5	-	-	-	-	-	-	-
Total Marks	10	10	50	50	120	100	100

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc .Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext	Total
IV	Major Core – 12	21P4DMC12	PHP Programming	4	5	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	✓

Course Content

- To know the basic concepts and functions.
- To impart the knowledge of OOPs concepts with arrays.
- To familiarize in regular expressions and exception handling mechanisms.
- To understand the designing of scripts using files, forms and database connectivity.
- To gain knowledge in Laravel Development Environment.

UNIT	CONTENT	Hrs	K-Level	CLO
I	PHP Basics: Embedding PHP Code in your Web Pages – Commenting your Code – Outputting Data to the Browser – PHP’s Supported Data Types – Identifiers – Variables – Constants – Expressions – String Interpolation – Control Structures. Functions: Invoking a function – Creating a function – Function Libraries.	15	K2	1
II	Arrays: Creating an Array – Outputting an array – Adding and Removing Array Elements – Locating Array Elements – Traversing Arrays – Determining Array size and Uniqueness – Sorting arrays – Merging, slicing, Splicing and Dissecting Arrays – Other useful Array functions. Object-Oriented PHP: The Benefits of OOP – Key OOP concepts – Constructors and Destructors – Static Class Members – Instance of Keyword.	15	K3	2
III	Advanced OOP Features: Object Cloning – Inheritance – Interfaces – Abstract Classes – Introducing Namespaces. Error and Exception Handling: Error Logging – Exception Handling. Strings and Regular Expressions: Regular Expressions-Other String-Specific Functions- Alternatives for Regular Expression Functions.	15	K3	3
IV	Working with Files – Working with HTML Forms: PHP and Web Forms – Validating Form Data. Handling File	15	K4	4

	Uploads: Uploading Files via HTTP - Uploading Files with PHP. Using PHP with MySQL: Interacting with the Database – Executing Database Transactions.			
V	Setting up the Laravel Development Environment: Local Development Environments – Creating a new Laravel project – Laravel’s directory structure – Configuration. Routing and controllers: Introduction to MVC, the HTTP verbs and REST – Route definition – Route groups – Signed Routes – Views – Controllers – Route model binding – Route caching.	15	K4	5

Books for Study

1. "Beginning PHP and MySQL", W. Jason Gilmore, Fourth edition, Springer publishers.
2. "Laravel: Up & Running A framework for building modern PHP Apps", Matt Stauffer, 2nd Edition 2019, O' Reilly Media.

Chapters

Book 1:

Unit I - 3, 4

Unit II - 5, 6

Unit III - 7 – 9

Unit IV - 10, 13, 15, 30

Book 2:

Unit V - 2, 3

Books for Reference

1. "PHP 5.1 for beginners", Ivan Bayross, Sharnam Shah, First edition, SPD publishers.
2. "Build your own database driven web site using PHP & MySQL", .Kevin Yank 2011, 4th edition, Sitepoint.
3. "Straight to the point PHP", Dinesh Maidasani, First edition, Firewall media.
4. "SAMS Teach yourself PHP4 in 24 hours", Matt Zandstra

Web Resources

1. <https://stackify.com/learn-php-tutorials/>
2. <https://www.arpattech.com/blog/top-20-websites-learn-php-programming/>
3. <https://medium.com/javarevisited/top-10-free-courses-to-learn-php-and-mysql-for-web-development-e96e69982675>
4. <https://tutorialspoint.com/laravel/laravelcontrollers.htm>

Rationale for Nature of the course

Helps to develop dynamic and interactive web sites.

Activities on Knowledge and Skill

Practice to write programs, bug fixing and dynamic web page creation.

Activities on Employability

Practice to write programs, bug fixing and dynamic web page creation.

Activities on Entrepreneurship

Web page development, web site maintenance.

Pedagogy

Chalk and talk, Materials, PPT, Assignment, Seminar, Group Discussion, Debugging and Demonstration.

Course Designers

1. Mrs. K. R. Ramadevi
2. Mrs. S. Rajalakshmi

Lesson Plan

Units	Topics to be Covered	Hrs	Mode
I	PHP Basics: Embedding PHP Code in your Web Pages – Commenting your Code – Outputting Data to the Browser – PHP's Supported Data Types – Identifiers – Variables – Constants – Expressions – String Interpolation – Control Structures. Functions: Invoking a function – Creating a function – Function Libraries.	9 6	Chalk and talk , Quiz Debugging and Demonstration.
II	Arrays: Creating an Array – Outputting an array – Adding and Removing Array Elements – Locating Array Elements – Traversing Arrays – Determining Array size and Uniqueness – Sorting arrays – Merging, slicing, Splicing and Dissecting Arrays – Other useful Array functions. Object-Oriented PHP: The Benefits of OOP – Key OOP concepts – Constructors and Destructors – Static Class Members – Instanceof Keyword.	9 6	Chalk and talk Quiz Debugging and Demonstration.
III	Advanced OOP Features: Object Cloning – Inheritance – Interfaces – Abstract Classes – Introducing Namespaces. Error and Exception Handling: Error Logging – Exception Handling. Strings and Regular Expressions: Regular Expressions-Other String-Specific Functions- Alternatives for Regular Expression Functions.	5 5 5	Chalk and talk, PPT, Group Discussion Quiz Debugging and Demonstration.
IV	Working with Files – Working with HTML Forms: PHP and Web Forms – Validating Form Data. Handling File Uploads: Uploading Files via HTTP - Uploading Files with PHP. Using PHP with MySQL: Interacting with the Database – Executing Database Transactions.	5 5 5	Chalk and talk, Quiz Debugging and Demonstration. Debugging and Demonstration.
V	Setting up the Laravel Development Environment: Local Development Environments – Creating a new Laravel project – Laravel's directory structure – Configuration. Routing and controllers: Introduction to MVC, the HTTP verbs and REST – Route definition – Route groups – Signed Routes – Views – Controllers – Route model binding – Route caching.	8 7	Chalk and talk PPT, Assignment Demonstration and Debugging.

COURSE LEARNING OUTCOMES:

On the completion of the course, the student will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Levels
CLO1	Describe basics and control statements and functions.	Up to K2
CLO2	Experiment with arrays and OOPS concepts.	Up to K3
CLO3	Construct program using exception handling, Regular expression.	Up to K3
CLO4	Focus on the concepts of file uploading, validating forms and database connectivity.	Up to K4
CLO-5	Devise projects with Laravel Development Environment.	Up to K4

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	1	1	2	1	1	2
CLO 2	2	2	1	1	2	2
CLO 3	3	2	2	2	1	1
CLO 4	1	3	2	3	2	2
CLO 5	2	3	3	3	2	3

(3– Advanced Application, 2– Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for PHP Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
CIA I	CLO 1	Up to K2	2	K1	2(K1&K1)	2(K2)
	CLO 2	Up to K3	3	K1	2(K2&K2)	1(K3)
CIA II	CLO 3	Up to K3	2	K2	2(K3&K3)	2(K3)
	CLO 4	Up to K4	3	K2	2(K4&K4)	1(K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		10		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	10	10	-	20	33.33	83
K2	-	10	20	30	50	
K3	-	-	10	10	16.67	17
K4	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100
K Levels	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated%
K1	-	-	-	-	-	17
K2	10	-	-	10	16.67	
K3	-	10	20	30	50	50
K4	-	10	10	20	33.33	33
Total Marks	10	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative - Blue Print – Model for PHP Programming
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

UNITS	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No of Questions	K - Level	No of Questions	K - Level		
1	CLO1	Up to K2	2	K1& K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
3	CLO3	Up to K3	2	K2 & K3	1	K2	2(K3&K3)	1(K3)
4	CLO4	Up to K4	2	K3 & K4	1	K2	2(K4&K4)	1(K4)
5	CLO5	Up to K4	2	K3 & K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
K5	-	-	-	-	-	-	-
Total Marks	10	10	50	50	120	100	100

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Elective - 3	21P4DME3	CLOUD COMPUTING	4	6	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To impart the knowledge on basic concepts of Cloud models.
- To learn various technologies and security issues.
- To acquire knowledge in preliminary and cost metrics.
- To understand virtualization techniques and end user accessing ways.
- To be familiar with various services and future trends.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Understanding Cloud Computing: Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges. Fundamental Concepts and Models - Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models.	18	K2	1
II	Cloud-Enabling Technology - Broadband Networks and Internet Architecture - Data Center Technology - Virtualization Technology - Web Technology – Multitenant technology. Fundamental Cloud Security: Basic Terms and Concepts - Threat Agents - Cloud Security Threats.	18	K3	2
III	Fundamental Cloud Architectures -Workload Distribution Architecture - Resource Pooling Architecture - Dynamic Scalability Architecture - Elastic Resource Capacity Architecture- Service Load Balancing Architecture - Cloud Bursting Architecture - Elastic Disk Provisioning Architecture - Redundant Storage Architecture. Cloud Delivery Model Considerations: Cloud Delivery Models: The Cloud Provider – The Cloud Consumer. Cost Metrics and Pricing Models: Cloud Usage Cost Metrics.	18	K4	3
IV	Virtualization Practicum: Downloading Sun xVM VirtualBox – Installing Sun xVM VirtualBox – Adding a Guest Operating System to VirtualBox – Downloading FreeDOS as a Guest OS – Downloaing the 7-Zip Archive Tool – Adding Guest OS to Sun xVM VirtualBox.	18	K3	4

	Common Standards in Cloud Computing: Standards for Application Developers - Standards for Messaging - Standards for Security - End-User Access to Cloud Computing: You tube – You tube API overview – Zimbra – Facebook – Zoho-DimDim collaborations.			
V	Microsoft Cloud services: Windows Azure platform. Google Cloud applications: Google applications utilizing Cloud – Google app engine. Amazon Cloud services: Understanding Amazon Web components and services – Elastic compute Cloud – Amazon storage system – Amazon database services. Future Trends: Future Trends of Cloud Computing – A survey – Ten emerging future trends in Cloud computing – Next generation networking – Next generation services.	18	K4	5

Books for Study

1. “Cloud Computing: Concepts, Technology & Architecture” - Thomas Fri, Ricardo Puttini, ZaighamMahmood, PHI,2013.
2. “Cloud Computing: Implementation, Management and Security”- John W. Rittinghouse,JamesF.Ransome, CRC Press2009.
3. Cloud Computing – A Practical Approach for Learning and Implementation”, A. Srinivasan and J. Suresh, Pearson India Publications, 2014.

Chapters

Book 1

Unit I- 3, 4
Unit II – 5, 6
Unit III – 11,14,15

Book 2

Unit IV – 4, 7, 8

Book 3

Unit V – 29, 30, 31, 33

Books for Reference

1. “Distributed and Cloud Computing From Parallel Processing to the Internet of Things” - Ai Hwang. Geoffrey C.Fox, Jack J. Dongarra, Elsevier,2012.
2. “Cloud Computing: Principles and Paradigms” - RajkumarBuyya, James Broberg and Andrzej M. Goscinski,(Wiley Series on Parallel and Distributed Computing), Wiley Publishing©2011.
3. “Cloud Computing” - A Practical Approach, Toby Velte, Anthony Velte, Robert Elsenpeter, MCH, 2017.

Web Resources

1. <https://www.javatpoint.com/cloud-service-models>
2. https://patterns.arcitura.com/cloud-computing-patterns/compound_patterns/cloud_balancing
3. <https://www.oreilly.com/library/view/cloud-computing-concepts/9780133387568/ch15.xhtml>
4. <https://stefanini.com/en/trends/news/what-is-end-user-computing>

Rationale for Nature of the course

More flexible resource allocation on demand with the promise of realizing elastic, Internet-accessible, computing on a pay-as-you-go basis.

Activities on Knowledge and Skill

Give practice to write Assignments, conduct Group Discussions.

Pedagogy

Chalk and talk, Materials, PPT, Assignment, Seminar, Group Discussion and Quiz.

Lesson Plan

UNIT	Topics to be Covered	Hours	Mode
I	Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges.	9	Chalk and Talk
	Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models.	9	Chalk and Talk, PPT, Quiz
II	Broadband Networks and Internet Architecture - Data Center Technology - Virtualization Technology.	6	Chalk and Talk
	Web Technology – Multitenant technology - Service Technology.	6	Chalk and Talk, Group Discussion
	Basic Terms and Concepts - Threat Agents - Cloud Security Threats.	6	PPT, Quiz
III	Workload Distribution Architecture - Resource Pooling Architecture - Dynamic Scalability Architecture - Elastic Resource Capacity Architecture- Service Load Balancing Architecture.	6	Chalk and Talk, Material
	Cloud Bursting Architecture - Elastic Disk Provisioning Architecture - Redundant Storage Architecture.	6	Chalk and Talk, PPT, Quiz
	Cloud Delivery Models: The Cloud Provider – The Cloud Consumer. Cloud Usage Cost Metrics.	9	Chalk and Talk, PPT
IV	Downloading Sun xVM VirtualBox – Installing Sun xVM VirtualBox – Adding a Guest Operating System to VirtualBox – Downloading FreeDOS as a Guest OS – Downloaing the 7-Zip Archive Tool – Adding Guest OS to Sun xVM VirtualBox.	6	Chalk and Talk, Group Discussion
		6	PPT, Quiz

	Standards for Application Developers - Standards for Messaging - Standards for Security You tube – You tube API overview – Zimbra – Facebook – Zoho- DimDim collaborations.	6	Chalk and Talk, Group Discussion
V	Windows Azure platform. Google applications utilizing Cloud – Google app engine.	6	Chalk and Talk, PPT
	Understanding Amazon Web components and services – Elastic compute Cloud – Amazon storage system – Amazon database services.	6	Assignment, Seminar
	Future Trends of Cloud Computing – A survey – Ten emerging future trends in Cloud computing – Next generation networking – Next generation services.	6	Chalk and Talk, Group Discussion

Course Designer(s) Name

3. Mrs. S.Rajalakshmi

4. Mrs. K. Imaya

Course Learning Outcomes

On the completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Level
CLO 1	Describe the nature of Cloud models.	Up to K2
CLO 2	Make use of various technologies in Cloud applications.	Up to K3
CLO 3	Focus on various Cloud architectures.	Up to K4
CLO 4	Identify various standards used to access by the end user.	Up to K3
CLO 5	Compare various services provided different organizations.	Up to K4

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	2	1	2	2	2	1
CLO 2	2	2	3	3	2	3
CLO 3	2	2	3	3	2	2
CLO 4	2	2	3	3	2	2
CLO 5	2	2	1	2	2	1

(3– Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Cloud Computing
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
CIA I	CLO 1	Up to K2	3	K1	2(K1&K1)	2(K2)
	CLO 2	Up to K3	2	K2	2(K3&K3)	1(K3)
CIA II	CLO 3	Up to K4	2	K2	2(K4&K4)	1(K4)
	CLO 4	Up to K3	3	K1	2(K2&K2)	2(K3)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		10		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	26.67	67
K2	4	-	20	24	40	
K3	-	10	10	20	33.33	33
K4	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100
K Levels	Section A (No Choice)	SectionB (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	6	-	-	6	10	34
K2	4	10	-	14	23.33	
K3	-	-	20	20	33.33	33
K4	-	10	10	20	33.33	33
Total Marks	10	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative -Blue Print – Model for Cloud Computing
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No of Questions	K -Level	No of Questions	K - Level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K2 & K3	1	K2	2(K3&K3)	1(K3)
3	CLO 3	Up to K4	2	K3 & K4	1	K2	2(K4&K4)	1(K4)
4	CLO 4	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
5	CLO 5	Up to K4	2	K3 & K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30.00	30
K4	2	-	20	20	42	35	35
Total Marks	10	10	50	50	120	100	100

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	EXT	Total
III	Elective - 3	21P4DME3	Mobile Computing	4	6	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the Mobile Computing Architecture.
- To impart the knowledge in GSM and GPRS.
- To familiarize with wireless application protocol.
- To gain knowledge in client programming and palm OS.
- To make them aware of 5G Technology.

UNIT	CONTENT	Hrs	K-Level	CLO
I	Introduction: Mobility of Bits and Bytes – Wireless-The Beginning – Mobile Computing – Dialogue control – Networks - Middleware and Gateways – Applications and Services – Developing Mobile Computing Applications – Security in Mobile Computing – Standards-Why are they Necessary? - Standard Bodies – Players in the wireless space. Mobile Computing Architecture: Architecture for Mobile Computing – Three Tire Architecture. Emerging Technologies: Bluetooth – Radio Frequency Identification (RFID) – Wireless Broadband (Wimax) – Mobile IP – Internet Protocol Version 6 (IPv6).	18	K2	1
II	Global System for Mobile Communications (GSM): Global System for mobile communications – GSM Architecture – GSM Entities – Call Routing in GSM. Short Message Service (SMS): Mobile Computing over SMS – Short Message Service - Value added service through SMS. General Packet Radio Service: Introduction - GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations – Data Services in GPRS – Applications in GPRS – Limitations of GPRS.	18	K3	2
III	Wireless Application Protocol (WAP): Introduction - WAP – MMS – GPRS Application. CDMA and 3G: Introduction – CDMA versus GSM - Third Generation Networks – Application on 3G. Wireless LAN: Wireless LAN Advantages – IEEE802.11 Standards – Wireless LAN Architecture – Mobility in wireless LAN – Deploying Wireless LAN – Mobile Ad hoc networks and sensor networks.	18	K3	3

IV	Programming for the Palm OS: Palm OS Architecture – Application Development – Communication in Palm OS. Voice over Internet protocol and convergence: Voice over IP – H.323 framework for voice over IP – Session initiation protocol – comparison between H.323 and SIP – Real-time protocols – Convergence technologies – Call routing – Voice over IP applications – IP multimedia subsystem – Mobile VoIP – Voice over wireless LAN.	18	K4	4
V	The 5G Internet: Internet of Things and Context-Awareness – Networking Reconfiguration and virtualization Support – Mobility – Quality of Service Control. Mobile Clouds: Technology and Services for Future Communication Platforms: The Mobile Cloud – Mobile Cloud Enablers – Network Coding. Cognitive Radio for 5G Wireless Networks: Spectrum Optimisation using Cognitive Radio – Relevant Spectrum Optimisation Literature in 5G – Cognitive Radio and Carrier Aggregation.	18	K4	5

Books for Study

1. “Mobile Computing Technology, Application and Services Creation” - Asoke.K.Talukder, Roopa.R.Yavagal, Hasan Ahmed, Tata McGraw Hill Publishing Company, 2011, Second Edition.
2. Fundamentals of 5G Mobile Networks Edited by Jonathan Rodriguez – Wiley.

Chapters

Book 1:

Unit I: 1, 2.4, 2.5, 4.2 - 4.6.
Unit II: 5.1 - 5.4, 6.1 - 6.3, 7.1 – 7.7.
Unit III: 8, 9.1, 9.4, 9.6, 10.1 - 10.7
Unit IV: 13.3 - 13.5, 17

Book 2:

Unit V: 2.1 – 2.5, 5.2 – 5.4, 6.3 – 6.5

Books for Reference

1. “Mobile Computing Theory and Practice” – Kumkum Garg , Pearson Education 2010.
2. “Mobile Computing” - Sipra Dasbit, Biplab K Sikdar – PHI Learning Eastern Economy Edition, 2009.
3. “Advances and applications in Mobile Computing “ – Idem Karahoca , Intech publishers

Web Resources

1. <https://www.ibm.com/in-en/cloud/learn/three-tier-architecture>
2. <https://en.wikipedia.org/wiki/GSM>
3. https://www.tutorialspoint.com/wap/wap_introduction.html
4. https://www.tutorialspoint.com/mobile_computing/mobile_computing_security_issues.html

Rationale for Nature of the course

Ability to get directions, entertainment, do business and including connectivity, social engagement and personalization.

Activities on Knowledge and Skill Development

Give practice to write Assignments, conduct Group Discussions.

Pedagogy

Chalk and talk, Materials, PPT, Assignment, Seminar, Group discussion, Interaction, Quiz.

Course Designer(s) Name

1. Mr. N. Radhakrishnan
2. Mrs. S.Brindha

Lesson Plan

Unit	Topics	Hours	Mode
I	Introduction: Mobility of Bits and Bytes – Wireless-The Beginning – Mobile Computing – Networks- Middleware and Gateways – Applications and Services – Developing Mobile Computing Application – Security in Mobile Computing - Standard Bodies.	6	Chalk and talk
	Mobile Computing Architecture: Architecture for Mobile Computing – Three Tire Architecture.	6	Chalk and talk & Quiz
	Emerging Technologies: Bluetooth – Radio Frequency Identification (RFID) – Wireless Broadband (Wimax) – Mobile IP – Internet Protocol Version 6 (IPv6).	6	Chalk and talk& GD
II	Global System for Mobile Communications (GSM): Global System for mobile communications – GSM Architecture – GSM Entities – Call Routing in GSM.	6	Chalk and talk
	Short Message Service (SMS): Mobile Computing over SMS – Value added service through SMS.	6	Chalk and talk & Quiz
	General Packet Radio Service: Introduction - GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operation – Data Services in GPRS – Application in GPRS – Limitations of GPRS – Billing and Charging in GPRS - Enhanced Data Rates for GSM Evolution (EDGE).	6	Chalk and talk& GD
III	Wireless Application Protocol (WAP): Introduction - WAP – MMS – GPRS Application.	6	Chalk and talk
	CDMA and 3G: Introduction – CDMA verse GSM - Third Generation Networks – Application on 3G.	6	Chalk and talk & QUIZ
	Wireless LAN: Wireless LAN Advantages – IEEE802.11 Standards – Wireless LAN Architecture.	6	PPT& GD
IV	Client Programming: Introduction – Moving Beyond the Desktop – A Peek Under the Hood: Hardware Overview – Mobile Phones .	6	Chalk and talk, Material
	Features of Mobile Phones – PDA – Design Constraints in Application for Handle Held Devices.	6	Chalk and talk,

	Programming for the Palm OS: Palm OS Architecture – Application Development – Communication in Palm OS. Wireless Devices with Windows CE: Windows CE Architecture.	6	Quiz Chalk and talk& GD
V	The 5G Internet: Internet of Things and Context-Awareness – Networking Reconfiguration and virtualization Support – Mobility – Quality of Service Control.	6	Interaction
	Mobile Clouds: Technology and Services for Future Communication Platforms: The Mobile Cloud – Mobile Cloud Enablers – Network Coding.	6	PPT, Seminar
	Cognitive Radio for 5G Wireless Networks: Spectrum Optimisation using Cognitive Radio – Relevant Spectrum Optimisation Literature in 5G – Cognitive Radio and Carrier Aggregation.	6	Chalk and talk, Assignment

Course Learning Outcomes

On the successful completion of the course, the students will be able to

CLOs	Course Learning Outcomes	K - Levels
CLO 1	Discuss on the Mobile computing architecture and its emerging trends.	Up to K2
CLO 2	Determine the concept of GSM and GPRS.	Up to K3
CLO 3	Identify the wireless application protocol, CDMA and Wireless LAN.	Up to K3
CLO 4	Analyze the client programming, Palm OS and windows CE architecture.	Up to K4
CLO 5	Focus on the concept of 5G technology.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	2	1	2	2	2	1
CLO 2	2	2	3	3	2	3
CLO 3	2	2	3	3	2	2
CLO 4	2	2	3	3	2	2
CLO 5	2	2	1	2	2	1

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative- Blue Print – Model for Mobile Computing
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

Internal	CLOs	K - Level	SectionA		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K - Level		
CIA I	CLO 1	Up to K2	2	K1	2 (K1&K1)	2 (K2)
	CLO 2	Up to K3	3	K1	2 (K2&K2)	1 (K3)
CIA II	CLO 3	Up to K3	2	K2	2 (K3&K3)	2 (K3)
	CLO 4	Up to K4	3	K2	2 (K4&K4)	1 (K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		10		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K – Levels*

K - Level	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	10	10	-	20	33.33	83
K2	-	10	20	30	50	
K3	-	-	10	10	16.67	17
K4	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100
K - Level	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	-	-	-	-	-	17
K2	10	-	-	10	16.67	
K3	-	10	20	30	50	50
K4	-	10	10	20	33.33	33
Total Marks	10	20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)
Summative- Blue Print – Model for Mobile Computing
Articulation Mapping - K – Levels with Course Learning Outcomes (CLOs)

UNIT	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K - Level	No. of Questions	K- Level		
1	CLO1	Up to K2	2	K1& K1	1	K1	2 (K1&K1)	1 (K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2 (K2&K2)	1 (K3)
3	CLO3	Up to K3	2	K2 & K3	1	K2	2 (K3&K3)	1 (K3)
4	CLO4	Up to K4	2	K3& K4	1	K2	2 (K4&K4)	1 (K4)
5	CLO5	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analysing, presentation and make inferences with evidences
- K5 – Ability to integrate ideas from one situation to newer situations.

K – Level	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
K5	-	-	-	-	-	-	-
Total Marks	10	10	50	50	120	100	100

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Elective - 3	21P4DME3	BLOCK CHAIN TECHNOLOGY	4	6	25	75	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

1. To impart knowledge on types, benefits and limitations of Blockchain.
2. To learn concepts of decentralization and cryptography concepts.
3. To acquire knowledge in bitcoin features and its alternative options.
4. To describe and deploy smart contracts and Ethereum.
5. To understand the blockchain features outside of currencies.

Course Content

Unit	Content	Hrs	K-Level	CLO
I	Blockchain 101: Distributed systems - History of blockchain - Introduction to blockchain - Types of blockchain - CAP theorem and blockchain - Benefits and limitations of blockchain.	18	K2	1
II	Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization - Decentralized organizations – Platforms for decentralization. Cryptography and Technical Foundations: Cryptographic primitives - Asymmetric cryptography - Public and private keys.	18	K3	2
III	Bitcoin: Bitcoin – Transactions – Blockchain - Bitcoin payments. Alternative Coins: Theoretical foundations - Bitcoin limitations - Namecoin - Litecoin – Primecoin – Zcash.	18	K3	3
IV	Smart Contracts: Definition - Ricardian contracts - Ethereum 101: Introduction – Ethereum blockchain - Elements of the Ethereum blockchain - Precompiled contracts.	18	K4	4
V	Alternative Blockchains: Blockchains – Platforms. Blockchain-Outside of Currencies: Internet of Things - Government - Health - Finance - Media.	18	K4	5

Book for Study

Mastering Blockchain - Imran Bashir, Packt Publishing Ltd, Second Edition, 2017

Chapters

Unit I: 1

Unit II: 2 & 3(Till Page No.105)

Unit III: 4 & 5

Unit IV: 6 & 7(Till Page No.235)

Unit V: 10 & 11

Books for Reference

1. Bitcoin and Cryptocurrency Technologies: a comprehensive introduction - Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016
2. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress, First Edition, 2017
3. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

Web Resources

1. <https://scet.berkeley.edu/wp-content/uploads/BlockchainPaper.pdf>
2. <https://blockchain.cse.iitk.ac.in/slides-NPTEL-BlockchainTechnologyApplications.pdf>
3. <https://www.federalreserve.gov/econresdata/feds/2014/files/2014104pap.pdf>
4. <https://eprint.iacr.org/2015/460.pdf>

Rationale for Nature of the course

Helps in the verification and traceability of multistep transactions. It can also provide secure transactions, reduce compliance costs, and speed up data transfer processing.

Activities on Knowledge and Skill & Employability Oriented

By having group discussions and interactive session at regular basis on cryptography concepts and deploying a model of smart contracts.

Pedagogy

Chalk and talk, Materials, PowerPoint Presentations, Assignment, Seminar, Group Discussion, and Quiz.

Lesson Plan

UNIT	Topics to be Covered	Hours	Mode
I	Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain	9	Chalk and Talk
	CAP theorem and blockchain, Benefits and limitations of blockchain.	9	Chalk and Talk, PPT, Quiz
II	Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations – Platforms for decentralization	9	Chalk and Talk Chalk and Talk,

	Cryptographic primitives, Asymmetric cryptography, Public and private keys.	9	Group Discussion PPT, Quiz
III	Bitcoin, Transactions, Blockchain, Bitcoin payments Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash.	9	Chalk and Talk, PPT
		9	Chalk and Talk, Quiz
IV	Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.	9	Chalk and Talk, Group Discussion
		9	PPT, Quiz
V	Alternative Blockchains: Blockchains – Platforms Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media.	8	Chalk and Talk
		10	Assignment , Seminar

Course Designer(s) Name

1. Mr. K. RajaSaravanaKumar
2. Mr. M. AshokKumar

Course Learning Outcomes

On the completion of the course, the students will be able to

CLOs	COURSE LEARNING OUTCOMES	K - Level
CLO 1	Describe the types, benefits and limitations of Blockchain	Up to K2
CLO 2	Make use of decentralization and cryptography concepts.	Up to K3
CLO 3	Identity the bitcoin features and its alternative options.	Up to K3
CLO 4	Illustrate and deploy smart contracts and Ethereum.	Up to K4
CLO 5	Focus on the significance of the blockchain features outside of currencies	Up to K4

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	2	1	2	2	2	1
CLO 2	2	2	3	3	2	3
CLO 3	2	2	3	3	2	2
CLO 4	2	2	3	3	2	2
CLO 5	2	2	1	2	2	1

(3– Advanced Application, 2 – Intermediate Level, 1- Basic Level)

Learning Outcome Based Education & Assessment (LOBE)
Formative - Blue Print – Model for Block Chain Technology
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Internal	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
CIA I	CLO 1	Up to K2	2	K1	2(K1&K1)	2(K2)
	CLO 2	Up to K3	3	K1	2(K2&K2)	1(K3)
CIA II	CLO 3	Up to K3	2	K2	2(K3&K3)	2(K3)
	CLO 4	Up to K4	3	K2	2(K4&K4)	1(K4)
Question Pattern (CIA I & II)	No. of Questions to be asked		5		4	3
	No. of Questions to be answered		5		2	2
	Marks for each question		2		5	10
	Total Marks for each section		10		10	20

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels *

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	10	10	-	20	33.33	83
K2	-	10	20	30	50	
K3	-		10	10	16.67	17
K4	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100
K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1		-	-	-	-	17
K2	10		-	10	16.67	
K3		10	20	30	50	50
K4		10	10	20	33.33	33
Total Marks		20	30	60	100	100

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Model for Block Chain Technology Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No of Questions	K -Level	No of Questions	K - Level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K2 & K3	1	K2	2(K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K3 & K4	1	K2	2(K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K3 & K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

Distribution of Section – wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
Total Marks	10	10	50	50	120	100	100

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	EXT	Total
IV	Major Core Practical -7	21P4DMP7	Dot Net Programming Lab	2	4	40	60	100

Nature of the Course			
Knowledge and skill	✓	Employability oriented	✓
Skill oriented		Entrepreneurship oriented	

Course Objectives

- To understand the fundamentals of MVC.
- To learn the various Controllers and Actions.
- To impart the knowledge of Data models.
- To be familiar with the Model Binder and its Validations.
- To learn and create the application using Database access

Course Content

UNIT	CONTENT	Hrs	K-Level	CLO
I	1. Program for the creation of Sample MVC Application. 2. To create a website using ad rotator control to add the script manager, timer, ad rotator control form toolbox. 3. Demonstrate the validation controls in ASP.NET	12	K2	1
II	4. Accessing Your Model's Data from a Controllers 5. Program for creating a View using ASP.Net 6. Program for handling the unknown actions.	12	K3	2
III	7. Create a user control that contains a list of colors. Add a button to the Web Form which when clicked changes the color of the Form to the color selected from the list. 8. Write a program to display three images in a line. When any one of the images is clicked, it must be displayed below. 9. Create a user control that displays the current date and time. Include it in a Web Form and refresh it each time a button is clicked.	12	K3	3

IV	10. Program for creating the custom model binder 11. Program for Pre binding and post binding validations 12. Program for validating the IDataErrorInfo Interface	12	K4	4
V	13. Write a program to connect to the master database in SQL Server, in the Page_Load event. When the connection is established, the message “Connection has been established” should be displayed in a label in the form. 14. Select the names of the employees from the emps table. Retrieve the result in a DataSet and display it in a CheckBoxList. 15. Bind a CheckBoxList to the pname field of the product table in the master database so that all the name of the product are displayed as a series of checkboxes.	12	K4	5

Book for Study

Stephen Walther -” Asp.Net MVC Framework”-2010- SAMS publications.

Books for Reference

1. Visual Basic .NET and the .NET platform, An Advanced Guide” – Andrew Troelsen – 2002 – Apress,Berkeley Publications.
2. “Programming Visual Basic .NET” – Dave Grundgeiger - 2002 – O’Reilly Publishers.
3. “Teach Yourself Visual Basic .NET in 21 days” Duncan Mackenzie and Kent Sharkey – 2001- SAMS publications
4. “Introducing Microsoft .NET “ -David S. Platt — Microsoft Press,U.S. -2001

Web Resources

1. [https://dotnet.microsoft.com/en-us/apps/aspnet/mvc`](https://dotnet.microsoft.com/en-us/apps/aspnet/mvc)
2. <https://archive.org/details/introducingmicro00plat>
3. <https://www.javatpoint.com/asp-net-mvc>
4. <https://dotnnettutorials.net/course/asp-dot-net-mvc-tutorials>

Rationale for Nature of the course

Helps to develop GUI based applications and connect them to handle functions provided in the modules.

Activities on Knowledge and Skill

Practice to write programs, Framework creation and bug fixing.

Activities on Employability oriented

Practice to develop Mini projects on variety of applications using Frameworks.

Pedagogy

Chalk and talk, E-content, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction and Demonstration, Quiz

Course Designer(s) Name

1. Mr. M.Ashok Kumar
2. Mrs.S.Brindha

Lesson Plan

Unit	Topics	Hours	Mode
I	1. Program for the creation of Sample MVC Application. 2. To create a website using ad rotator control to add the script manager, timer, ad rotator control form toolbox. 3. Demonstrate the validation controls in ASP.NET	12	Demo & Practical Session
II	4. Accessing Your Model's Data from a Controllers 5. Program for creating a View using ASP.Net 6. Program for handling the unknown actions.	12	Demo & Practical Session
III	7. Create a user control that contains a list of colors. Add a button to the Web Form which when clicked changes the color of the Form to the color selected from the list. 8. Write a program to display three images in a line. When any one of the images is clicked, it must be displayed below. 9. Create a user control that displays the current date and time. Include it in a Web Form and refresh it each time a button is clicked.	12	Demo & Practical Session
IV	10. Program for creating the custom model binder 11. Program for Pre binding and post binding validations 12. Program for validating the IDataErrorInfo Interface	12	Demo & Practical Session
V	13. Write a program to connect to the master database in SQL Server, in the PageLoad event. When the connection is established, the message "Connection has been established" should be displayed in a label in the form. 14. Select the names of the employees from the emps table. Retrieve the result in a Data Set and display it in a CheckBoxList. 15. Bind a CheckBoxList to the pname field of the product table in the master database so that all the name of the product are displayed as a series of checkboxes.	12	Demo & Practical Session

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLOs	Course Learning Outcomes	K - Levels
CLO 1	Discuss the concept to build ASP.NET MVC Applications.	Up to K2
CLO 2	Utilize the concept of Controllers and Actions.	Up to K3
CLO 3	Identify the Data Models and HTML Helpers.	Up to K3
CLO 4	Analyze the Model Binder and Validation techniques.	Up to K4
CLO 5	Classify the concept of Database access and understanding view Master pages and User controls.	Up to K4

Mapping of CLOs with POs

CLOs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	2	2	2	1	2	1
CLO 2	2	2	1	1	2	1
CLO 3	2	1	3	1	2	1
CLO 4	3	1	3	1	2	1
CLO 5	3	2	3	2	3	1

(3 – Advanced Application, 2 – Intermediate Level, 1- Basic Level)

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.Sc. Computer Science				
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	EXT	Total
IV	Major Core- Practical-8	21P4DMP8	PHP Lab	2	4	40	60	100

Nature of the Course			
Knowledge and Skill	✓	Employability Oriented	✓
Skill oriented		Entrepreneurship Oriented	✓

Course Objectives

- To know the basic concepts and functions.
- To impart the knowledge of OOPs concepts with arrays.
- To familiarize in regular expressions and exception handling mechanisms.
- To understand the designing of scripts using files, forms and database connectivity.
- To gain knowledge in Laravel Development Environment.

Course Content

UNIT	CONTENT	HRS	K-LEVEL	CLO
I	1. Write a program in PHP to display current date and change background color based on day of the week using if else statements. 2. Write a program in PHP which writes the given number in words. 3. Write a program in PHP to display payment schedule for the loan amount in table format. 4. Write a simple program in PHP for i) generating Prime number ii) generate Fibonacci series 5. Write a PHP program to display the content of the text file.	9	K2	1
II	6. Write a PHP program to create array of Indian states and capitals. Perform the following operations: Add, Remove, search and traverse. 7. Write a program in PHP for processing a simple form (use controls like textbox, checkbox, radio buttons and options). 8. Write a PHP program to create a class employee, display the in time and out time. 9. Write a PHP program to create a class Book assign values using constructor and display the same.	9	K3	2

	10. Write a PHP program to calculate the number of visitors visiting the site and display the same.			
III	11. Write a PHP program to implement object cloning. 12. Write a PHP program to implement inheritance. 13. Write a PHP program to validate email address, raise exception if the mail id invalid. 14. Write a PHP program to manipulate strings.	9	K3	3
IV	15. Write a PHP program to manipulate the file and display the last opening and closing of file. 16. Write a PHP to process a CSV file containing student's data. 17. Write a program in PHP for setting and retrieving a cookie. 18. Write a program in PHP to upload file using form control. 19. Write a program in PHP to add, update and delete using student database.	9	K4	4
V	20. Write a program to create controller in Laravel to perform CRUD operations. 21. Write a program to implement routes in controllers using Laravel.	9	K4	5

Books for Study

1” Beginning PHP and Mysql”, W.Jason Gilmore, Fourth edition, Springer publishers.

2“Laravel Up & Running A framework for building modern PHP Apps”, Matt Stauffer, 2nd Edition 2019, O’ Reilly Media.

Chapters

Book 1:

Unit I - 3, 4

Unit II - 5, 6

Unit III - 7 – 9

Unit IV - 10, 13, 15, 30

Book 2:

Unit V - 2, 3

Books for Reference

1. “PHP 5.1 for beginners”, Ivan Bayross, Sharnam Shah, First edition, SPD publishers.
2. ” Build your own database driven web site using PHP & MySQL”, Kevin Yank 2011, 4th edition, Sitepoint.
3. “Straight to the point PHP”, Dinesh Maidasani, First edition, Firewall media.
4. ” SAMS Teach yourself PHP4 in 24 hours”, Matt Zandstra

eb Resources

1. <https://stackify.com/learn-php-tutorials/>
2. <https://www.arpatech.com/blog/top-20-websites-learn-php-programming/>
3. <https://medium.com/javarevisited/top-10-free-courses-to-learn-php-and-mysql-for-web-development-e96e69982675>
4. <https://tutorialspoint.com/laravel/laravelcontrollers.htm>

Rationale for Nature of the course

Helps to develop dynamic and interactive web sites.

Activities on Knowledge and Skill

Practice to write programs, bug fixing and dynamic web page creation.

Activities on Employability

Practice to write programs, bug fixing and dynamic web page creation.

Activities on Entrepreneurship

Web page development, web site maintenance.

Pedagogy

Chalk and talk, Materials, PPT, Assignment, Seminar, Group Discussion, Debugging and Demonstration.

Course Designers Name

3. Mrs. K.R.Ramadevi
4. Mrs.S.Rajalakshmi

Lesson Plan

Unit	Topics	Hours	Mode
I	1. Write a program in PHP to display current date and change background color based on day of the week using if else statements. 2. Write a program in PHP which writes the given number in words. 3. Write a program in PHP to display payment schedule for the loan amount in table format. 4. Write a simple program in PHP for i) generating Prime number ii) generate Fibonacci series 5. Write a PHP program to display the content of the text file.	12	Demo & Practical Session
II	6. Write a PHP program to create array of Indian states and capitals. Perform the following operations: Add, Remove, search and traverse. 7. Write a program in PHP for processing a simple form (use controls like textbox, checkbox, radio buttons and options). 8. Write a PHP program to create a class employee, display the in time and out time. 9. Write a PHP program to create a class Book assign values using constructor and display the same. 10. Write a PHP program to calculate the number of visitors visiting the site and display the same.	12	Demo & Practical Session
III	11. Write a PHP program to implement object cloning. 12. Write a PHP program to implement inheritance. 13. Write a PHP program to validate email address, raise exception if the mail id invalid. 14. Write a PHP program to manipulate strings.	12	Demo & Practical Session
IV	15. Write a PHP program to manipulate the file and display the last opening and closing of file. 16. Write a PHP to process a CSV file containing student's data. 17. Write a program in PHP for setting and retrieving a cookie. 18. Write a program in PHP to upload file using form control. 19. Write a program in PHP to add, update and delete using student database.	12	Demo & Practical Session
V	20. Write a program to create controller in Laravel to perform CRUD operations. 21. Write a program to implement routes in controllers using Laravel.	12	Demo & Practical Session

COURSE LEARNING OUTCOMES:**On the completion of the course the student will be able to**

CLOs	COURSE LEARNING OUTCOMES	K - Levels
CLO1	Describe basics and control statements and functions.	Up to K2
CLO2	Experiment with arrays and OOPS concepts.	Up to K3
CLO3	Construct program using exception handling, Regular expression.	Up to K3
CLO4	Focus on the concepts of file uploading, validating forms and databases connectivity.	Up to K4
CLO-5	Devise projects with Laravel Development Environment.	Up to K4

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	1	1	2	1	1	2
CLO 2	2	2	1	1	2	2
CLO 3	3	2	2	2	1	1
CLO 4	1	3	2	3	2	2
CLO 5	2	3	3	3	2	3

(3– Advanced Application, 2– Intermediate Level, 1- Basic Level)

PG DEPARTMENT OF COMPUTER SCIENCE				CLASS: II M.SC (Computer Science)				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Project	21P4DMPR	Project & Viva-voce	6	0	60	40	100

Nature of the Course			
Knowledge and skill		Employability oriented	✓
Skill oriented	✓	Entrepreneurship oriented	✓

Course Objectives

- Work with others and on one's own to pursue a goal.
- Increase, develop and apply computer knowledge.
- Gain project management skill and get experience at meeting deadlines.
- Apply all the concepts studied in the curriculum.
- Decide and agree with peers what work moves all toward a goal.

During the sixth semester, students shall undertake a project and submit the Project Report on the Platforms like the following.

Front Ends	Back Ends
Visual Basic • VB is an event driven and component integrated programming language, make it suitable to develop user friendly projects. • The VB-IDE has been highly optimized to support rapid application development • VB features provide graphical, integrated data access to any ODBC or OLE DB data source. Java • Java is a fully object-oriented language and platform-independent. • It can be used to transfer and execution of programs by remote computers on the local machines through the internet. • Java supports multithreaded programming, Exception handling, Swings and Servlets- make it suitable for typical project requirements PHP • PHP is an open-source, interpreted, and object-oriented scripting language that can be executed at the server-side.	Microsoft Access • MS Access is a relational database application included in the Microsoft Office Suite, which allows users to enter, manage, and construct reports on a larger scale. • MS Access is most suitable for those who need to quickly organize a large amount of data. • MS Access stores different data sets known as Tables that are potentially related, which, when combined together, increases data flexibility. Microsoft SQL Server • MS SQL server has come up with higher-end integration of modules such as Azure SQL Database, Azure SQL Data Warehouse and Hadoop Distributed File System (HDFS), all packed together to provide a single, integrated solution.

• PHP is well suited for web development. • PHP scripting language offers a lot of resources, such as commands, functions, and codes. • The ease of use, easy integration, cost efficiency, and easy access makes PHP one of the most popular server-side programming languages. Dot Net • .NET provides a framework that facilitates designing and developing applications that are portable, scalable, and robust, and that can be executed in a distributed environment. • All .NET applications run under a common execution environment, called the Common Language Runtime. • The .NET IDE (integrated development environment) provides an easy and rich debugging support. • It is suitable to develop applications for web, Windows, phone. Python • Python is an open-source, fully object-oriented Programming language and available at free of cost. • Python is an interpreted language. It comes with the IDLE (Interactive Development Environment). This is an interpreter and follows the REPL structure (Read-Evaluate-Print-Loop). • The standard library is large and has many packages and modules with common and important functionality.	• MS SQL Server is built with an aim to take the Artificial Intelligence (AI), a step forward, by integrating Big Data with the Database services. My SQL • MySQL is one of the most popular languages for accessing and managing the records in the table. MySQL is open-source and free software. • MySQL consists of a solid data security layer that protects sensitive data from intruders. • MySQL follows the working of a client/server architecture. There is a database server (MySQL) and arbitrarily many clients (application programs). Oracle • Oracle products are scalable and secure, with high performance ability, compared to other databases available in the market. • It is a multi-model relational database management system, mainly designed for enterprise grid computing and data warehousing. • Its layout complete recovery features to recover data from almost all kinds of failures. • Implementing authorization and editing user actions can prevent unauthorized access and allow distinct access to the users

COURSE LEARNING OUTCOMES:**On the completion of the course the student will be able to**

CLOs	COURSE LEARNING OUTCOMES	K - Levels
CLO1	Understanding end user requirements and Gain knowledge.	Up to K2
CLO2	Apply knowledge of computing and mathematics to the appropriate discipline.	Up to K3
CLO3	Developing the functions effectively on teams to accomplish shared computing design, evaluation, or implementation goals.	Up to K3
CLO4	Focus on appropriate techniques, skills, and tools necessary for computing practice.	Up to K4
CLO-5	Identify the need for and ability to engage in continuing professional development	Up to K3

Mapping of CLOs with POs

CLOs / POs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	3	3	3	3	3	3
CLO 2	3	3	3	3	3	3
CLO 3	3	3	3	3	3	3
CLO 4	3	3	3	3	3	3
CLO 5	3	3	3	3	3	3

(3– Advanced Application, 2– Intermediate Level, 1- Basic Level)**Evaluation Pattern: Project & Viva -voce**

Internal		External	
60->40 Marks by Guide; 20 Marks by Department		40	
Guide Evaluation		External Evaluation	
10 Marks	Students Ability & Interest	10 Marks	Report
10 Marks	Regularity & Punctuality	30 Marks	Presentation, Quality of work and Viva- voce
20 Marks	Quality of work & Presentation		
Department Evaluation			
10 Marks	Presentation using ICT tools		
10 Marks	Quality & Publication/ Presentation in Seminar/ Conferences		

THE MADURA COLLEGE
 An Autonomous Institution affiliated to Madurai Kamaraj University
 Re-accredited (3rd cycle) with 'A' grade by NAAC
 Vidya Nagar, T.P.K. Road, Madurai – 625 011
SELF FINANCED STREAM

DEPARTMENT OF INFORMATION TECHNOLOGY

Programme : B.Sc. (Information Technology)
Metric and weight calculation

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U1TLA1/20U1HLA1/20U1SLA1	CLO1	0.000	0.049	0.049	0.097	0.097	1.556
	CLO2	0.000	0.097	0.097	0.146	0.097	
	CLO3	0.000	0.146	0.049	0.000	0.097	
	CLO4	0.146	0.000	0.049	0.000	0.097	
	CLO5	0.000	0.000	0.146	0.000	0.097	
	Total	0.146	0.292	0.389	0.243	0.486	
20U1NEN1	CLO1	0.000	0.097	0.146	0.097	0.000	1.702
	CLO2	0.000	0.097	0.146	0.146	0.000	
	CLO3	0.000	0.097	0.097	0.097	0.000	
	CLO4	0.000	0.097	0.097	0.097	0.000	
	CLO5	0.000	0.097	0.146	0.146	0.000	
	Total	0.000	0.486	0.632	0.583	0.000	
20U1VEN1	CLO1	0.146	0.000	0.097	0.146	0.146	2.723
	CLO2	0.146	0.000	0.097	0.146	0.146	
	CLO3	0.146	0.000	0.097	0.146	0.146	
	CLO4	0.097	0.000	0.097	0.146	0.146	
	CLO5	0.146	0.097	0.097	0.146	0.146	
	Total	0.681	0.097	0.486	0.729	0.729	
20U1FAC1	CLO1	0.146	0.097	0.049	0.049	0.146	2.091
	CLO2	0.146	0.146	0.000	0.000	0.097	
	CLO3	0.146	0.146	0.000	0.000	0.097	
	CLO4	0.146	0.049	0.000	0.000	0.146	
	CLO5	0.146	0.097	0.049	0.049	0.146	
	Total	0.729	0.535	0.097	0.097	0.632	
20U1FMC1	CLO1	0.146	0.097	0.049	0.049	0.146	1.896
	CLO2	0.146	0.146	0.000	0.000	0.146	
	CLO3	0.146	0.097	0.000	0.000	0.146	
	CLO4	0.097	0.097	0.000	0.000	0.097	
	CLO5	0.097	0.097	0.000	0.000	0.097	
	Total	0.632	0.535	0.049	0.049	0.632	

20U1FMC2	CLO1	0.146	0.097	0.049	0.049	0.146	2.042
	CLO2	0.146	0.049	0.000	0.000	0.097	
	CLO3	0.097	0.146	0.000	0.000	0.146	
	CLO4	0.146	0.097	0.000	0.000	0.097	
	CLO5	0.097	0.146	0.049	0.097	0.146	
	Total	0.632	0.535	0.097	0.146	0.632	
20U1FMP1	CLO1	0.146	0.146	0.097	0.146	0.097	3.112
	CLO2	0.146	0.146	0.097	0.146	0.049	
	CLO3	0.146	0.146	0.049	0.146	0.049	
	CLO4	0.146	0.146	0.097	0.146	0.097	
	CLO5	0.146	0.146	0.146	0.146	0.146	
	Total	0.729	0.729	0.486	0.729	0.438	
20U2TLA2/20U2HLA2/20U2SLA2	CLO1	0.049	0.000	0.146	0.000	0.097	1.605
	CLO2	0.000	0.000	0.097	0.000	0.146	
	CLO3	0.049	0.000	0.146	0.049	0.097	
	CLO4	0.097	0.049	0.146	0.049	0.146	
	CLO5	0.000	0.000	0.146	0.049	0.049	
	Total	0.194	0.049	0.681	0.146	0.535	
20U2NENH2	CLO1	0.000	0.097	0.146	0.097	0.000	1.702
	CLO2	0.000	0.097	0.146	0.146	0.000	
	CLO3	0.000	0.097	0.097	0.097	0.000	
	CLO4	0.000	0.097	0.097	0.097	0.000	
	CLO5	0.000	0.097	0.146	0.146	0.000	
	Total	0.000	0.486	0.632	0.583	0.000	
20U2EVS1	CLO1	0.097	0.000	0.000	0.049	0.146	2.042
	CLO2	0.097	0.000	0.097	0.049	0.146	
	CLO3	0.097	0.146	0.000	0.049	0.146	
	CLO4	0.097	0.000	0.000	0.146	0.146	
	CLO5	0.097	0.146	0.000	0.146	0.146	
	Total	0.486	0.292	0.097	0.438	0.729	
20U2FAC2	CLO1	0.146	0.146	0.049	0.000	0.146	2.285
	CLO2	0.146	0.097	0.000	0.000	0.049	
	CLO3	0.146	0.146	0.000	0.146	0.097	
	CLO4	0.146	0.097	0.049	0.000	0.097	
	CLO5	0.146	0.146	0.000	0.146	0.146	
	Total	0.729	0.632	0.097	0.292	0.535	
20U2FMC3	CLO1	0.146	0.097	0.097	0.000	0.049	1.750
	CLO2	0.097	0.049	0.000	0.000	0.049	
	CLO3	0.097	0.146	0.000	0.000	0.097	
	CLO4	0.146	0.146	0.000	0.000	0.146	
	CLO5	0.097	0.146	0.000	0.000	0.146	
	Total	0.583	0.583	0.097	0.000	0.486	

20U2FMC4	CLO1	0.049	0.097	0.049	0.146	0.049	1.945
	CLO2	0.049	0.049	0.049	0.000	0.049	
	CLO3	0.049	0.146	0.097	0.000	0.097	
	CLO4	0.049	0.146	0.146	0.000	0.146	
	CLO5	0.049	0.049	0.146	0.146	0.097	
	Total	0.243	0.486	0.486	0.292	0.438	
20U2FMP2	CLO1	0.146	0.097	0.097	0.000	0.049	1.896
	CLO2	0.146	0.049	0.000	0.000	0.049	
	CLO3	0.146	0.146	0.000	0.000	0.097	
	CLO4	0.146	0.146	0.000	0.000	0.146	
	CLO5	0.146	0.146	0.000	0.000	0.146	
	Total	0.729	0.583	0.097	0.000	0.486	
20U3TLA3/17U3HLA3/20U3SLA3	CLO1	0.000	0.049	0.049	0.097	0.097	1.556
	CLO2	0.000	0.097	0.097	0.146	0.097	
	CLO3	0.000	0.146	0.049	0.000	0.097	
	CLO4	0.146	0.000	0.049	0.000	0.097	
	CLO5	0.000	0.000	0.146	0.000	0.097	
	Total	0.146	0.292	0.389	0.243	0.486	
20U3NENH3	CLO1	0.000	0.097	0.146	0.097	0.000	1.702
	CLO2	0.000	0.097	0.146	0.146	0.000	
	CLO3	0.000	0.097	0.097	0.097	0.000	
	CLO4	0.000	0.097	0.097	0.097	0.000	
	CLO5	0.000	0.097	0.146	0.146	0.000	
	Total	0.000	0.486	0.632	0.583	0.000	
20U3FNM1	CLO1	0.146	0.049	0.097	0.049	0.146	3.160
	CLO2	0.146	0.097	0.146	0.097	0.146	
	CLO3	0.146	0.097	0.097	0.146	0.146	
	CLO4	0.146	0.146	0.146	0.146	0.146	
	CLO5	0.146	0.146	0.097	0.146	0.146	
	Total	0.729	0.535	0.583	0.583	0.729	
20U3FSM1	CLO1	0.146	0.049	0.049	0.000	0.049	2.237
	CLO2	0.146	0.146	0.146	0.097	0.097	
	CLO3	0.146	0.097	0.146	0.000	0.049	
	CLO4	0.146	0.049	0.049	0.049	0.097	
	CLO5	0.146	0.097	0.097	0.000	0.146	
	Total	0.729	0.438	0.486	0.146	0.438	
20U3FAC3	CLO1	0.097	0.097	0.097	0.097	0.097	2.528
	CLO2	0.097	0.097	0.097	0.097	0.097	
	CLO3	0.097	0.146	0.097	0.097	0.097	
	CLO4	0.097	0.097	0.097	0.097	0.097	
	CLO5	0.097	0.146	0.097	0.097	0.097	
	Total	0.486	0.583	0.486	0.486	0.486	

20U3FMC5	CLO1	0.146	0.097	0.146	0.146	0.097	3.015
	CLO2	0.146	0.146	0.146	0.097	0.097	
	CLO3	0.146	0.097	0.097	0.049	0.146	
	CLO4	0.146	0.146	0.049	0.146	0.146	
	CLO5	0.146	0.097	0.049	0.146	0.146	
	Total	0.729	0.583	0.486	0.583	0.632	
20U3FMP3	CLO1	0.146	0.097	0.146	0.146	0.097	3.015
	CLO2	0.146	0.146	0.146	0.097	0.097	
	CLO3	0.146	0.097	0.097	0.049	0.146	
	CLO4	0.146	0.146	0.049	0.146	0.146	
	CLO5	0.146	0.097	0.049	0.146	0.146	
	Total	0.729	0.583	0.486	0.583	0.632	
20U4TLA4/17U4HLA4/20U4SLA4	CLO1	0.000	0.049	0.049	0.097	0.097	1.556
	CLO2	0.000	0.097	0.097	0.146	0.097	
	CLO3	0.000	0.146	0.049	0.000	0.097	
	CLO4	0.146	0.000	0.049	0.000	0.097	
	CLO5	0.000	0.000	0.146	0.000	0.097	
	Total	0.146	0.292	0.389	0.243	0.486	
20U4NEN4	CLO1	0.000	0.097	0.146	0.097	0.000	1.702
	CLO2	0.000	0.097	0.146	0.146	0.000	
	CLO3	0.000	0.097	0.097	0.097	0.000	
	CLO4	0.000	0.097	0.097	0.097	0.000	
	CLO5	0.000	0.097	0.146	0.146	0.000	
	Total	0.000	0.486	0.632	0.583	0.000	
20U4FNM2	CLO1	0.146	0.000	0.049	0.000	0.049	2.091
	CLO2	0.146	0.049	0.097	0.000	0.097	
	CLO3	0.146	0.000	0.146	0.000	0.146	
	CLO4	0.146	0.097	0.146	0.000	0.146	
	CLO5	0.146	0.097	0.097	0.000	0.146	
	Total	0.729	0.243	0.535	0.000	0.583	
20U4FSM2	CLO1	0.146	0.146	0.097	0.049	0.049	2.334
	CLO2	0.146	0.049	0.000	0.146	0.049	
	CLO3	0.146	0.146	0.000	0.097	0.097	
	CLO4	0.146	0.097	0.000	0.097	0.097	
	CLO5	0.146	0.097	0.000	0.146	0.146	
	Total	0.729	0.535	0.097	0.535	0.438	
20U4FAC4	CLO1	0.097	0.097	0.097	0.097	0.097	2.528
	CLO2	0.097	0.097	0.097	0.097	0.097	
	CLO3	0.097	0.146	0.097	0.097	0.097	
	CLO4	0.097	0.097	0.097	0.097	0.097	
	CLO5	0.097	0.146	0.097	0.097	0.097	
	Total	0.486	0.583	0.486	0.486	0.486	

20U4FMC6	CLO1	0.146	0.146	0.097	0.049	0.049	2.334
	CLO2	0.146	0.049	0.000	0.146	0.097	
	CLO3	0.146	0.146	0.000	0.097	0.049	
	CLO4	0.146	0.097	0.000	0.097	0.097	
	CLO5	0.146	0.097	0.000	0.146	0.146	
	Total	0.729	0.535	0.097	0.535	0.438	
20U4FMP4	CLO1	0.146	0.146	0.097	0.049	0.049	2.334
	CLO2	0.146	0.049	0.000	0.146	0.097	
	CLO3	0.146	0.146	0.000	0.097	0.049	
	CLO4	0.146	0.097	0.000	0.097	0.097	
	CLO5	0.146	0.097	0.000	0.146	0.146	
	Total	0.729	0.535	0.097	0.535	0.438	
20U5FSM3	CLO1	0.097	0.049	0.097	0.097	0.146	2.528
	CLO2	0.049	0.049	0.146	0.097	0.146	
	CLO3	0.097	0.049	0.097	0.097	0.146	
	CLO4	0.049	0.049	0.146	0.097	0.146	
	CLO5	0.097	0.049	0.146	0.146	0.146	
	Total	0.389	0.243	0.632	0.535	0.729	
20U5FMC7	CLO1	0.097	0.049	0.097	0.097	0.146	2.382
	CLO2	0.097	0.049	0.097	0.097	0.146	
	CLO3	0.097	0.049	0.097	0.097	0.097	
	CLO4	0.097	0.049	0.097	0.097	0.146	
	CLO5	0.097	0.097	0.097	0.049	0.146	
	Total	0.486	0.292	0.486	0.438	0.681	
20U5FMC8	CLO1	0.097	0.097	0.097	0.049	0.146	2.528
	CLO2	0.146	0.146	0.049	0.049	0.097	
	CLO3	0.097	0.097	0.049	0.049	0.097	
	CLO4	0.097	0.097	0.049	0.146	0.097	
	CLO5	0.146	0.146	0.097	0.146	0.146	
	Total	0.583	0.583	0.340	0.438	0.583	
20U5FMC9	CLO1	0.146	0.049	0.049	0.049	0.049	2.237
	CLO2	0.146	0.049	0.097	0.049	0.097	
	CLO3	0.146	0.049	0.097	0.049	0.097	
	CLO4	0.146	0.049	0.097	0.049	0.097	
	CLO5	0.146	0.097	0.097	0.097	0.146	
	Total	0.729	0.292	0.438	0.292	0.486	
20U5FMP5	CLO1	0.097	0.049	0.097	0.097	0.146	2.382
	CLO2	0.097	0.049	0.097	0.097	0.146	
	CLO3	0.097	0.049	0.097	0.097	0.097	
	CLO4	0.097	0.049	0.097	0.097	0.146	
	CLO5	0.097	0.097	0.097	0.049	0.146	
	Total	0.486	0.292	0.486	0.438	0.681	

20U5FMP6	CLO1	0.097	0.097	0.097	0.049	0.146	2.528
	CLO2	0.146	0.146	0.049	0.049	0.097	
	CLO3	0.097	0.097	0.049	0.049	0.097	
	CLO4	0.097	0.097	0.049	0.146	0.097	
	CLO5	0.146	0.146	0.097	0.146	0.146	
	Total	0.583	0.583	0.340	0.438	0.583	
20U5FME1	CLO1	0.097	0.097	0.146	0.049	0.146	2.771
	CLO2	0.146	0.146	0.097	0.049	0.097	
	CLO3	0.097	0.097	0.146	0.049	0.097	
	CLO4	0.097	0.146	0.146	0.049	0.146	
	CLO5	0.146	0.146	0.146	0.049	0.146	
	Total	0.583	0.632	0.681	0.243	0.632	
20U5FIDC	CLO1	0.146	0.097	0.049	0.097	0.146	3.160
	CLO2	0.146	0.097	0.049	0.097	0.146	
	CLO3	0.146	0.146	0.097	0.097	0.146	
	CLO4	0.146	0.146	0.146	0.146	0.146	
	CLO5	0.146	0.146	0.146	0.146	0.146	
	Total	0.729	0.632	0.486	0.583	0.729	
20U6FSM4	CLO1	0.049	0.049	0.049	0.049	0.049	2.334
	CLO2	0.146	0.049	0.146	0.049	0.049	
	CLO3	0.097	0.049	0.146	0.097	0.097	
	CLO4	0.146	0.097	0.146	0.097	0.146	
	CLO5	0.049	0.146	0.049	0.146	0.146	
	Total	0.486	0.389	0.535	0.438	0.486	
20U6FMC10	CLO1	0.097	0.097	0.097	0.049	0.049	2.091
	CLO2	0.097	0.097	0.097	0.049	0.049	
	CLO3	0.049	0.097	0.049	0.049	0.097	
	CLO4	0.049	0.146	0.097	0.097	0.146	
	CLO5	0.049	0.097	0.049	0.097	0.146	
	Total	0.340	0.535	0.389	0.340	0.486	
20U6FMC11	CLO1	0.097	0.049	0.097	0.049	0.049	2.188
	CLO2	0.097	0.146	0.049	0.146	0.097	
	CLO3	0.097	0.097	0.049	0.097	0.097	
	CLO4	0.097	0.097	0.049	0.049	0.049	
	CLO5	0.097	0.049	0.146	0.097	0.146	
	Total	0.486	0.438	0.389	0.438	0.438	
20U6FMC12	CLO1	0.097	0.049	0.049	0.049	0.049	2.334
	CLO2	0.049	0.097	0.049	0.097	0.146	
	CLO3	0.049	0.097	0.146	0.097	0.146	
	CLO4	0.049	0.146	0.146	0.097	0.146	
	CLO5	0.049	0.049	0.146	0.097	0.146	
	Total	0.292	0.438	0.535	0.438	0.632	

20U6FMP7	CLO1	0.097	0.097	0.097	0.049	0.049	2.091
	CLO2	0.097	0.097	0.097	0.049	0.049	
	CLO3	0.049	0.097	0.049	0.049	0.097	
	CLO4	0.049	0.146	0.097	0.097	0.146	
	CLO5	0.049	0.097	0.049	0.097	0.146	
	Total	0.340	0.535	0.389	0.340	0.486	
20U6FME2	CLO1	0.097	0.097	0.049	0.097	0.097	2.577
	CLO2	0.097	0.146	0.097	0.097	0.097	
	CLO3	0.097	0.146	0.146	0.097	0.049	
	CLO4	0.097	0.146	0.146	0.097	0.097	
	CLO5	0.097	0.097	0.097	0.097	0.097	
	Total	0.486	0.632	0.535	0.486	0.438	
20U6FME3	CLO1	0.049	0.097	0.049	0.097	0.097	2.431
	CLO2	0.049	0.146	0.049	0.097	0.146	
	CLO3	0.049	0.146	0.049	0.097	0.146	
	CLO4	0.049	0.146	0.049	0.097	0.146	
	CLO5	0.097	0.146	0.097	0.097	0.146	
	Total	0.292	0.681	0.292	0.486	0.681	
	Total	20.907	20.227	17.261	16.823	21.782	97

NME COURSES

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U3FNM1	CLO1	0.046	0.015	0.031	0.015	0.046	
	CLO2	0.046	0.031	0.046	0.031	0.046	
	CLO3	0.046	0.031	0.031	0.046	0.046	
	CLO4	0.046	0.046	0.046	0.046	0.046	
	CLO5	0.046	0.046	0.031	0.046	0.046	
	Total	0.231	0.169	0.185	0.185	0.231	1
20U4FNM2	CLO1	0.070	0.000	0.023	0.000	0.023	
	CLO2	0.070	0.023	0.047	0.000	0.047	
	CLO3	0.070	0.000	0.070	0.000	0.070	
	CLO4	0.070	0.047	0.070	0.000	0.070	
	CLO5	0.070	0.047	0.047	0.000	0.070	
	Total	0.349	0.116	0.256	0.000	0.279	1

All the course outcomes are adequately mapped against the programme outcomes and all the programme outcomes carry adequate weight against the cumulative outcome of the programme.

THE MADURA COLLEGE
 An Autonomous Institution affiliated to Madurai Kamaraj University
 Re-accredited (3rd cycle) with 'A' grade by NAAC
 Vidya Nagar, T.P.K. Road, Madurai – 625 011
SELF FINANCED STREAM
DEPARTMENT OF COMPUTER SCIENCE

Programme : M.Sc (Computer Science)
Metric and weight calculation

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	
21P1DMC1	CLO1	0.131	0.065	0.131	0.131	0.131	0.000	3.396
	CLO2	0.131	0.065	0.196	0.196	0.196	0.131	
	CLO3	0.131	0.065	0.065	0.065	0.065	0.000	
	CLO4	0.131	0.131	0.131	0.065	0.065	0.000	
	CLO5	0.131	0.131	0.196	0.196	0.196	0.131	
	Total	0.653	0.457	0.718	0.653	0.653	0.261	
21P1DMC2	CLO1	0.196	0.131	0.196	0.196	0.131	0.000	4.702
	CLO2	0.196	0.196	0.196	0.196	0.131	0.000	
	CLO3	0.196	0.196	0.196	0.131	0.131	0.131	
	CLO4	0.196	0.196	0.196	0.196	0.131	0.131	
	CLO5	0.196	0.196	0.196	0.196	0.131	0.000	
	Total	0.980	0.914	0.980	0.914	0.653	0.261	
21P1DMC3	CLO1	0.131	0.131	0.065	0.131	0.131	0.065	3.918
	CLO2	0.131	0.196	0.131	0.131	0.131	0.131	
	CLO3	0.131	0.196	0.196	0.131	0.065	0.065	
	CLO4	0.131	0.196	0.196	0.131	0.131	0.131	
	CLO5	0.131	0.131	0.131	0.131	0.131	0.065	
	Total	0.653	0.849	0.718	0.653	0.588	0.457	
21P1DME1	CLO1	0.131	0.065	0.000	0.000	0.065	0.000	2.808
	CLO2	0.131	0.131	0.131	0.065	0.131	0.000	
	CLO3	0.131	0.196	0.131	0.131	0.196	0.131	
	CLO4	0.131	0.065	0.000	0.065	0.131	0.000	
	CLO5	0.131	0.131	0.065	0.065	0.131	0.131	
	Total	0.653	0.588	0.327	0.327	0.653	0.261	
21P1DMP1	CLO1	0.196	0.131	0.196	0.196	0.131	0.000	4.702
	CLO2	0.196	0.196	0.196	0.196	0.131	0.000	
	CLO3	0.196	0.196	0.196	0.131	0.131	0.131	
	CLO4	0.196	0.196	0.196	0.196	0.131	0.131	
	CLO5	0.196	0.196	0.196	0.196	0.131	0.000	
	Total	0.980	0.914	0.980	0.914	0.653	0.261	
21P1DMP2	CLO1	0.131	0.131	0.065	0.131	0.131	0.065	3.918
	CLO2	0.131	0.196	0.131	0.131	0.131	0.131	
	CLO3	0.131	0.196	0.196	0.131	0.065	0.065	
	CLO4	0.131	0.196	0.196	0.131	0.131	0.131	
	CLO5	0.131	0.131	0.131	0.131	0.131	0.065	
	Total	0.653	0.849	0.718	0.653	0.588	0.457	

21P2DMC4	CLO1	0.131	0.131	0.065	0.000	0.000	0.000	3.200
	CLO2	0.131	0.131	0.131	0.065	0.000	0.000	
	CLO3	0.131	0.131	0.131	0.131	0.065	0.065	
	CLO4	0.131	0.196	0.196	0.131	0.131	0.131	
	CLO5	0.131	0.196	0.196	0.131	0.131	0.065	
	Total	0.653	0.784	0.718	0.457	0.327	0.261	
21P2DMC5	CLO1	0.131	0.131	0.131	0.065	0.065	0.000	3.331
	CLO2	0.131	0.131	0.131	0.065	0.131	0.000	
	CLO3	0.131	0.131	0.131	0.131	0.131	0.065	
	CLO4	0.131	0.131	0.065	0.131	0.131	0.065	
	CLO5	0.131	0.131	0.065	0.131	0.196	0.196	
	Total	0.653	0.653	0.522	0.522	0.653	0.327	
21P2DMC6	CLO1	0.131	0.065	0.065	0.000	0.000	0.000	3.788
	CLO2	0.131	0.196	0.196	0.196	0.065	0.000	
	CLO3	0.131	0.196	0.131	0.131	0.065	0.000	
	CLO4	0.131	0.196	0.196	0.196	0.196	0.131	
	CLO5	0.131	0.196	0.196	0.196	0.196	0.131	
	Total	0.653	0.849	0.784	0.718	0.522	0.261	
21P2DME2	CLO1	0.131	0.131	0.131	0.131	0.196	0.000	3.788
	CLO2	0.131	0.196	0.131	0.131	0.196	0.000	
	CLO3	0.131	0.065	0.131	0.131	0.196	0.000	
	CLO4	0.131	0.065	0.131	0.131	0.196	0.000	
	CLO5	0.131	0.196	0.196	0.131	0.196	0.131	
	Total	0.653	0.653	0.718	0.653	0.980	0.131	
21P2DMP3	CLO1	0.131	0.131	0.131	0.196	0.131	0.131	4.245
	CLO2	0.131	0.131	0.131	0.196	0.131	0.131	
	CLO3	0.131	0.131	0.131	0.196	0.131	0.131	
	CLO4	0.131	0.131	0.131	0.196	0.131	0.131	
	CLO5	0.131	0.131	0.131	0.196	0.131	0.131	
	Total	0.653	0.653	0.653	0.980	0.653	0.653	
21P2DMP4	CLO1	0.131	0.065	0.065	0.000	0.000	0.000	3.788
	CLO2	0.131	0.196	0.196	0.196	0.065	0.000	
	CLO3	0.131	0.196	0.131	0.131	0.065	0.000	
	CLO4	0.131	0.196	0.196	0.196	0.196	0.131	
	CLO5	0.131	0.196	0.196	0.196	0.196	0.131	
	Total	0.653	0.849	0.784	0.718	0.522	0.261	
21P3DMC7	CLO1	0.131	0.131	0.131	0.131	0.131	0.065	3.853
	CLO2	0.196	0.196	0.196	0.196	0.196	0.131	
	CLO3	0.196	0.196	0.131	0.196	0.131	0.065	
	CLO4	0.131	0.065	0.065	0.131	0.065	0.065	
	CLO5	0.065	0.065	0.131	0.065	0.131	0.131	
	Total	0.718	0.653	0.653	0.718	0.653	0.457	

21P3DMC8	CLO1	0.131	0.065	0.065	0.196	0.065	0.131	3.722
	CLO2	0.065	0.065	0.065	0.196	0.065	0.131	
	CLO3	0.065	0.196	0.196	0.065	0.196	0.196	
	CLO4	0.131	0.065	0.131	0.065	0.131	0.196	
	CLO5	0.196	0.196	0.196	0.065	0.131	0.065	
	Total	0.588	0.588	0.653	0.588	0.588	0.718	
21P3DMC9	CLO1	0.131	0.065	0.065	0.131	0.065	0.065	4.310
	CLO2	0.131	0.131	0.131	0.131	0.131	0.131	
	CLO3	0.131	0.131	0.196	0.131	0.196	0.196	
	CLO4	0.196	0.131	0.131	0.196	0.196	0.196	
	CLO5	0.131	0.131	0.131	0.196	0.196	0.196	
	Total	0.718	0.588	0.653	0.784	0.784	0.784	
21P3DMDC	CLO1	0.131	0.065	0.131	0.065	0.131	0.065	3.461
	CLO2	0.131	0.196	0.131	0.131	0.131	0.065	
	CLO3	0.065	0.131	0.131	0.065	0.065	0.131	
	CLO4	0.065	0.131	0.065	0.131	0.131	0.196	
	CLO5	0.131	0.065	0.065	0.131	0.196	0.196	
	Total	0.522	0.588	0.522	0.522	0.653	0.653	
21P3DMP5	CLO1	0.131	0.131	0.131	0.131	0.131	0.065	3.853
	CLO2	0.196	0.196	0.196	0.196	0.196	0.131	
	CLO3	0.196	0.196	0.131	0.196	0.131	0.065	
	CLO4	0.131	0.065	0.065	0.131	0.065	0.065	
	CLO5	0.065	0.065	0.131	0.065	0.131	0.131	
	Total	0.718	0.653	0.653	0.718	0.653	0.457	
21P3DMP6	CLO1	0.131	0.065	0.065	0.196	0.065	0.131	3.722
	CLO2	0.065	0.065	0.065	0.196	0.065	0.131	
	CLO3	0.065	0.196	0.196	0.065	0.196	0.196	
	CLO4	0.131	0.065	0.131	0.065	0.131	0.196	
	CLO5	0.196	0.196	0.196	0.065	0.131	0.065	
	Total	0.588	0.588	0.653	0.588	0.588	0.718	
21P4DMC10	CLO1	0.131	0.131	0.131	0.131	0.131	0.196	3.722
	CLO2	0.065	0.065	0.131	0.065	0.065	0.065	
	CLO3	0.065	0.065	0.131	0.196	0.065	0.131	
	CLO4	0.196	0.196	0.131	0.131	0.196	0.065	
	CLO5	0.196	0.196	0.065	0.065	0.196	0.131	
	Total	0.653	0.653	0.588	0.588	0.653	0.588	
21P4DMC11	CLO1	0.131	0.131	0.131	0.065	0.131	0.065	3.527
	CLO2	0.131	0.131	0.065	0.065	0.131	0.065	
	CLO3	0.131	0.065	0.196	0.065	0.131	0.065	
	CLO4	0.196	0.065	0.196	0.065	0.131	0.065	
	CLO5	0.196	0.131	0.196	0.131	0.196	0.065	
	Total	0.784	0.522	0.784	0.392	0.718	0.327	

21P4DMC12	CLO1	0.065	0.065	0.131	0.065	0.065	0.131	3.788
	CLO2	0.131	0.131	0.065	0.065	0.131	0.131	
	CLO3	0.196	0.131	0.131	0.131	0.065	0.065	
	CLO4	0.065	0.196	0.131	0.196	0.131	0.131	
	CLO5	0.131	0.196	0.196	0.196	0.131	0.196	
	Total	0.588	0.718	0.653	0.653	0.522	0.653	
21P4DME3	CLO1	0.131	0.065	0.000	0.065	0.131	0.065	3.265
	CLO2	0.131	0.131	0.131	0.065	0.131	0.065	
	CLO3	0.131	0.196	0.131	0.131	0.196	0.131	
	CLO4	0.131	0.065	0.000	0.065	0.131	0.065	
	CLO5	0.131	0.131	0.065	0.196	0.131	0.131	
	Total	0.653	0.588	0.327	0.522	0.718	0.457	
21P4DMP7	CLO1	0.131	0.131	0.131	0.065	0.131	0.065	3.527
	CLO2	0.131	0.131	0.065	0.065	0.131	0.065	
	CLO3	0.131	0.065	0.196	0.065	0.131	0.065	
	CLO4	0.196	0.065	0.196	0.065	0.131	0.065	
	CLO5	0.196	0.131	0.196	0.131	0.196	0.065	
	Total	0.784	0.522	0.784	0.392	0.718	0.327	
21P4DMP8	CLO1	0.065	0.065	0.131	0.065	0.065	0.131	3.788
	CLO2	0.131	0.131	0.065	0.065	0.131	0.131	
	CLO3	0.196	0.131	0.131	0.131	0.065	0.065	
	CLO4	0.065	0.196	0.131	0.196	0.131	0.131	
	CLO5	0.131	0.196	0.196	0.196	0.131	0.196	
	Total	0.588	0.718	0.653	0.653	0.522	0.653	
21P4DMPR	CLO1	0.196	0.196	0.196	0.196	0.196	0.196	5.878
	CLO2	0.196	0.196	0.196	0.196	0.196	0.196	
	CLO3	0.196	0.196	0.196	0.196	0.196	0.196	
	CLO4	0.196	0.196	0.196	0.196	0.196	0.196	
	CLO5	0.196	0.196	0.196	0.196	0.196	0.196	
	Total	0.980	0.980	0.980	0.980	0.980	0.980	
	Total	17.371	17.371	17.176	16.261	16.196	11.624	96

NME COURSES

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	
21P1DNM1	CLO1	0.070	0.070	0.070	0.070	0.070	0.035	
	CLO2	0.070	0.070	0.105	0.070	0.105	0.070	
	CLO3	0.070	0.070	0.105	0.070	0.105	0.070	
	CLO4	0.070	0.070	0.105	0.070	0.105	0.105	
	CLO5	0.070	0.070	0.105	0.070	0.070	0.070	
	Total	0.351	0.351	0.491	0.351	0.456	0.351	2
21P2DNM2	CLO1	0.148	0.000	0.000	0.000	0.074	0.074	
	CLO2	0.148	0.000	0.000	0.000	0.074	0.074	
	CLO3	0.148	0.148	0.074	0.148	0.074	0.148	
	CLO4	0.148	0.000	0.000	0.148	0.222	0.148	
	CLO5	0.148	0.000	0.000	0.222	0.222	0.148	
	Total	0.741	0.148	0.074	0.519	0.667	0.593	2

All the course outcomes are adequately mapped against the programme outcomes and all the programme outcomes carry adequate weight against the cumulative outcome of the programme.



DEPARTMENT OF MICROBIOLOGY

Revised Curriculum
(Choice Based Credit system with Outcome Based Education)
Academic Year 2020-2021 onwards

V and VI semesters (B.Sc. Microbiology)
III and IV semesters (M.Sc. Microbiology)

The Madura College, Madurai

Department of Microbiology

Vision:

- The Department strives to provide high quality education in the field of Microbiology and Biological sciences to produce world class, highly qualified competent and socially responsible graduates who work together to achieve the goals.

Mission:

- To provide a basic and fundamental knowledge in life sciences that includes the skills in the theory and practical.
- To promote good quality of education and inspiring training in various disciplines of Microbiology.
- To create a conducive environment for innovation and application in the field of Microbiology.
- To train the students in both practical and theoretical aspects of Microbiology.
- To motivate and guide the students to develop new techniques in Microbiology
- To achieve excellence in academic and employment career in the field of biological sciences.

The Graduate Attributes

- a. Knowledge in core competency
- b. Problem analysis
- c. Design and development of solutions for complex problems
- d. Conduct investigations of complex problems
- e. Modern tool usage
- f. Environment and sustainability
- g. Ethics
- h. Individual and team work
- i. Communication
- j. Project management and finance
- k. Life-long learning

Programme Educational Objectives (PEOs)

The objectives of this programme are:

PEOs	Programme Educational Objectives
PEO-1	To provide graduates with fundamental knowledge about life science especially microbiology with a view to impart in them high quality scientific skills like analyzing, designing and implementing techniques.
PEO-2	To prepare graduates with recent scientific developments in the field of life Science and help them for life learning.
PEO-3	To train graduates to choose a suitable career option or higher studies and excel in competitive examination.
PEO-4	To make graduates socially responsible and to develop interpersonal skills in order to become a good team member and leader.
PEO-5	To accomplish ability to communicate effectively and able to understand ethical responsibility.

Programme Specific Outcomes (PSOs)

On the successful completion of B.Sc., Microbiology, the students will be able to

PSOs	Programme Specific Outcomes	Graduate Attributes
PSO-1	Understand, analyze and apply microbiological techniques in the areas related to medical, food, agricultural, environmental, industrial and pharmaceutical microbiology field.	a. Knowledge in core competency b. Problem analysis c. Design and development of solutions for complex problems
PSO-2	Apply recent microbiological techniques in creating career paths to become an entrepreneur or getting higher studies/employability in the field of microbiology.	c. Design and development of solutions for complex problems k. Life-long learning
PSO-3	Design scientific methodology, hypothesis generation and testing, design and execution of experiments.	c. Design and development of solutions for complex problems d. Conduct investigations of complex problems h. Individual and team work
PSO-4	Recognize the application oriented aspects of Microbiology and Build proficiency in the quantitative skills necessary to analyze biological problems.	1. Problem analysis 2. Design and development of solutions for complex problems 3. Conduct investigations of complex problems e. Modern tool usage
PSO-5	Acquire and demonstrate proficiency in good laboratory practices in a microbiological laboratory and Develop strong oral and written communication skills through the effective presentation of experimental results as well as through seminars.	g. Ethics 4. Modern tool usage Communication Project management and finance

Qualification for Admission

Candidates should have passed the Higher Secondary Examination /Botany/Zoology/Biology as one of the subject, conducted by the Board of Higher Education, Government of Tamilnadu, CBSE& ICSE or any other examination approved by Madurai Kamaraj University as equivalent.

Duration of the Course

The students shall undergo prescribed course of study for the period of three academic years under CBCS semester pattern with outcome based education.

Medium of Instruction: English.

System: Choice Based Credit System with Outcome Based Model.

EVALUATION (THEORY)

Internal(Formative)	: 25marks
External(Summative)	: 75marks
Total	:100 marks

Continuous Internal Assessment (CIA): 25 Marks

Components of CIA	Marks
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz/ Documentation/ Case lets/ ICT based Assignment/ Mini Projects	5
Attendance / Quiz	5
Total	25

BLUE PRINT FOR INTERNAL ASSESSMENT - I

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	SectionD (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 2	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	11
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answer
K3- Application oriented-
Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

BLUE PRINT FOR INTERNAL ASSESSMENT - II

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	SectionD (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K2	2	K1 & K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K3	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	11
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with

general answersK3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	2		--	4	6.67	50
K2	2	4	10	10	26	43.33	
K3	-	-	10	10	20	33.33	33
K4	-	-	-	10	10	16.67	17
Total Marks	4	6	20	30	60	100.00	100%

Question Paper Pattern for External Examination: 75 Marks

Section	Marks
A- Multiple Choice Questions(10 X 1mark)	10
B- Shortanswertype (5 X 2mark)	10
B- Either/Or type(5X 5 marks)	25
C- Open Choice type (3out of 5 X10 marks)	30
Total	75

EVALUATION (PRACTICAL)

Internal(Formative)	: 40 marks
External(Summative)	: 60 marks
Total	:100 marks

Question Paper Pattern for External Practical Examination (Major):60 Marks

Components	Marks
I – Major question	20
II - Minor question	15
III-Spotter (5 x 4)	20
IV –Record book	5
Total	60

Question Paper Pattern for External Practical Examination (Ancillary) :60 Marks

Components	Marks
I – Major question	20
II - Minor question	15
III - Spotter (4 x 5)	20
IV – Record book	5
Total	60

In respect of external examinations passing minimum is 35% for Under Graduate Courses and in total, aggregate of 40%.The curriculum is revised to suit the changing trends by propagation of ideas ensuring professional growth through innovative method of teaching. The curriculum is strengthened through the latest amendments and revisions as per UGC Norm.

Add-On Courses**Evaluation pattern for Add-on courses**

Internal evaluation	: 50 % marks
External evaluation	: 50 %marks

Continuous Internal Assessment components	Marks
Assignment (3nos)/mini project	20 %
Paper presentation/seminar	15 %
Quiz	15 %
Total	50%

External examination duration: 2 hours

Question paper pattern

Part-A	Multiple choice type	10 x 1 = 10 marks
Part- B	Descriptive type [4 out of 7]	4 x 10 = 40 marks

Self-learning Courses

Evaluation pattern for Self-study courses

Assessment components	Marks
Assignments (minimum 2)	25%
Project/innovative experimental design	25%
Paper presentation/ viva voce	25%
Internal test	25%
Total	100%

**The Madura College (Autonomous), Madurai–
625011 Department of Microbiology**

**Curriculum structure for B.Sc. Microbiology implemented from 2020–2021
onwards**

Semester	Course	Subject Code	Course Title	Contact hours/Week	Credits
I	Part I: Language I	20U1TLA1	Tamil-I/Sanskrit-I/Hindi-I	6	3
	Part II: English. I	20U1NEN1	English-I	6	3
	VE&PE	20U1VEN1	Value Education and Professional Ethics	3	3
	Part III: Allied-I	20U1LAC1	Paper I-Concepts in Biotechnology	4	4
	Allied Practical	20U1LAP1	Allied Practical-I	2	1
	MajorCore-1	20U1RMC1	General Microbiology	3	3
	MajorCore-2	20U1RMC2	Basic Techniques in Microbiology	3	3
	Major Core practical -I	20U1RMP1	Major Practical-I	3	2
			Total	30	22
II	Part I: Language II	20U2TLA2	Tamil-II/Sanskrit-II /Hindi-II	6	3
	Part II: English. II	20U2NEN2	English-II	6	3
	E&GS	20U2EVS1	Environmental and Gender Studies	3	3
	Part III: Allied-II	20U2LAC2	Paper I-Biotechnology in Human Welfare	4	4
	Allied Practical	20U2LAP2	Allied Practical-II	2	1
	MajorCore-3	20U2RMC3	Microbial Taxonomy	3	3
	MajorCore-4	20U2RMC4	Cell and Molecular Biology	3	3
	Major Core practical -II	20U2RMP2	Major Practical-II	3	2
	Extension(AEEP)			-	1
			Total	30	23
III	Part I:Language.III	20U3TLA3	Tamil-III/Sanskrit-III/Hindi-III	6	3
	Part II: English. III	20U3NEN3	English-III	6	3
	Non Major Elective-I	20U3RNM1	Nutrition and Health	2	2
	Skill based Elective (SBE-I)	20U3RSM1	Cosmetic Microbiology	2	2
	Part III: Allied-I	20U3CAC1	Allied Chemistry-I	4	4
	Allied Practical	20U3CAP1	Allied Practical-I	2	1
	MajorCore-5	20U3RMC5	Biochemistry	5	5
	Major Core Practical-III	20U3RMP3	Major Practical-III	3	2
			Total	30	22
IV	Part I: Language IV	20U4TLA4	Tamil-IV/Sanskrit-IV/Hindi-IV	6	3
	Part II: English. IV	20U4NEN4	English-IV	6	3
	Non Major Elective-II	20U4RNM2	Microbes in Human Welfare	2	2
	Skill based Elective-II	20U4RSM2	Immunology and Immunotechnology	2	2
	Part III: Allied-II	20U4CAC2	Allied Chemistry-II	4	4
	Allied Practical	20U4CAP2	Allied Practical-II	2	1
	Major Core-6	20U4RMC6	Microbial Physiology	5	5
	Major Core Practical-IV	20U4RMP4	Major Practical-IV	3	2
			Total	30	22

V	Skill Based Elective (SBE-III)	20U5RSM3	Diagnostic Microbiology and Haematology	2	2
	MajorCore-7	20U5RMC7	Environmental Microbiology	5	5
	MajorCore-8	20U5RMC8	Medical Microbiology	5	5
	MajorCore-9	20U5RMC9	Microbial Genetics	5	5
	Major Core Practical-V	20U5RMP5	Major Practical-V	3	2
	Major Core Practical-VI	20U5RMP6	Major Practical-VI	3	2
	Major Interdisciplinary*	20U5RIDC	Bioeconomics	4	3
	Major Elective I	20U5RME1	Parasitology and Entomology Introduction to Genomics	3	2
			Total	30	26
VI	Skill Based Elective (SBE-IV)	20U6RSM4	Entrepreneurship in Microbiology	2	2
	MajorCore-10	20U6RMC10	Food Microbiology	5	5
	MajorCore-11	20U6RMC11	Principles of Gene Manipulation	5	5
	MajorCore-12	20U6RMC12	Pharmaceutical and Forensic Microbiology	5	5
	Major Core Practical-VII	20U6RMP7	Major Practical-VII	3	2
	Major Core Practical-VIII	20U6RMP8	Major Practical-VIII	3	2
	Major Elective II	20U6RME2	Fermentation Technology Agricultural Microbiology	4	3
	Major Elective III	20U6RME3	Microbial Nanotechnology Veterinary Microbiology	3	2
			Total	30	26

***Major Interdisciplinary course involves Economics**

Elective Papers* for B.Sc., Microbiology

ELECTIVES OFFERED

Semester	Paper	Title of the paper
V	Major Interdisciplinary (20U5RIDC)	1. Bioeconomics
	Major Electives I (20U5RME1)	1. Parasitology and Entomology
		2. Introduction to Genomics
VI	Major Electives II (20U6RME2)	1. Fermentation Technology
		2. Agricultural Microbiology
	Major Electives III (20U6RME3)	3. Microbial Nanotechnology
		4. Veterinary Microbiology

***Students can choose any 2 papers each in V and VI Semesters as electives**
Add-on and Self-study Papers for B.Sc., Microbiology

Semester	Paper	Subject Code	Title of the paper
III	Add-On I	20U3RAD1	Biofertilizers and Biopesticides
IV	Add-On II	20U4RAD2	Medical Coding
III & IV	Self-Study	20U4RSS1	Probiotics
EVEN	Certificate Course - I	CRCO1	Mushroom Technology
ODD	Certificate Course - II	CRCO2	Food Processing and Preservation

The Madura College (Autonomous), Madurai-625011

Department of Microbiology

Curriculum structure for B.Sc. Biotechnology (Major) with Ancillary Microbiology implemented from 2021-2022

Semester	Course	Subject Code	Course title	Contact hours/week	Credits
III	20U3RAC1	Ancillary-I Theory	Basic Microbiology	4	4
	20U3RAP1	Ancillary-I Practicals	Lab in Basic Microbiology	2	1
IV	20U4RAC2	Ancillary-II Theory	Applied Microbiology	4	4
	20U4RAP2	Ancillary-II Practicals	Lab in Applied Microbiology	2	1
			Total	12	10

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	SBE - III	20U5RSM3	Diagnostic Microbiology and Haematology	2	2	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To explore the methods of collection and processing of clinical specimens and presumptive identification of microorganisms
- To identify medically important microbes
- To demonstrate the basic principles of haematology and diagnostic microbiology instrumentation
- To explain the origin of blood cells and articulate the process of erythropoiesis and leukopoiesis as it relates to health and disease.
- To discuss the coagulation process and its role in maintaining hemostasis and to demonstrate current hematological procedures used to diagnose, monitor and evaluate disorders

Unit	Description	Hours	K-Level	CLO
I	Unit-I: Introduction to Diagnostic Microbiology The Laboratory role in diagnosis and infection control. Performance improvement in the Microbiology laboratory. Clinical specimen collection, transport and processing - blood, urine, sputum, pus and faeces. Microscopic examination of materials from infected sites. Use of colony morphology for the presumptive identification of microorganisms. Biochemical identification of Gram-Negative bacteria. Emerging and Re-emerging microbial diseases. Nosocomial infections.	6 hrs	Up to K2	1
II	Unit-II: Laboratory Identification of Significant Isolates Laboratory identification of bacteria - <i>Staphylococcus</i> , <i>Streptococcus</i> , <i>Neisseria</i> , <i>Haemophilus</i> , <i>Salmonella</i> and <i>Vibrio</i> . Anaerobes of Clinical Importance. The Spirochetes. <i>Chlamydia</i> , <i>Rickettsia</i> , <i>Mycoplasma</i> , <i>Mycobacterium tuberculosis</i> . Medically significant fungi- <i>Cryptococcus neoformans</i> , <i>Candida</i> spp. Medically significant parasites and viruses.	6 hrs	Up to K3	2

III	Unit-III: Laboratory Diagnosis of Infectious Diseases WIDAL, RPR, Haemaagglutination. VDRL. Immunodiffusion – Ouchterlony double immunodiffusion, Immuno-electrophoresis (rocket, counter current). ELISA, Radioimmune assay (RIA). Western blot analysis for HIV. Immunofluorescence – Fluorescent Antibody Technique (FAT). RT-PCR. Diagnostic methods for pathogenic fungi – KOH method and culture of organisms. Blood smear method. Concentration method for detection of faecal parasites. Applications of Molecular Diagnostics. Rapid and Automation methods in Diagnostic Microbiology.	6 hrs	Up to K3	3
IV	Unit-IV: Blood Cell Disorders Red cell Disorders - anaemia. Hypochromic anaemias. Megaloblastic anaemias and other macrocytic anaemias. Haemolytic anaemias. Genetic disorders of haemoglobin. White cell disorders – Leukytosis and leukopenia. Acute myeloid leukaemia. Chronic myeloid leukaemia, Acute lymphoblastic leukaemia, chronic lymphoid leukaemias, Hodgkin's lymphoma and Non-Hodgkin's lymphoma. Multiple myeloma and related disorders. Aplastic anaemia.	6 hrs	Up to K3	4
V	Unit-V: Hemostasis and Bleeding Disorders Platelets, blood coagulation and hemostasis. Bleeding disorders caused by vascular and platelet abnormalities. Coagulation disorders. Thrombosis. Haematological changes in systemic disease. Blood grouping. Blood transfusion.	6 hrs	Up to K4	5

**Total 30
Hours**

Books for Study

1. Mahon, C. R., Lehman, D.C. and Manuselis, G. (2014). Textbook of Diagnostic Microbiology. Elsevier Health Science, Netherland.
2. Sood Ramnik. (2015). Text book of Medical Laboratory Technology, 2nd edition, Jaypee Publications, Chennai.
3. Hoffbrand A.V, Moss P.H.A and Pettit J.E. (2010). Essential Hematology, 6th Ed., Wiley Blackwell, USA.

Books for Reference

1. Baron, Peterson and Fine gold. (1994). Bailey and Scotts Diagnostic Microbiology, 9th Ed, CV Mosby Publications, USA.
2. Atlas, Bernadette F. Rodak, Jacqueline H. Carr. (2013). Clinical Hematology. 4th Edition, Elsevier, Netherland.
3. Abdul Khader. (2003). Medical laboratory techniques, 1st edition. Frontline Publications, Hyderabad.

Web Resources

1. www.bloodline.net
2. www.bloodmed.com
3. www.hematologyatlas.com
4. <http://pathy.med.nagoya-u.ac.jp/atlas/doc/atlas.html>http://courseweb.edteched.uottawa.ca/Medicine_hematology/LectureTopics/Default.html

Rationale for Nature of the course

Diagnostic Microbiology and Haematology deals with roles of clinical microbiology laboratory, identification of pathogenic microbes thus enabling to explore the methods of identification and treatment modalities for various microbial infections and to understand haematological problems and their diagnosis.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Identify and devise the methods of identification pathogenic microbes and blood disorders. Understand the pathogenesis of various disease causing microbes and etiology of blood disorders. Explore the diagnostic importance of pathogenic microbes and blood disorders

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designers

1. Mr. P. Sasikumar

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Explain the methods of collection and processing of clinical specimens and presumptive identification of microorganisms	Up to K2
CLO2	Identify medically important microbes	Up to K3
CLO3	Demonstrate the basic principles of haematology and diagnostic microbiology instrumentation	Up to K3
CLO4	Explain the origin of blood cells and articulate the process of erythropoiesis and leukopoiesis as it relates to health and disease.	Up to K3
CLO5	Discuss the coagulation process and its role in maintaining hemostasis and to demonstrate current haematological procedures used to diagnose, monitor and evaluate disorders	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	1	1	-
CLO2	2	1	1	-	1
CLO3	2	2	-	1	1
CLO4	2	2	-	2	2
CLO5	3	-	2	2	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	-	2	1	1
CLO2	1	1	-	2	2
CLO3	1	2	1	-	2
CLO4	2	-	1	1	2
CLO5	1	1	2	-	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE) Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction to Diagnostic Microbiology	The laboratory role in diagnosis and infection control. Performance improvement in the Microbiology laboratory.		1	Chalk and Talk & Quiz
	Clinical specimen collection, transport and processing - blood, urine, sputum, pus and faeces. Microscopic examination of materials from infected sites.		2	
	Use of colony morphology for the presumptive identification of microorganisms. Biochemical identification of Gram-Negative bacteria.		2	
	Emerging and Re-emerging microbial diseases. Nosocomial infections.		1	
II Laboratory Identification of Significant Isolates	Laboratory identification of bacteria - <i>Staphylococcus</i> , <i>Streptococcus</i> , <i>Neisseria</i> , <i>Haemophilus</i> , <i>Salmonella</i> and <i>Vibrio</i> .		2	Chalk and Talk & Quiz
	Anaerobes of Clinical Importance. The Spirochetes.		1	
	<i>Chlamydia</i> , <i>Rickettsia</i> , <i>Mycoplasma</i> , <i>Mycobacterium tuberculosis</i> .		1	
	Medically significant fungi, parasites and viruses.		2	

III Laboratory Diagnosis of Infectious Diseases	WIDAL, RPR, Haemaagglutination. VDRL.Immunodiffusion – Ouchterlony double immunodiffusion, Immunoelctrophoresis (rocket, counter current).		2	Chalk and Talk &PPT& Quiz
	ELISA, Radioimmune assay (RIA). Western blot analysisfor HIV. Immunoflorescence – Fluorescent Antibody Technique (FAT). RT-PCR.		2	
	Diagnostic methods for pathogenic fungi – KOH method and culture of organisms. Blood smear method. Concentration method for detection of faecal parasites. Applications of Molecular Diagnostics. Rapid and Automation methods in Diagnostic Microbiology.		2	
IV Blood Cell Disorders	Red cell Disorders - anaemia. Hypochromic anaemias. Megaloblastic anaemias and other macrocytic anaemias. Haemolytic anaemias. Genetic disorders of haemoglobin.		2	PPT & Chalk and Talk& Quiz
	White cell disorders – Leukytosis and leukotopenia. Acute myeloid leukaemia. Chronic myeloid leukaemia, Acute lymphoblastic leukaemia, chronic lymphoid leukaemias.		2	
	Hodgkin’s lymphoma and Non-Hodgkin’s lymphoma. Multiple myeloma and related disorders. Aplastic anaemia.		2	
V Hemostasis and Bleeding Disorders	Platelets, blood coagulation and hemostasis.		2	Assign ment &PPT
	Bleeding disorders caused by vascular and plateletabnormalities.		2	
	Coagulation disorders. Thrombosis. Haematological changes in systemic disease. Blood grouping. Blood transfusion.		2	
Total		30 Hrs		

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major core7	20U5RMC7	Environmental Microbiology	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To understand the soil characteristics and factors affecting microbial population
- To learn the role of microbes in different biogeochemical cycles
- To gain basic knowledge on interactions of microbes in environment
- To know the microbial analysis of water and air
- To acquire knowledge on bioremediation and microbial leaching

Unit	Description	Hours	K-Level	CLO
I	Unit-I: Introduction to soil Microbiology Types and significance of soil microbes -Bacteria, fungi, actinomycetes and algae. Factors affecting microbial population. Aquatic Environment: Microflora of fresh water and marine habitats. Atmosphere: Aeromicroflora and dispersal of microbes. Animal Environment: Microbes in/on human body (Microbiomics) and animal (ruminants) body. Extreme Habitats: Extremophiles: Microbes thriving at high and low temperatures, pH, high hydrostatic and osmotic pressures, salinity, and low nutrient levels.	15hrs	Up to K2	1
II	Unit-II: Biogeochemical cycles and Biofertilizers Carbon, phosphorus, nitrogen, hydrogen, oxygen and sulfur. Biological nitrogen fixation. Biofertilizers– <i>Rhizobium</i> and <i>Azotobacter</i> , Cyanobacteria – Mass multiplication.	15 hrs	Up to K3	2
III	Unit-III: Microbial interactions Positive and negative interactions, neutralism, commensalism, synergism, mutualism, ammensalism, competition, parasitism and predation. Interaction of microbes with plants – Rhizosphere and Mycorrhizae.	15 hrs	Up to K3	3

IV	Unit-IV: Microbiology of Air and Water Aeromicrobial pathways – Enumeration of microbes (Bacteria, Fungi, Actinomycetes) from air – Air sampling devices – Air sanitation. Microbiology of water- Potability of water quality – Indicator organisms – Water purification – Waterborne diseases – Typhoid and Amoebic dysentery and their control measures.	15 hrs	Up to K3	4
V	Unit-V: Bioremediation Bioremediation principle and processes: Biosorption, Bioaccumulation, Bioconversion, Biotransformation, Bioleaching, Biodegradation, Detoxification, Activation, Acclimatization and Co- metabolism, strategies and techniques of bioremediation: <i>in situ</i> and <i>ex situ</i> , bioremediation of contaminated soils and aquifers, bioremediation of oil pollutants eg., Alaska oil spills. bioremediation of pesticides-DDT, endosulfan. Biodegradation of heavy metals- mercury and lead. Bioleaching -copper and uranium.	15 hrs	Up to K4	5

Total 75 Hours

Books for Study

1. Atlas, R.A. and Bartha, R. (2000). Microbial Ecology. Fundamentals and Application, Benjamin Cummings, New York.
2. Mara. D and Horan. N. (2003). The Handbook of Water and Waste Water Microbiology. Academic. Press, California.
3. Clescri, L.S., Greenberk, A.E. and Eaton, A.D. (1998). Standard Methods for Examination of Water and Waste Water, 20th Edition, American Public Health Association, USA

Books for Reference

1. Rangasami G and Bagyaraj D.J.(1993). Agricultural Microbiology , Prentice-Hall publications.
2. Alexander. (1997). Introduction to soil Microbiology. John Wiley and Sons.N.Y.
3. Subba Rao, N.S. (1995) .Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
4. Prescott L.M, Harley J.P. and Klein D.A.,(2006). Microbiology , McGraw Hill Publishers.
5. Madigan M.T., Martinko J.M. & Brock P.J.(1997). Biology of Microorganisms , Prentice-Hall Inc., US
6. Kanika Sharma, (2011). Textbook of Microbiology – Tools and Techniques. 1st Edition, Ane Books Pvt. Ltd., New Delhi.

Web Resources

1. www.highveld.com/microbiology/environmentalmicrobiology.
2. www.sfam.org.uk/en/journals/environmentalmicrobiology.cfm
3. https://www.researchgate.net/publication/23379500_Introduction_to_Environmental_Microbiology

Rationale for Nature of the course

This course study makes students to understand how microbes interact with the environment and each other, including their effects on the landscape, the spread of viruses and bacteria, the

distribution of algae, fungi and parasitical organisms and the associated implications for human health and the environment.

Activities having direct impact on Skill development/Employability / Entrepreneurship

A career in Environmental Microbiology may work for private companies in the pharmaceutical industry, agricultural, petroleum, environmental remediation, or waste management sectors. They may also work for the government at agencies like the Environmental Protection Agency.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos, Assignment and quiz

Course designers 1.Dr.N.PanneerSelvam

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Describe the role of microorganisms in soil	Up to K2
CLO2	Interpret the role of microbes in biogeochemical cycles	Up to K3
CLO3	Summarize the relationship between microbial interaction with plants	Up to K3
CLO4	Analyze the air and water quality	Up to K3
CLO5	Explain bioremediation and microbial leaching process	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	1	1	1
CLO2	2	1	1	1	-
CLO3	2	2	-	1	1
CLO4	2	2	1	2	2
CLO5	3	2	2	2	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	1	2	1	1
CLO2	1	1	1	2	2
CLO3	-	2	1	1	2
CLO4	2	2	1	-	2
CLO5	1	1	2	3	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K 3	2	K3 & K3	1	K3	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 3	2	K3 & K3	1	K3	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K3 & K3	1	K3	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K4 & K4	1	K4	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of. Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction to soil Microbiology	Types and significance of soil microbes. Bacteria, fungi, actinomycetes and algae. Factors affecting microbial population.		5	Chalk and Talk, Quiz
	Aquatic Environment: Microflora of fresh water andmarine habitats. Atmosphere: Aeromicroflora and dispersal of microbes.		5	

	Animal Environment: Microbes in/on human body (Microbiomics) and animal (ruminants) body. ExtremeHabitats: Extremophiles: Microbes thriving at high andlow temperatures, pH, high hydrostatic and osmotic pressures, salinity, and low nutrient levels.		5	
II Biogeochemical cycle and Biofertilizers	Carbon, phosphorus, nitrogen, hydrogen and oxygenand sulphur.		5	Chalk and Talk, Quiz
	Biological nitrogen fixation		4	
	Biofertilizer– <i>Rhizobium</i> and <i>Azotobacter</i>		3	
	Cyanobacteria – Mass multiplication		3	
III Microbial interaction	Positive and negative interactions, neutralism, commensalism, synergism, mutualism.		5	Chalk and Talk & PPT, Quiz
	Ammensalism, competition, parasitism and predation.		5	
	Interaction of microbes with plants – Rhizosphere and Mycorrhizae.		5	
IV Microbiology of Air and Water	Aeromicrobial pathways – Enumeration of microbes (Bacteria, Fungi, Actinomycetes) from air – Air sampling devices – Air sanitation.		5	PPT , Quiz
	Microbiology of water- Potability of water quality – Indicator organisms		5	
	Water purification – Waterborne diseases – Typhoidand Amoebic dysentery and their control measures.		5	
V Bioremediation	Bioremediation principle and processes: Biosorption, Bioaccumulation, Bioconversion, Biotransformation, Bioleaching, Biodegradation, Detoxification, Activation, Acclimatization and Co-metabolism, strategies		5	PPT & Chalk and Talk, Assignment
	Techniques of bioremediation: <i>in situ</i> and <i>ex situ</i> , bioremediation of contaminated soils and aquifers, bioremediation of oil pollutants eg., Alaska oil spills.		5	
	Bioremediation of pesticides-DDT, endosulfan.		5	
	Biodegradation of heavy metals-mercury and lead. Bioleaching -copper and uranium.			
Total		75 Hrs		

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major core 8	20U5RMC8	Medical Microbiology	5	5	25	75	100

Nature of Course			
Knowledge and skill	✓		Employability oriented
Skill oriented			Entrepreneurship oriented

Course Objectives:

- To learn basics of infection and the epidemiology of infectious diseases.
- To understand the morphology, pathogenicity and laboratory diagnosis of Gram positive and negative cocci
- To study the morphology, pathogenicity and laboratory diagnosis of Gram positive and negative rods
- To study the morphology, life cycle and pathogenesis of viruses
- To acquire basic knowledge about the pathogenicity and laboratory diagnosis of fungal and protozoan pathogens.

Unit	Description	Hours	K-Level	CLO
I	Unit- I : Infections - sources of infections Normal microbial flora of human body; Host Pathogen relationships. Infections – Sources of infections – Types of infections – Methods of infections – Definitions: Epidemic, Pandemic, Endemic diseases, Nosocomial infections – Epidemiology of Infectious diseases, Infectious diseases cycle – Investigation of epidemics – Control of epidemics.	15 hrs	Up to K2	1
II	Unit- II : Bacterial infections- Cocci Morphology, Cultural characteristics, Pathogenicity and laboratory diagnosis- Gram positive cocci - <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Pneumococcus</i> , <i>Enterococcus faecalis</i> . Gram negative cocci <i>Neisseria gonorrhea</i> and <i>Neisseria meningitides</i>	15 hrs	Up to K3	2
III	Unit- III : Bacterial infections- Bacilli Morphology, Cultural characteristics, Pathogenicity and laboratory diagnosis - Gram positive organisms - <i>Bacillus anthracis</i> , <i>Corynebacterium diphtheriae</i> , <i>Clostridium botulinum</i> , <i>Clostridium tetani</i> , <i>Listeria monocytogenes</i> . <i>Hemophilus influenza</i> , <i>Helicobacter pylori</i> . Gram negative organisms <i>Escherichia coli</i> , <i>Klebsiella</i> , <i>Salmonella</i> , <i>Shigella</i> , <i>Pseudomonas</i> , <i>Vibrio cholera</i> , <i>Mycobacterium tuberculosis</i> , <i>Treponema pallidum</i> , <i>Leptospira</i> .	15 hrs	Up to K3	3

IV	Unit- IV : Viral diseases Causative agent, mode of transmission, Pathogenesis, Laboratory diagnosis, and prophylaxis of viral infections of <i>Hepatitis (A, B and C)</i> , <i>Herpes</i> , <i>HIV</i> , <i>Polio</i> , <i>Rabies</i> , <i>Influenza</i> , <i>AIDS</i> , <i>SARS</i> , <i>Ebola virus</i> and <i>SARS-CoV-2 (Coronavirus disease - Covid – 19)</i> .	15 hrs	Up to K3	4
V	Unit- V : Medical Mycology and Protozoology Causative agent, mode of transmission, Pathogenesis, Laboratory diagnosis, and prophylaxis of fungal and protozoan disease: Superficial (<i>Black and White Piedra</i>) Cutaneous mycoses (<i>Dermatophytosis</i>), Sub cutaneous (<i>Mycetoma</i>), systemic mycoses (<i>Histoplasmosis</i>), opportunistic mycoses (<i>Mucormycosis</i>). Life cycle, diagnosis and treatment of following protozoa – <i>Giardiasis intestinalis</i> , <i>Leishmania tropica</i> , <i>Trypanosoma brucei</i>	15 hrs	Up to K4	5

Total 75 Hours

Books for Study

1. Ananthanarayanan R and CK Jayaram Panicker, (2017). Textbook of Microbiology, 10th Ed. Orient Longman, London.
2. David Greenwood, Richard C B Slack, Michael R. Barer, Will L Irving, (2012). Medical Microbiology, 18th Ed. Elsevier Ltd., Amsterdam.
3. Chatterjee K D. (2016). Parasitology, Protozoology & Helminthology. 13th Edition, CBS publishers and distributors pvt. Ltd., India.

Books for Reference

1. Mackie and McCartney. (1994). Medical Microbiology, 14th Ed. Churchill Livingstone, Elsevier, Netherland.
2. Baron, Peterson and Fine gold. (1994). Bailey and Scotts Diagnostic Microbiology, 9th Ed, CVMosby Publications, USA.
3. Jawetz E Melnic JL and Adelberg EA, (1998). Review of Medical Microbiology Lange Medical Publications, USA.
4. Monica Cheesbrough (2003). District Laboratory Practice in Tropical Countries. Part 1 & 2 Low-Price edition, Cambridge University Press.
5. Chandler, A. C. & Read. C. P. (1961). Introduction to Parasitology, 10th ed. John Wiley & Sons Inc., New York.
6. Hati, A. K. (2001). Medical Parasitology. Allied Book Agency, Kolkata.

Web Resources

1. <https://www.youtube.com/watch?v=IBX3jj2uUjo2>
2. <https://www.youtube.com/watch?v=MZyW3V8F7zY3>
3. https://www.youtube.com/watch?v=b8BD_3IWx_A
4. <https://study.com/academy/lesson/what-is-streptococcus-pyogenes5>
5. <https://www.youtube.com/watch?v=thBZPXcGtmM>

Rationale for Nature of the course

This paper gives students a broad perception of epidemiology, transmission, control and treatment of bacterial, fungal, viral and parasitic diseases.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Illustrate the role of microbes in human health. Emphasizes the etiology, mode of transmission, pathogenesis, diagnosis, prevention and treatment of diseases caused by microbes. Health care professionals are employed by national, state and local governments and can work for international agencies such as the World Health Organization.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designers

1.Dr.P.N.Rajarajan

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Define the concept of infection, types and infectious disease process	Up to K2
CLO2	Classify the morphology, cultural characteristics, and pathogenesis of Gram positive and negative cocci	Up to K3
CLO3	Identify and classify the gram positive and negative rods	Up to K3
CLO4	Infer the morphology, cultural characteristics, and pathogenesis of viruses	Up to K3
CLO5	Gain the basic knowledge about fungal and parasitic infections	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	-	1	1	-	1
CLO2	2	1	1	1	1
CLO3	2	-	-	1	1
CLO4	-	2	1	2	2
CLO5	3	2	2	2	-

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	1	2	1	-
CLO2	1	-	1	2	2
CLO3	-	2	1	-	2
CLO4	2	2	1	1	2
CLO5	1	1	2	3	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Infections-sources of infections	Normal microbial flora of human body; Host Pathogen relationships.		4	Chalk and Talk & Quiz
	Infections – Sources of infections – Types of infections – Methods of infections		3	
	Definitions : Epidemic, Pandemic, Endemic diseases, Nosocomial infections – Epidemiology of Infectious diseases,		5	
	Infectious diseases cycle – Investigation of epidemics – Control of epidemics.		3	

II Bacterial infections- Cocci	Morphology, Cultural characteristics, Pathogenicity and laboratory diagnosis- Gram positive cocci - <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> ,		5	Chalk and Talk & Quiz
	<i>Pneumococcus</i> , <i>Enterococcus faecalis</i> .		4	
	Gram negative cocci <i>Neisseria gonorrhea</i>		3	
	<i>Neisseria meningitidis</i>		3	
III Bacterial infections- Bacilli	Morphology, Cultural characteristics, Pathogenicity and laboratory diagnosis - Gram positive organisms - <i>Bacillus anthracis</i> , <i>Corynebacterium diphtheriae</i> ,		5	Chalk and Talk , PPT & Quiz
	<i>Clostridium botulinum</i> , <i>Clostridium tetani</i> , <i>Listeria monocytogenes</i> . <i>Hemophilus influenza</i> , <i>Helicobacter pylori</i> .		5	
	Gram negative organisms <i>Escherichia coli</i> , <i>Klebsiella</i> , <i>Salmonella</i> , <i>Shigella</i> , <i>Pseudomonas</i> , <i>Vibrio cholera</i> , <i>Mycobacterium tuberculosis</i> , <i>Treponema pallidum</i> , <i>Leptospira</i> .		5	
IV Viral diseases	Causative agent, mode of transmission, Pathogenesis, Laboratory diagnosis, and prophylaxis of viral infections of <i>Hepatitis (A, B & C)</i> . <i>Herpes</i> ,		6	PPT & Quiz
	<i>HIV</i> , <i>Polio</i> , <i>Rabies</i> , <i>Influenza</i> , <i>AIDS</i> , <i>SARS</i> ,		5	
	<i>Ebola virus</i> and <i>Covid – 19</i>		4	
V Medical Mycology and Protozoology	Causative agent, mode of transmission, Pathogenesis, Laboratory diagnosis, and prophylaxis of fungal and protozoan disease: Superficial (<i>Black and White Piedra</i>)		5	PPT & Chalk, Talk & Assignment
	Cutaneous mycoses (<i>Dermatophytosis</i>), Sub cutaneous (<i>Mycetoma</i>), systemic mycoses (<i>Histoplasmosis</i>), opportunistic mycoses (<i>Mucormycosis</i>).		5	
	Life cycle, diagnosis and treatment of following protozoa – <i>Giardiasis intestinalis</i> , <i>Leishmania tropica</i> , <i>Trypanosoma brucei</i>		5	
Total			75 Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Core – 9	20U5RMC9	Microbial Genetics	5	5	25	75	100

Nature of Course

Knowledge and skill	✓		Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To comprehend the history, genetics of bacteria and recombination.
- To gain knowledge on types of mutations and repair mechanisms.
- To know the mechanism of genetic transfer in microbes.
- To understand phage biology and types of transduction.
- To learn about regulation of gene expression.

Unit	Description	Hours	K-level	CLO
I	Unit-I History of microbial genetics History of microbial genetics-Mutations and genetic analysis-terms used in genetics-useful phenotypes in bacterial and phage genetics-Experiment of Luria and Delbruck. Newcombe-Isolation of Auxotrophic mutants-positive and negative selection of mutants. Complementation-allelism and cis/trans tests. DNA recombination-homologous, site specific recombination and nonhomologous end joining.	15Hrs	Up to K2	1
II	Unit-II Mutations and repair mechanisms Mutations- spontaneous mutations (tautomerism, de-purination, de-amination, slipped strand mispairing). Induced mutations-mutagens- physical and chemical mutagens. Types of mutations-point, transition, transversion, frame shift, silent, lethal mutations, inversion and deletion, null mutation, mis-sense and non-sense, reversion of mutations. DNA damage and repair mechanisms-direct, excision and methyl mediated mismatch, recombinational and SOS repair. Diseases caused due to mutation- sickle cell anaemia and cystic fibrosis.	15Hrs	Up to K3	2

III	Unit-III Mechanism of genetic exchange Prokaryotic gene transfer mechanism- Bacterial conjugation – F Factor, F+, F- Hfr, F' strains. Genetic mapping with Hfr crosses. Complementation test using F-prime factors-conjugation in <i>Streptomyces sp.</i> and role of pheromones in plasmid transfer in <i>Enterococcus faecalis</i> . Transformation: Definition -mechanism of DNA uptake in <i>E.coli.</i> and <i>Haemophilus sp.</i> Plasmid-transformation, competence induction. Mechanism of transposition -Transposons – Insertion sequences and composite transposons, phages as transposons, replicative, non-replicative and conservative transposition.	15Hrs	Up to K3	3
IV	Unit-IV Phage biology and Transduction Phage biology : virulent and temperate bacteriophages (T4, Lambda, P1) Stages in the lytic and lysogenic life cycle of a phage, properties of a phage infected bacterial culture, immunity to infection, prophage integration, induction & prophage excision, repressor, structure of the operator and binding of the repressor and the <i>cro</i> product, decision between the lytic and lysogenic cycles, transducing phages, phage crosses, mapping of bacterial markers. Co-transduction. Gene expression during lambda lytic cycle and lysogeny. Transduction- generalized and specialized transduction.	15Hrs	Up to K3	4
V	Unit-V Regulation of gene expression Regulation of gene expression in prokaryotes. Introduction to operon concept, co-ordinated control of structural genes, stringent response, catabolite repression, instability of bacterial RNA, positive and negative regulation in <i>E.coli</i> - lac operon, ara operon, inducers and repressors, regulation by attenuation of trp operon	15Hrs	Up to K4	5

Total 75 Hours

Books for Study

1. Larry Snyder and Wendy Champness. (2007). Molecular Genetics of Bacteria, 3rd edition, ASM press, USA.
2. Moat, A.G., Foster, J.W. and Spector, M.P. (2002). Microbial Physiology, 4th Ed., Wiley Liss. Inc., New York.
3. Freifelder, D., Malacinski, G.M. (1987). Essentials of Molecular Biology John and Bartlett Publishers, London.

Books for Reference

1. J. W. Dale, (1994). Molecular Genetics of Bacteria. John Wiley and Sons, USA.
2. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, (1989). J.D., Molecular Biology of The Cell, 2nd ed., Garland Publishing, Inc., New York.
3. Darnell, J., Lodish, H., Baltimore, D., (1990). Molecular Cell Biology Scientific American Books, New York.
4. Watson, Baker, Bell, Gann, Levine, Losick. (2004). Molecular biology of the gene. 5th ed. Pears education, India.

Web Resources

1. <https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/microbial-genetics>
2. <https://www.onlinebiologynotes.com/repair-mechanism-of-mutation/>

3. <https://www.ncbi.nlm.nih.gov/books/NBK7908/>
4. <https://www.nature.com/scitable/definition/transduction-prokaryotes-292/>
5. <https://courses.lumenlearning.com/suny-wmopen-biology1/chapter/regulation-of-gene-expression/>

Rationale for Nature of the course

The purpose of this course is to share the unique knowledge of mutagenesis, adaptation and genetics. Gene transfer and its mechanism: transformation, transduction and lysogeny, conjugation, expression and regulation of genes.

Activities having direct impact on Skill development/Employability / Entrepreneurship

- Sound understanding of the core principles, paradigms and unique aspects of microbial genetics
- Familiarity with historically important, contemporary, and state-of-the-art research techniques used in microbial genetics
- Development of skills in critical thinking, integration/synthesis of concepts and ideas and scientific problem-solving

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designers:

Dr. K.Rajeswari

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO1	Outline the history of genetics, bacterial inheritance and recombination.	Up to K2
CLO2	Explain the process involved in genetic changes and mutations	Up to K3
CLO3	Perceive and distinguish various gene transfer mechanisms.	Up to K3
CLO4	Summarize the features of phages of genetical significance.	Up to K3
CLO5	Rationalize the bacterial operon concepts.	Up to K4

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	3	2	2
CLO2	-	2	3	2	2
CLO3	2	3	-	2	3
CLO4	2	2	2	2	2
CLO5	3	2	3	3	-

Advance application-3

Intermediate level-2

Basic level-1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	-	2	2	2	3
CLO2	2	2	2	3	2
CLO3	2	2	-	2	3
CLO4	3	2	2	2	2
CLO5	3	3	3	3	-

Advance application–3

Intermediate level–2

Basic level–1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	SectionD (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)Blue Print Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either /or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2– Basic understanding of facts and stating main ideas with general answersK3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I History of microbial genetics	History of microbial genetics-Mutations and genetic analysis-terms used in genetics-useful phenotypes in bacterial and phage genetics-Experiment of Luria and Delbruck.		5	Chalk and Talk & Quiz
	Newcombe-Isolation of Auxotrophic mutants-positive and negative selection of mutants. Complementation-allelism and cis/trans tests.		5	
	DNA recombination-homologous, site specific recombination and nonhomologous end joining.		5	
II Mutations and repair mechanisms	Mutations- spontaneous mutations (tautomerism, de- purination, de-amination, slipped strand mispairing).		2	Chalk and Talk & Quiz
	Induced mutations-mutagens- physical and chemical mutagens.		1	
	Types of mutations- point, transition, transversion, frame shift, silent, lethal mutations, inversion and deletion, null mutation, mis-sense and non-sense, reversion of mutations.		6	
	DNA damage and repair mechanisms-direct, excision and methyl mediated mismatch, recombinational and SOS repair.		5	
	Diseases caused due to mutation- sickle cell anaemia and cystic fibrosis.		4	
III Mechanism of genetic exchange	Prokaryotic gene transfer mechanism- Bacterial conjugation – F Factor, F+, F- Hfr, F' strains. Genetic mapping with Hfr crosses.		3	Chalk and Talk, PPT & Quiz
	Complementation test using F-prime factors-conjugation in <i>Streptomyces sp.</i> and role of pheromones in plasmid transfer in <i>Enterococcus faecalis</i> .		4	
	Transformation: Definition -mechanism of DNA uptake in <i>E.coli.</i> and <i>Haemophilus sp.</i> Plasmid-transformation, competence induction.		4	
	Mechanism of transposition -Transposons – Insertion sequences and composite transposons, phages as transposons, replicative, non-replicative and conservative transposition.		4	

IV Phage biology and Transduction	Phage biology : virulent and temperate bacteriophages (T4,Lambda, P1) stages in the lytic and lysogenic life cycle of a phage.		4	Chalk and Talk, PPT & Quiz
	Properties of a phage infected bacterial culture, immunity to infection, prophage integration, induction & prophage excision, repressor, structure of the operator and binding of the repressor and the <i>cro</i> product, decision between the lytic and lysogenic cycles.		4	
	Transducing phages, phage crosses, mapping of bacterial markers. Co-transduction. Gene expression during lambdalytic cycle and lysogeny.		4	
	Transduction- Generalized and Specialized transduction.		3	
V Regulation of gene expression	Regulation of gene expression in prokaryotes. Introduction to operon concept, co-ordinated control of structural genes, stringent response, catabolite repression, instability of bacterial RNA.		4	PPT & Assignment
	Positive and negative regulation in <i>E.coli</i> - <i>lac</i> operon		4	
	Positive and negative regulation in <i>E.coli</i> - <i>ara</i> operon, inducers and repressors.		4	
	Regulation by attenuation of <i>trp</i> operon.		3	
Total			75 Hours	

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Practical - V	20U5RMP5	Major Practical - 5	2	3	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To diagnose infectious diseases by using various qualitative and quantitative tests
- To analyse clinical specimens microscopically for the presence of parasites
- To know the blood collection process and normal cells/components of blood
- To understand the blood disorders, its lab diagnosis and various type of laboratory test
- To perform various laboratory tests related to diagnostic microbiology

S.No.	Experiments
1	Determination of VDRL by qualitative and quantitative method
2	Determination of ASO by qualitative method
3	Isolation and identification of microorganisms from urine sample (<i>E. coli</i> , <i>Proteus</i> , <i>Pseudomonas</i>)
4	Microscopic examination of stool for parasitic diseases- <i>Entamoeba histolytica</i> and <i>Giardia</i> .
5	Determination of Hemoglobin by Sahli's hemoglobinometer
6	Serodiagnosis of bacterial infection using WIDAL test.
7	Antimicrobial activity by well diffusion technique.
8	Preparation of blood smear for normal blood cells and malarial parasite
9	Determination of blood grouping and Rh typing by slide and tube method and Cross matching
10	Morphological examination of insect larvae of ticks and fleas

Books for Study

1. Bailey and Scott's., (1990). Diagnostic Microbiology, 8th edition. The C.V. Mosby Company, USA.
2. Abdul Khader, (2003), Medical laboratory techniques, 1st edition. Frontline Publications, Hyderabad.
3. Mukherjee.L.K(2017), Medical Laboratory Technology, Vol.1-3, 3rd edition, Tata Mcgraw Hill, India.

Books for Reference

1. Atlas, Bernadette F. Rodak, Jacqueline H. Carr, (2013). Clinical Hematology 4th Edition, Elsevier, Netherland.
2. Sood Ramnik, (2015), Text book of Medical Laboratory Technology, 2nd edition, Jaypee Publications, Chennai.
3. Monica Cheesbrough, (1985). Medical laboratory manual for tropical countries. Microbiology (ELBS). Tropical Health Technology, Butter worths, UK.

Web Resources

1. www.bloodline.net
2. www.bloodmed.com
3. www.hematologyatlas.com
4. <http://pathy.med.nagoya-u.ac.jp/atlas/doc/atlas.html>
5. http://courseweb.edteched.uottawa.ca/Medicine_hematology/LectureTopics/Default.html

Rationale for Nature of the course

Diagnostic Microbiology and Haematology deals with roles of clinical microbiology laboratory, identification of pathogenic microbes thus enabling to explore the methods of identification and treatment modalities for various microbial infections and to understand haematological problems and their diagnosis.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Identify and device the methods of identification pathogenic microbes and blood disorders. Diagnose the various disease causing microbes and etiology of blood disorders. Investigate the diagnostic importance of pathogenic microbes and blood disorders

Pedagogy

Individual and Group work, Lab visit, Screening of educational videos and quiz

Course designers

1. Mr. P. Sasikumar

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Interpret diagnosis of infectious diseases by using various qualitative and quantitative tests	Up to K2
CLO2	Analyse clinical specimens microscopically for the presence of parasites	Up to K3
CLO3	Perform the blood collection process and normal cells/components of blood	Up to K3
CLO4	Learn the differential diagnosis and appropriate diagnostic evaluation of common hematologic abnormalities	Up to K3
CLO5	Perform various laboratory tests of Diagnostic Microbiology	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	-	3	3	2	2
CLO2	2	-	3	-	3
CLO3	2	2	-	2	3
CLO4	2	2	3	2	2
CLO5	3	2	-	2	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	-	2	3	3
CLO2	2	2	-	2	2
CLO3	2	2	1	2	2
CLO4	2	2	-	3	2
CLO5	1	2	2	-	2

Advance application–3

Intermediate level –2

Basic level –1

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Core Practical - VI	20U5RMP6	Major Practical - 6	2	3	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To familiarize with soil microbiology techniques
- To understand the analytical techniques of quality control sector in microbiological industry
- To gain knowledge on genetic material
- To apply different statistical tools in presenting biological data.
- To familiarize students in applying bioinformatics tools in biomedical research

S.No.	Experiments
1	Enumeration of bacteria and fungi from soil, air
2	Isolation and screening of <i>Rhizobium</i> sp. from root nodules of legumes
3	Isolation, screening and analysis of phosphate solubilizing microorganisms from soil by pot inoculation method
4	Potability analysis of drinking water (MPN test)
5	Isolation and demonstration of genomic DNA and plasmid DNA from bacteria
6	Isolation of petite and auxotrophic mutants
7	Demonstration of gene transfer by transformation
8	Isolation of streptomycin resistant mutants using gradient plate technique
9	Analysis of biological data using statistical tools
10	Pair-wise, multiple sequence alignment and prediction of phylogenetic tree

Books for study

1. Aneja, K.R. (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, NewAge International Publishers, Chennai.
2. Cappuccino, J.H. and Sherman, N. (2007). Microbiology- A Lab Manual. 7th Edition. The Benjamin Publishing Company, Singapore.
3. Kannan, N. (1996). Laboratory Manual in General Microbiology. 1st Edition, Palani Paramount Publications, Tamil Nadu.

Books for Reference

1. Madigan, M.T. and Martinko, J.M. (2014). Brock Biology of Microorganisms. 14th Edition. PrenticeHall International Inc., USA.
2. Dubey, R.C. and Maheswari, D.K. (2004). Practical Microbiology 1st Edition, S.Chand & CompanyLtd., New Delhi.
3. Ratledge C & Kristiansen B.(2008). Basic Biotechnology 3rd Edition, Cambridge University Press,England.
4. Gunasekaran, P. (1995). Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers,New Delhi.
5. Malov, S.R. (1990). Experimental Techniques in Bacterial Genetics, Jones and Bartlett Publishers, Boston.
6. Claverie, J and C.Notredame (2003).Bioinformatics A beginner's guide.Wiley PublishingInc.India.

Web Resources

1. <https://www.biocourseware.com>
2. <https://www.microbiologyonline.com>
3. <https://www.ncbi.nlm.nih.gov/>
4. <https://www.youtube.com/watch?v=...>
5. <https://www.youtube.com/watch?v=...>

Rationale for Nature of the course

The course familiarizes different concepts in the field of applied biological science and agriculture and competence in the broad scientific theory and application of techniques associated with microbial genetics. Also provides hands on training on basic how bioinformatics tools can be utilized in biomedical research.

Activities having direct bearing on skill development/ employability/entrepreneurship

Technical skills on isolation and characterization of microbes will be helpful for screening and solving environmental problems – waste water treatment and bioremediation. Providing practical insight on microbial genetics techniques. Provides the basis for developing and applying computational methods to test biological hypotheses.

Pedagogy

Demonstration and practical session

Course designers:

1. Dr.P.N.Rajarajan

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Identify the role and interaction of microbes in soil	Up to K2
CLO2	Perform the role of microbes in the soil and their sampling	Up to K3
CLO3	Demonstrate gene transfer mechanisms and gene regulation	Up to K3
CLO4	Obtain analytical knowledge to apply various statistical tools	Up to K4
CLO5	Monitor life science division of software and pharmaceutical industry	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of course outcome with Programme outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	3	3	-
CLO2	-	3	2	3	2
CLO3	3	1	-	2	2
CLO4	3	3	3	3	3
CLO5	3	3	3	-	2

Advance application – 3, Intermediate level – 2, Basic level – 1.

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	3	-	3	2	2
CLO2	3	2	-	3	3
CLO3	-	2	2	-	2
CLO4	3	3	3	3	-
CLO5	3	2	2	2	2

Advance application – 3, Intermediate level – 2, Basic level – 1.

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Interdisciplinary	20U5RIDC	Bioeconomics	3	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

1. To introduce the basic concepts of bioeconomics
2. To give a broad perception of biobased resources and value chains
3. To equip with the distinguishing features among bioenergy and marine bioeconomy
4. To understand the recent advancements in Banking
5. To know the budgetary procedure and the Union Government

Course Learning Outcomes:

On successful completion of the programme, the students will be able to

1. Explain the basic concepts of bioeconomics, challenges, opportunities and regulations
2. Discuss a broad perception of biobased resources, value chain, innovative use of biomass and biological knowledge to provide food, feed and industrial products
3. Acquaint the distinguishing features among marine bioeconomy
4. Able to understand the advancements in banking
5. Capacity to know the budgetary procedure in India

Unit	Description	Hours	K-level	CLO
I	Unit-I : Introduction to Bioeconomics Bio-economics- Definition and Concept. Evolution and Development of Economics and Biology (Charles Darwin and the evolutionary paradigm). Biological adaptation in human society, sustainable bioeconomy. Indian bioeconomy - opportunities, challenges and regulations. Pros and cons of bioeconomy: the case of genetically modified foods.	12hrs	Up to K2	1

II	Unit-II : Biobased Resources Biobased resources and value chains. Processing of biobased resources, food security and healthy nutrition in the context of the bioeconomy. Biomass resource - use of biomass for the production and dynamic management of fossil fuel, biofuel and chemicals. The importance of biotechnology in bioeconomy	12 hrs	Up to K2	2
III	Unit-III : Bioenergy and Marine Bioeconomy Economics of bioenergy - Agricultural bioenergy, Algal bioenergy. Marine bioeconomics – uses and conservation of coral reefs, marine turtle, sea weed farming. Fisheries bioeconomy - Inherent characteristic of fish stocks. Economics of biodiversity.	12 hrs	Up to K2	3
IV	Unit- IV : Money and Banking Money – Functions – Methods of note issue – Banking – Types – Functions of Commercial Banks – Functions of Reserve Bank of India/Central Bank – Recent Advancements in Banking Sector: E-Banking, RTGS and NEFT, BHIM, GPay, Phone Pay, Paytm, Debit and Credit Card - Role of Banks in promoting Science – Impact of COVID-19 on Indian Economy.	12 hrs	Up to K2	1
V	Unit: V Budgetary Procedure Meaning of Budget - Importance of the Budget - Budgetary Procedure – Preparation of the Budget - Enactment of the Budget – The Voting of the Budget – Execution of the Budget - Meaning of Local Finance - Sources of Local Bodies - Meaning of Federal Finance – Principles of Federal Finance.	12hrs	Up to K2	1

Total 60 Hours

Books for Study

1. I. Sundar, Principles of bioeconomics, (2017). Vedams Books pvt limited, New Delhi
2. Iris Lewandowski, Bioeconomy shaping the transition to a sustainable , biobased economy, (2018). Springer
3. Koslowki Peter . Sociobiology and bioeconomics. (1999). Springer.
4. Mithani, D. M, Money, Banking, International Trade and Public Finance, ., (2020). Himalaya Publishing House, Mumbai.
5. Samkaran, S. Fiscal Economics, . (2020). Margham Publications, Chennai.

Books for Reference

1. Arrow, K., Bolin, B., Costanza, R., Dasgupta, P., Folke, C., Holling, C.S., Jansson, B.O., Levin, S., Maler, K.G., Perrings, C., Pimentel, D. (1995). Economic growth, carrying capacity, and the environment. *Ecological Economics* 15: 91-95.
2. Perman, R. (2003). *Natural Resource and Environmental Economics*. Pearson Education.
3. Singh, K. & Shishodia, A. (2007). *Environmental Economics: Theory and Applications*. Sage Publications.
4. Thomas, J.M. & Callan, S.J. (2007). *Environmental Economics*. Thomson Learning Inc. □
5. Tietenberg, T. 2004. *Environmental and Natural Resource Economics* (6th Edition). Pearson Education Pvt. Ltd.
6. Seth, M. L., . Money, Banking, International Trade and Public Finance, (2020). Lakshmi Narain Agarwal, Uttarpradesh.
6. Bhatia, H. L. Public Finance, (2020). Vikas Publishing House Pvt. Ltd., New Delhi.

Web Resources

1. <https://www.youtube.com/watch?v=2xvXkOMRTs4>
2. <https://www.youtube.com/watch?v=gqjmdWHzlhk>
3. <https://www.youtube.com/watch?v=1yix9wHmiTY>
4. https://www.youtube.com/watch?v=bYD_VpCDdbE
5. https://my.uopeople.edu/pluginfile.php/57436/mod_book/chapter/37370/book.wrightmoneybanking.optimized.complete.pdf

Rationale for Nature of the course

Understanding of the basic knowledge of bioeconomics to students so that they can explore entrepreneurship opportunities in the bio based industry. This course also serves interdisciplinary innovation in terms of sustainable bioeconomy

Activities having direct impact on Skill development/Employability / Entrepreneurship

- Students will be able to understand basic concept of Bioeconomics, challenges, opportunities& regulations
- Students will be able to understand advancements in banking and the budgetary procedure in India

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designers

1. Department of Microbiology
2. Department of Economics

Course Learning Outcomes (CLO)

	Course Learning Outcome <i>On successful completion of the programme, the students will be able to</i>	Knowledge Level
CLO1	Explain the basic concepts of bioeconomics, challenges, opportunities & regulations	Up to K2
CLO2	Discuss a broad perception of biobased resources, value chain, innovative use of biomass and biological knowledge to provide food, feed and industrial products	Up to K2
CLO3	Acquaint the distinguishing features among marine bioeconomy	Up to K2
CLO4	Able to understand the advancements in banking	Up to K2
CLO5	Capacity to know the budgetary procedure in India	Up to K2

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make inferences with evidences

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	3	-	3
CLO2	2	2	3	2	2
CLO3	-	3	3	2	3
CLO4	2	2	2	3	3
CLO5	3	3	3	3	-

Advance application–3

Intermediate level–2

Basic level–1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	-	2	2	2	-
CLO2	2	2	2	3	2
CLO3	2	2	2	2	3
CLO4	3	2	-	2	2
CLO5	3	3	3	3	2

Advance application–3

Intermediate level–2

Basic level–1

Learning Outcome Based Education & Assessment (LOBE)
Formative Exam – Blue Print (CIA I & II)
Articulation Mapping - K Levels with Courses Learning Outcomes (CLOs)

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
CLO x	Up to K2	2	K1	2	2(K2/K2)	2	K2
CLO y	Up to K2	1	K1	2	2(K2/K2)	1	K2
No. of Questions to be asked		3		4		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		6		14		20	

* CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels (CIA I & II)

Internal	K Levels	Section A Short Answers	Section B (Either or Choice)	Section C (Open Choice)	Total Marks	% of Mark without choice
CIA I	K1	6	-	-	6	9.38%
	K2	-	28	30	58	90.62%
Marks		6	28	30	64	100%
CIA II	K1	6	-	-	6	9.38%
	K2	-	28	30	58	90.62%
Marks		6	28	30	64	100%

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction to Bioeconomics	Bio-economics- Definition and Concept. Evolution and Development of Economics and Biology (Charles Darwin and the evolutionary paradigm).		3	Chalk and Talk
	Biological adaptation in human society, sustainable bioeconomy.		3	

	Indian bioeconomy - opportunities, challenges and regulations.		3	
	Pros and cons of bioeconomy: the case of genetically modified foods.		3	
II Biobased Resources	Biobased resources and value chains. Processing of biobased resources,		3	Chalk and Talk
	food security and healthy nutrition in the context of the bioeconomy.		3	
	Biomass resource - use of biomass for the production and dynamic management of fossil fuel,		3	
	biofuel and chemicals. The importance of biotechnology in bioeconomy		3	
III Bioenergy and Marine Bioeconomy	Economics of bioenergy - Agricultural bioenergy, Algal bioenergy.		4	Chalk and Talk & PPT
	Marine bioeconomics – uses and conservation of coral reefs, marine turtle		4	
	Sea weed farming. Fisheries bioeconomy - Inherent characteristic of fish stocks. Economics of biodiversity.		4	
IV Money and Banking	Money: Functions and Methods of note issue		3	Lecture Method, OOC
	Banking: Types, Functions of Commercial Banks and Functions of Reserve Bank of India/Central Bank		3	
	Recent Advancements in Banking Sector: E-Banking, RTGS and NEFT, BHIM, GPay, Phone Pay, Paytm, Debit and Credit Card		3	
	Role of Banks in Promoting Science and Impact of COVID-19 on Indian Economy.		3	
V Budgetary Procedure	Budget: Meaning and Importance		3	Lecture Method, PPT
	Budgetary Procedure, Preparation of the Budget, Enactment of the Budget The Voting of the Budget, Execution of the Budget		5	
	Meaning of Local Finance and Finances of Local Bodies, Meaning of Federal Finance and Sources of Revenue.		4	
	Total		60 Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Elective - I	20U5RME1	Parasitology and Entomology	2	3	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To introduce the basic concepts of parasitology and host-parasite relationship
- To give a broad perception of epidemiology, transmission, control and treatment of parasitic diseases
- To equip with the distinguishing features among cestodes, nematodes and trematodes
- To explore the diagnostic methods in parasitology
- To understand the significance of medical entomology

Unit	Description	Hours	K-level	CLO
I	Unit-I : Parasitism and host-parasite interactions Introduction- general characteristics and classification of parasites- host-parasite relationships. Sources of Infection. Modes of Infection. Pathogenesis. Immunity in parasitic infection. Immune evasion. Vaccination.	9 hrs	Up to K2	1
II	Unit-II : Protozoa and their medical significance General characteristics, Epidemiology, morphology, cultivation, lifecycle, mode of transmission, pathogenic mechanisms, clinical symptoms, lab diagnosis, treatment of Intestinal Amoebae (<i>Entamoeba histolytica</i>), Ciliated protozoa (<i>Balantidium coli</i>), Malarial parasite (<i>Plasmodium</i>), Tissue and Blood flagellates (<i>Trypanosoma cruzi</i> , <i>Leishmania donovani</i>)	9 hrs	Up to K3	2
III	Unit-III : Helminths and their medical significance Introduction to Helminthology. Classification, Morphology, life cycle, pathogenicity, clinical features, laboratory diagnosis and treatment: Cestodes – <i>Taenia solium</i> , <i>Taenia saginata</i> Trematodes – <i>Fasciola hepatica</i> , <i>Schistosoma haematobium</i> , Nematodes: <i>Ascaris lumbricoides</i> , <i>Wuchereria bancrofti</i>	9 hrs	Up to K3	3

IV	Unit-IV : Diagnostic Parasitology Laboratory techniques in Parasitology- Examination of faeces of ova and cyst, Wet mount, blood smears, concentration method, sedimentation methods- egg count- cultivation of protozoan parasites, Examination of biopsy material.	9 hrs	Up to K4	5
V	Unit-V : Medical Entomology Medical Entomology: Morphology, Life cycle, medical importance, Pathogenicity and Control: Ticks (Soft ticks and Hard ticks), Fleas (Sand fly and Black fly) and Mites (Scrub and Scabies).	9 hrs	Up to K4	5

Total 45 Hours

Books for Study

1. Subhas Chandra Parija (2004). Text book of Medical Parasitology. Second edition, All India Publishers and Distributors, Medical Books Publishers, New Delhi.
2. Jayaram Paniker CK (2004). Text book of Medical Parasitology. Fifth edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.
3. Ratan Lal Chhpujani and Rajesh Bhatia (2004). Essentials of Medical Microbiology. Third edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.

Books for Reference

1. Monica Cheesbrough (2003). District Laboratory Practice in Tropical Countries. Part 1 & 2 Low-Price edition, Cambridge University Press.
2. Gullen, P.J and Cranston, P.S, (2010). The Insects: An Outline of Entomology. 4th Edition, Blackwell Science, Ltd. UK
3. Chandler, A. C. & Read. C. P. (1961). Introduction to Parasitology, 10th ed. John Wiley & Sons Inc. USA
4. Hati, A. K. (2001). Medical Parasitology. Allied Book Agency, Kolkata

Web Resources

1. <http://tmp.wustl.edu/ParasitesOnWWW.html>
2. <https://dshs.texas.gov/lab/paraResources.shtm>
3. <https://www.jstor.org/stable/4462528>
4. <https://extension.entm.purdue.edu/publichealth/resources.html>

Rationale for Nature of the course

The paper gives students a broad perception of epidemiology, transmission, control and treatment of parasitic diseases, organisms living in the human body (the host) and the medical significance of host- parasite relationship.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Parasitology has become an established branch of Applied Zoology which has been able to integrate with other branches of sciences as well as social sciences in managing parasitic diseases world over. Health care professionals are employed by national, state and local governments and can work for international agencies such as the World Health Organization.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designers

1.Dr.P.N.Rajarajan

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Explain the basic concepts of parasitology and acquire the knowledge of host-parasite relationship	Up to K2
CLO2	Discuss a broad perception of epidemiology, transmission, control and treatment of parasitic disease	Up to K3
CLO3	Acquaint with the distinguishing features among cestodes, nematodes and trematodes	Up to K3
CLO4	Explore the diagnostic methods in parasitology	Up to K4
CLO5	Understand the significance of medical entomology and medically important insects	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	-	1	2	1	1
CLO2	3	1	1	1	3
CLO3	3	3	-	3	3
CLO4	3	2	3	2	-
CLO5	-	2	2	2	1

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	2	1	1	-
CLO2	-	3	2	3	2
CLO3	3	3	-	3	3
CLO4	3	3	1	1	-
CLO5	2	-	2	3	2

Advance application–3

Intermediate level –2

Basic level –1

Learning Outcome Based Education & Assessment (LOBE)Blue Print Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K3& K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 3	2	K3& K3	1	K2	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K 4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Parasitism and host-parasite interactions	Introduction- General characteristics and Classification of Parasitology		3	Chalk and Talk & Quiz
	Host-parasite relationships - Life cycle of parasites.		2	
	Sources of Infection. Modes of Infection. Pathogenesis.		2	
	Immunity i Parasitic Infection. Immune Evasion. nVaccination.		2	
II Protozoa and their medical significance	General characteristics , Epidemiology, morphology, cultivation, life cycle, mode of transmission, pathogenic mechanisms, clinical symptoms, lab diagnosis, treatment of Intestinal Amoebae (<i>Entamoeba histolytica</i>)		3	Chalk and Talk & Quiz
	Ciliated protozoa (<i>Balantidium coli</i>)		2	
	Malarial parasite (<i>Plasmodium</i>)		2	
	Tissue and Blood flagellates (<i>Trypanosoma cruzi</i> , <i>Leishmania donovani</i>)		2	
III Helminths and their medical significance	Introduction to Helminthology. Classification, , Morphology, life cycle, pathogenicity and clinical features, laboratory diagnosis and treatment for the following parasites: Cestodes – <i>Taenia solium</i> , <i>Taenia saginata</i>		3	Chalk and Talk, PPT & Quiz
	Trematodes – <i>Fasciola hepatica</i> , <i>Schistosoma haematobium</i>		3	
	Nematodes: <i>Ascaris lumbricoides</i> , <i>Wuchereria bancrofti</i>		3	

IV Diagnostic Parasitology	Medical entomology: Morphology, Life cycle, medical importance, Pathogenecity and Control of: Ticks (<i>Soft tick</i> and <i>Hard ticks</i>)		3	PPT & Quiz
	Fleas (<i>Sand fly</i> and <i>Black fly</i>)		3	
	Mites (<i>Scrub</i> and <i>Scabies</i>).		3	
V Medical Entomology	Laboratory techniques in Parasitology- Examination of faeces of ova and cyst,		3	PPT & Chalk and Talk & Assignment
	Wet mount, blood smears, concentration method, sedimentation methods- egg count-		3	
	cultivation of protozoan parasites, Examination of biopsymaterial		3	
Total		45 Hrs		

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Elective - I	20U5RME1	Introduction to Genomics	2	3	25	75	100

Nature of Course			
Knowledge and skill	✓		Employability oriented
Skill oriented	✓		Entrepreneurship oriented

Course Objectives:

- To familiarize students with genomic methods
- To encourage students to think on genomic scale
- To expose modern genomics methods and concepts
- To discover basic biology in the context of theoretical and applied genomics research
- To become proficient with basic web-based tools for analyzing genomics

Unit	Description	Hou rs	K- level	CLO
I	Unit I: Organization of genomes: Overview of prokaryotic and eukaryotic genomes- Human genome project: mapping strategies-Mitochondrial genome, nuclear genome, gene density, CpG islands-Gene families and super families- gene duplication, pseudogenes, repetitive DNA and transposable elements-Genome annotation: Chromosome structure, gene structure, and gene content- Genome investigation using “Next Generation Sequencing” - The basic forces of evolution: Mutation, recombination, mating, migration. Neutral evolution and drift, effective population size, coalescent theory.	9 Hrs	Up to K2	1
II	Unit II: Comparative Genomics: Conservation and diversity of genomes- Genome size and organization of genes- C-value, number of genes and complexity of genomes- Comparative genomics as an aid to gene mapping and study of human disease genes - Prediction of gene function using: Homology, context, structure, networks - Paleogenomics and synthetic genomics	9 Hrs	Up to K3	2
III	Unit III : Functional Genomics: Concepts of transcriptome and proteome- Microarray technology, 2D- electrophoresis, protein sequencing- Prediction, diversity and multiplicity of protein functions - Sequence homology and prediction of gene functions - epigenetics and metagenomics.	9Hrs	Up to K3	3

IV	Unit IV: Pharmacogenomics and Human Health: Concept of pharmacogenomics and pharmacogenetics- Genetic polymorphisms in drug metabolizing enzymes, drug targets, effects on drug response- Personalized medicine optimizing drug therapy- Gene chips: applications in disease profiles, drug target discovery, drug action and toxicity -recent technology developments; Target selection, Ligand (lead compound) design, optimization and analysis	9 Hrs	Up to K3	4
V	Unit V: Applications and tools involved: Construction of molecular phylogenetic trees, establishment of evolutionary relationship-molecular clock - Gene therapy- DNA based diagnosis of genetic diseases and pathogen detection (HIV etc.) - Genome editing -CRISPR system and its types - Overview of genomics databases, databanks, and genome browsers	9 Hrs	Up to K4	5

Total 45 Hours

Books for study:

1. T. A. Brown. (2006). Genomes III, Taylor and Francis, UK
2. S.B. Primrose and R. M. Twyman. (2006). Genomics: Application in Human Biology, 7th edition, Blackwell Publication. USA
3. A. M. Campbell and L. J. Heyer. (2007). Discovering Genomics, proteomics and Bioinformatics, CSHL Press, USA

Books for Reference:

1. S.M. Primrose, Twyman, and R.W. Old, (2006). Principle of Gene Manipulation & Genomics, Blackwell Science Inc. USA
2. B. Alberts, D. Bray, J. Lewis. (1983). Molecular Biology of the Cell -, Garland Pub. New York.

Web resources:

1. <https://www.nature.com/subjects/genomics>
2. <https://www.futurelearn.com/info/courses/the-genomics-era/0/steps/4911>
3. <https://www.frontiersin.org/articles/10.3389/fgene.2018.00575/full>
4. <https://www.youtube.com/watch?v=mmgIClg0Y1k>

Rationale for Nature of the course

This paper gives students a broad perception over genomes, techniques involved, structure and molecular prediction and applying various tools and techniques.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Illustrate the importance of genomes and its structure. Health care, Medical research, Pharma professionals are employed by governments and private institutions and industries and can work as researchers and scientists for the discovery of new medicine and vaccines.

Pedagogy

Chalk and talk, PPT, Quiz, assignment Group discussion, hands on software training, Seminar, Screening of educational videos and quiz.

Course designers

1. Dr. K. Kannan

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcome	KnowledgeLevel
CLO1	Distinguish the structure and organization of genomes	Up to K2
CLO2	Compare and Analysis the various genomes	Up to K3
CLO3	Know the functional role of the genomes	Up to K3
CLO4	Articulate the genes for drug design and therapy	Up to K3
CLO5	Explain different tools involved in genomics	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answersK3 –

Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	1	1	1	1	3
CLO2	1	1	1	2	2
CLO3	1	2	1	1	3
CLO4	2	2	2	1	2
CLO5	2	2	2	2	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	1	1	1
CLO2	1	1	1	1	1
CLO3	1	1	1	1	1
CLO4	1	2	2	2	2
CLO5	2	2	2	2	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

**Learning Outcome Based Education & Assessment (LOBE) Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Lesson Plan

Units	Description	Staff	Hours	Mode
I Organization of genomes	a) Overview of prokaryotic and eukaryotic genomes- Human genome project:mapping strategies-Mitochondrial genome, nuclear genome, gene density		2	Chalk and Talk
	b) CpG islands-Gene families and super families- gene duplication, pseudogenes, repetitive DNA and transposable elements		2	
	c) Genome annotation: Chromosome structure, gene structure, and gene content-Genome investigation using “Next Generation Sequencing”		2	
	d) The basic forces of evolution: Mutation, recombination, mating, migration.Neutral evolution and drift, effective population size, coalescent theory		3	

II Comparative Genomics	a) Conservation and diversity of genomes-Genome size and organization of genes		2	Chalk and Talk
	b) C-value, number of genes and complexityof genomes- Comparative genomics as an aid to gene mapping		2	
	c) Study of human disease genes - Predictionof gene function using: Homology, context, structure, networks		2	
	d) Paleogenomics and synthetic genomics		3	
III Functional Genomics	a) Concepts of transcriptome and proteome- Microarray technology		2	Chalk and Talk, & PPT
	b) 2D-electrophoresis, protein sequencing		2	
	c) Prediction, diversity and multiplicity of protein functions		2	
	d) Sequence homology and prediction of genefunctions, epigenetics and metagenomics		3	
IV Pharmacogenomics and Human Health	a) Concept of pharmacogenomics polymorphisms in drug metabolizing enzymes		2	PPT & Chalk and Talk
	b) drug targets, effects on drug response- Personalized medicine optimizing drugtherapy		2	
	c) Gene chips: applications in disease profiles, drug target discovery, drugaction and toxicity		2	
	d) Recent technology developments; Targetselection, Ligand (lead compound) design, optimization and analysis		3	
V Applications and tools involved	a) Construction of molecular phylogenetic trees, establishment of evolutionaryrelationship		2	PPT & Chalk and Talk, Assignment
	b) Molecular clock - Gene therapy- DNA based diagnosis of genetic diseases and pathogen detection (HIV etc.)		2	
	c) Genome editing - CRISPR system and its types		2	
	d) Overview of genomicsdatabases, databanks, and genome browsers		3	
Total			45 Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Skill based elective - IV	20U6RSM4	Entrepreneurship in Microbiology	2	2	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	✓

Course Objectives:

- To understand the concept of entrepreneurship and its development
- To impart basic skills required for a successful entrepreneur
- To learn the concepts of management such as planning, decision making, leadership, organization and authority
- To expertise in managing the start-up and to run an organization
- To explore the various entrepreneurial avenues in microbiology

Unit	Description	Hours	K-Level	CLO
I	Unit –I: Introduction to Entrepreneurship and Planning for a small business Introduction, Concept, Characteristics and Classification of entrepreneurs, Entrepreneurial scenario in India. Factors influencing entrepreneurship. Types of entrepreneurship- Women, Rural. Role of self-help group (SHG). Project- meaning identification, selection. Finance- need for financial planning, sources of finance and term loans. Marketing- concept- problems- market assessments, segmentation and marketing- “Mix Test” Commercialisation of the product.	6hrs	Up to K2	1
II	Unit –:II Entrepreneurial avenues in Food Microbiology Scope of dairy industry. Facilities required to set up a company dairy industry – choosing the location, infrastructure - equipment and their cost. Mandatory licences – Dairy farm licence FSSAI, and approval from government agencies. Personnel qualification, Packing, storage and marketing Standard operating procedures. Feed-back and follow-up.	6 hrs	Up to K3	2

III	Unit –:III Entrepreneurial avenues in Agricultural Microbiology Scope of Bio-fertilizers. Facilities required to set up a Bio-fertilizer company - area required, infrastructure - equipment and their cost. Mandatory licences - TNAU certificate, and approval from government agencies. Personnel qualification, Inoculum development and scale up. Mass production. Field efficacy studies -National Accreditation Board for Testing and Calibration Laboratories (NABL) standards. Packing and marketing. End user interaction,sales, feed-back and follow-up.	6hrs	Up toK4	3
IV	Unit –:IV Entrepreneurial avenues in Clinical and Diagnostic Microbiology Scope and need of clinical/diagnostic Microbiology laboratories. Facilities required for the set up of a clinical laboratory. Area required and infrastructure - equipment and their cost. Govt approval/licences. Personnel qualification. Interaction with physicians and their consensus. Standard operating procedures. Field efficacy studies -National Accreditation Board for Testing and Calibration Laboratories (NABL) standards. Ethics in clinical practice.	6 hrs	Up toK4	4
V	Unit –:V Entrepreneurial avenues in industrial Microbiology Facilities required to set up a Bio-gas plant - area required, infrastructure - equipment and their cost. Mandatory licences – National Dairy Development Board's (NDDB)orKhadi and Village Industries Commission (KVIC) State Office/ Regional Offices for installation of biogas plants under “New National Biogas and Organic Manure Programme (NNBOMP)” approval from government agencies. Mass production. Field efficacy studies. Packing and Marketing. End user interaction, sales, feed-back and follow-up.Case study- Vermicompost production	6hrs	Up toK3	5

Total - 30 hours

Books for study

1. Jayshree Suresh, (2003), Entrepreneurial Development, Margham Publication, India

Books for reference:

1. Ramachandran , (2008).Entrepreneurship Development, McGraw Hill, USA.
2. Katz ,(2021) Entrepreneurship Small Business, McGraw Hill, USA.
3. Byrd Megginson,(2006). Small Business Management An Entrepreneur’s Guidebook 7th ed, McGraw Hill, USA.
4. Fayolle A (2007). Entrepreneurship and new value creation. Cambridge, Cambridge University Press,UK.
5. Hougaard S. (2005). The business idea. Springer, Berlin.
6. Lowe R & S Mariott (2006) Enterprise: Entrepreneurship & Innovation. Burlington, ButterworthHeinemann, UK.
7. Léo-Paul Dana ,(2011).World Encyclopedia of Entrepreneurship, Edward Elgar publication, Cheltenham.

Web Resources

1. <https://www.biospace.com/article/microbiology-a-field-ripe-for-entrepreneurship/>
2. <https://sme.snu.edu.in/node/8161>
3. <https://www.zippia.com/microbiologist-jobs/skills/>
4. <https://biooekonomie.de/en/actors/portraits/microbiologist-entrepreneurial-vision>
5. https://www.researchgate.net/publication/339253998_A_Review_on_the_Effect_of_Bioscience_Entrepreneurship_Education_in_Economic_Development_in_Nigeria

Rationale for nature of the course

Entrepreneurial skills in Microbiology course will help to understand the concept of entrepreneurship and the objectives of Entrepreneurship Development. This field will impart basic understanding and skills required for a successful entrepreneur. The study of entrepreneurship development will enable the students to understand the basic concepts of management and entrepreneurships such as planning decision making, leadership, organizations and authority. This course will help the students to attain skills to manage the start- up and run an organization. This course will help the students to explore the various entrepreneurial avenues in Microbiology.

Activities having direct bearing on skill development/ employability/entrepreneurship

Entrepreneurial skills in Microbiology course will help to start a company and also help to become an entrepreneur.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Assignment, Screening of educational videos and quiz

Course designers

Dr.AshaKannan A.P

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Discuss the concept of entrepreneurship and its development	Up to K2
CLO2	Interpret the basic skills to become an entrepreneur	Up to K3
CLO3	Realize the concepts of management such as planning, decision making, leadership, organizations and authority	Up to K4
CLO4	Formulate the skills needed to manage the start-up and run an organization	Up to K4
CLO5	Designate the various entrepreneurial avenues in Microbiology	Up to K3

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	-	1	1	1
CLO2	1	1	1	1	-
CLO3	-	1	1	1	1
CLO4	1	2	2	-	2
CLO5	2	2	-	2	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	1	3	-	3
CLO2	1	-	1	2	2
CLO3	2	2	-	1	3
CLO4	2	2	2	-	2
CLO5	2	-	2	2	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	3	6	10	-	19	15.83	37.5%
K2	2	4	10	10	26	21.67	
K3	2	-	20	20	42	35.0	35%
K4	3	-	10	20	33	27.5	27.5%
Total Marks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Learning Outcome Based Education & Assessment (LOBE)Blue Print Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K3	2	K2 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K4	2	K3 & K4	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K3	2	K1& K1	1	K1	2 (K1&K1)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Lesson Plan

UNITS	DESCRIPTION	STAFF	HOURS	MODE
I Introduction to Entrepreneurship and Entrepreneurial development	Introduction, Concept, Characteristics and Classification of entrepreneurs, Entrepreneurial scene in India. Factors influencing entrepreneurship		2	Chalk and Talk PPT Quiz
	Identification-meaning of project-project identification, project selection. Finance-need for financial planning, sources of finance and term loans.		2	
	Marketing- concept- problems- market assessments segmentation and Marketing Mix Test- Commercialisation of the product.		2	
II Entrepreneurial avenues in Food Microbiology	Scope of dairy industry. Facilities required to set up a company dairy industry – choosing the location, infrastructure - equipment and their cost.		2	Chalk and Talk PPT Quiz
	Mandatory licences – Dairy farm licence FSSAI, and approval from government agencies.		2	
	Personnel qualification, Packing, storage and marketing Standard operating procedures. Feed-back and follow-up.		2	
III Entrepreneurial avenues in Agricultural Microbiology	Scope of Bio-fertilizers. Facilities required to set up a Bio-fertilizer company - area required, infrastructure - equipment and their cost. Mandatory licences - TNAU certificate, and approval from government agencies.		2	Chalk and Talk & PPT Quiz
	Personnel qualification, Inoculum development and scale up. Mass production. Field efficacy studies -National Accreditation Board for Testing and Calibration Laboratories (NABL) standards.		2	
	Packing and marketing. End user interaction, sales, feed-back and follow-up.		2	
IV Entrepreneurial avenues in Clinical and Diagnostic Microbiology	Scope and need of clinical/diagnostic Microbiology laboratories.		1	PPT & Chalk and Talk Quiz
	Facilities required for the set up of a clinical laboratory. Area required and infrastructure - equipment and their cost. Govt approval/licences.		1	

	Personnel qualification. Interaction with physicians and their consensus. Standard operating procedures.		1	
	Field efficacy studies -National Accreditation Board for Testing and Calibration Laboratories(NABL) standards. Ethics in clinical practice.		3	
V Entrepreneurship in Industrial Microbiology- Bio- Gas	Facilities required to set up a Bio- waste plant - area required, infrastructure - equipment and their cost. Inoculum development and scale up.		2	PPT &Chalk and Talk Assignment
	Mandatory licences –National Dairy Development Board's (NDDB) or Khadi and Village Industries Commission (KVIC) State Office/ Regional Offices for installation of biogas plants under “New National Biogas and Organic Manure Programme (NNBOMP)” approval from government agencies.		1	
	Staff recruitment - BSc Agri/ Diploma in Agri/BSc Chemistry.		1	
	Mass production. Field efficacy studies - NABL studies. Packing and Marketing. End user interaction, sales, feed-back and follow-up		2	
Total			30 Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Core-10	20U6RMC10	Food Microbiology	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To understand the significance and activities of microorganisms in food and role of various factors on growth and survival of microorganisms in food
- To gain knowledge on spoilage mechanisms of microbes in different food types and to identify the methods to prevent deterioration and spoilage
- To identify ways to control microorganisms in food and to recognize the principles behind various food preservation techniques
- To know the roles of bacteria, mycotoxins, algal toxins and viruses in food borne diseases and food intoxication
- To learn various methods for detection and identification of microbes in food and to emphasize the rationale for applying food safety regulations in food industries

Unit	Description	Hours	K-level	CLO
I	Unit - I: Microbes in food Importance and types of microorganisms in food (Bacteria, Mold and Yeasts), sources and applications of microbial enzymes in foods, prebiotics, probiotics and single cell protein. Sources of contamination, factors influencing microbial growth in food – pH, moisture, oxidation-reduction potential, nutrient contents and inhibitory substances.	15 Hrs	Up to K2	1
II	Unit- II: Microbial Food Spoilage Causes and principles underlying food spoilage – contamination, spoilage and preservation of cereals and cereal products, sugar and sugar products, vegetables and fruits, meat and meat products, sea foods, poultry and eggs, milk and milk products, spoilage of canned food.	15 Hrs	Up to K3	2

III	Unit- III: Preservation of food Principles and methods of preservations, physical and chemical methods: asepsis, anaerobic conditions, high and low temperatures, drying, radiation (Ultraviolet radiation, ionizing radiation, gamma rays, cathode rays and microwaves), chemical preservatives and food additives (organic acids and their salts, nitrites and nitrates, sulfur dioxide and sulfites, ethylene and propylene oxide, sugar, salt, alcohol, formaldehyde, wood smoke, spices and condiments, antibiotics).	15 Hrs	Up to K3	3
IV	Unit- IV: Food borne diseases and food poisoning Food borne illness caused by <i>Staphylococcus</i> , <i>Clostridium</i> , <i>E.coli</i> , <i>Salmonella</i> , <i>Shigella</i> and <i>Listeria</i> . Food poisoning by mycotoxins (aflatoxins, patulin, ochratoxin A, luteoskyrin, sterigmatocystin, penicillic acid, roquefortine), algal toxins (ciguatoxin, saxitoxin, domoic acid) and viruses (Poliomyelitis, Norovirus group, Coxsackie viruses).	15 Hrs	Up to K3	4
V	Unit- V: Food sanitation and control Microorganisms in foods and methods for detection: Culture, microscopic, and sampling methods for detecting microbes- physical, chemical methods, whole animal assays, immunological methods. Microbiological quality standards of food- FDA, FSSAI, EPA, HACCP, ISI. Food safety-control of hazards.	15 Hrs	Up to K4	5

Total 75 Hours

Books for study

1. Frazier WC and Westhoff DC (1988). Food Microbiology, 4th Edition, Mc Graw Hill, New York.

Books for Reference

1. Garbutt, J., (1997). Essentials of Food Microbiology, Arnold-International Students' edition, London.
2. Atlas, R.M., (1997). Principles of Microbiology, Second edition, WCB/McGraw Hill, U.S.A.
3. Deak, T, and L.R. Beuchat, (1996). Hand Book of Food Spoilage Yeasts, CRC Press, New York.
4. Adams MR & MO Moss (2005). Food Microbiology. 1st Edition. Reprinted, Published by New Age International (P) Limited. Publishers, New Delhi.
5. James M Jay (2004). Modern Food Microbiology. 4th Edition, CBS Publishers & Distributors, New Delhi.
6. Banwart, G.J., (1987). Basic Food Microbiology, CBS Publishers & Distributors, New Delhi.

Web Resources

1. <https://www.britannica.com/science/microbiology/Food-microbiology>
2. <https://aggie-horticulture.tamu.edu/food-technology/food-processing-entrepreneurs/microbiology-of-food/>
3. <https://egyankosh.ac.in/bitstream/123456789/61874/1/UNIT%201%20Introduction%20to%20Food%20Microbiology%20Microbiology.pdf>

4. <https://thebiologynotes.com/category/food-microbiology/>
5. <https://microbenotes.com/category/food-microbiology/>

Rationale for Nature of the course

The goal of this course is to provide students with information and skills that will allow them to understand the fundamentals of food microbiology, factors influencing microbial growth in food, food preservation principles, role of microbes in food spoilage and food borne diseases. This course also highlights detection and identification of microbes in food samples and methods to evaluate microbiological quality of food.

Activities having direct bearing on skill development/ employability/entrepreneurship

Imparting knowledge and technical skills to analyze microbiological quality of various food samples. Applying the techniques related to food quality control in various industrial sectors and research units. Inculcating the understanding of microorganisms and their mechanism in food processing and preservation.

Pedagogy

Chalk and talk, PPT, group discussion, seminar, screening of educational videos, assignment and quiz

Course designers

Dr.P.Kiruthika Lakshmi

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO1	Elaborate the factors influencing food microflora and discuss the significance of microbes in food industries	Up to K2
CLO2	Correlate the most common microorganisms in food spoilage, their origin, mechanism and methods to control spoilage of food	Up to K3
CLO3	Explain the principle and apply the suitable technique to prevent microbial growth in food	Up to K3
CLO4	Differentiate the role of various microorganisms and their toxins in food borne diseases	Up to K3
CLO5	Evaluate the microbiological quality of food samples by qualitative and quantitative methods and comprehend various food safety guidelines	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	3	-	3	1	2
CLO2	3	2	2	2	3
CLO3	3	3	2	1	3
CLO4	2	2	-	2	3
CLO5	3	3	3	2	3

Advance application–3 Intermediate level –2 Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	3	1	3	3	3
CLO2	3	3	3	3	-
CLO3	3	3	3	3	3
CLO4	1	-	2	2	2
CLO5	3	3	3	3	3

Advance application–3 Intermediate level –2 Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

**Learning Outcome Based Education & Assessment (LOBE) - BluePrint Articulation Mapping
– K Levels with Courses Learning Outcomes (CLOs)**

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either /or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Microbes in food	a) Importance and types of microorganisms in food (Bacteria, Mold and Yeasts)		4	Chalk and Talk, PPT, Quiz
	b) Sources and applications of microbial enzymes in foods		3	
	c) Prebiotics, probiotics and single cell protein		3	
	d) Sources of contamination, factors influencing microbial growth in food – pH, moisture		3	
	e) Oxidation-reduction potential, nutrient contents and inhibitory substances		2	
II Microbial Food Spoilage	a) Causes and principles underlying food spoilage		2	Chalk and Talk, PPT, Quiz
	b) Contamination, spoilage and preservation of: cereals and cereal products, sugar and sugar products		4	
	c) Vegetables and fruits, meat and meat products		3	
	d) Sea foods, poultry and eggs		3	
	e) Milk and milk products, spoilage of canned food		3	

III Preservation of food	a) Principles and methods of preservations, physical and chemical methods: asepsis		4	Chalk and talk, PPT, Group Discussion, quiz
	b) Anaerobic conditions, high and low temperatures		4	
	c) Drying, radiation		3	
	d) Chemical preservatives and food additives		4	
IV Food borne diseases and food poisoning	a) Food borne illness caused by <i>Staphylococcus</i> , <i>Clostridium</i> , <i>E.coli</i>		4	Chalk and talk, PPT, Group Discussion, quiz
	b) <i>Salmonella</i> , <i>Shigella</i> and <i>Listeria</i>		4	
	c) Food poisoning by mycotoxins		3	
	d) Algal toxins and viruses		4	
V Food sanitation and control	a) Microorganisms in foods and methods for detection: Culture, microscopic, and sampling method for detecting microbes		5	PPT, Seminar, Screening of educational videos, assignment
	b) Physical, chemical methods, whole animal assays, immunological methods		3	
	c) Microbiological quality standards of food- FDA, FSSAI, EPA, HACCP, ISI		4	
	d) Food safety-control of hazards		3	
Total			75 Hours	

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Core 11	20U6RMC11	Principles of Gene Manipulation	5	5	25	75	100
Nature of Course								
Knowledge and skill				Employability oriented				
Skill oriented			✓	Entrepreneurship oriented				

Course Objectives:

- To introduce the basic concept of gene manipulation and rDNA technology
- To learn various types of gene cloning vectors
- To understand the molecular methods of cloning
- To gain knowledge on DNA sequencing and genomic libraries
- To know the applications of gene manipulation.

Unit	Description	Hours	K-level	CLO
I	Unit – I Introduction to gene manipulation An overview-definition, scope and importance of gene manipulation, Concept of recombinant DNA technology and Gene cloning, organizations involved in gene manipulation. Cloning Tools; Restriction modification systems: Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering, DNA modifying enzymes and their applications: DNA polymerases, terminal deoxynucleotidyltransferase, kinases, phosphatases, and DNA ligases.	15 hrs	Up to K2	1
II	Unit - II Cloning vectors Cloning Vectors: Definition and Properties. Plasmid vectors: pBR322 and pUC18 series. Bacteriophage -lambda and M13 based vectors, Cosmids, Phagemids, BACs and YACs. Uses of linkers and adaptors. Shuttle vectors and expression vectors: <i>E.coli</i> .lac and T7 promoter-based vectors, yeast YIp, YEp and YCp vectors, Baculovirus based vectors, mammalian SV40-based expression vectors.	15 hrs	Up to K3	2

III	Unit – III Methods in Molecular Cloning Methods in Molecular Cloning -Transformation of DNA: Chemical method, Electroporation, Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated delivery, Agrobacterium - mediated delivery, and transfection. DNA, RNA and Protein analysis: Agarose gel electrophoresis, Southern - and Northern - blotting techniques, dot blot, DNA microarray analysis, SDS-PAGE and Western blotting.	15 hrs	Up to K3	3
IV	Unit – IV DNA sequencing and genomic libraries DNA Amplification: Basics and types of PCR - RT-PCR, Real-Time PCR. DNA Sequencing: Sanger's method and Maxam-Gilbert's method, primer walking, shotgun sequencing and automated sequencing. Construction and uses of genomic and cDNA libraries, Screening of libraries: Colony hybridization and colony PCR, Chromosome walking and chromosome jumping.	15 hrs	Up to K3	4
V	Unit - V Applications of gene manipulation Transgenic plants- Bt cotton and golden rice. Transgenic animals – transgenic cattle and transgenic fish. Gene therapy – ex vivo and in vivo gene therapy; somatic and germ line gene therapy. Stem cells – potency definitions; embryonic and adult stem cells; applications of stem cells – cell based therapies and regenerative medicine.	15 hrs	Up to K4	5

Total 75 Hours

Books for Study

1. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
2. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
3. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press, USA

Books for Reference

1. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
3. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education, USA

Web Resources

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1685074/>
2. <https://byjus.com/biology/cloning-vector/>
3. <https://www.jove.com/v/5074/molecular-cloning>
4. <https://smujo.id/biodiv/article/download/2035/1912/2483>
5. <https://www.wiley.com/en-us/Genetic+Manipulation%3A+Techniques+and+Applications-p-9781444314137>

Rationale for Nature of the course

The aim of this course is to provide an introduction to recombinant DNA technology. It helps the students to understand the principles of molecular methods in cloning have been used to develop techniques in recombinant DNA technology.

Activities having direct impact on Skill development/Employability / Entrepreneurship

To familiarize the student with the basic concepts in genetic engineering - enzymes, cloning vehicles, gene libraries, analysis and expression of the cloned gene in host cell. At the end of the course the student will have enough background of recombinant DNA technology essential for taking up projects in the field of Biotechnology.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designer:

N.Sumathy

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO1	Explain scope and importance of rDNA technology	Up to K2
CLO2	Outline the salient features of cloning vectors	Up to K3
CLO3	Describe the methods in molecular cloning	Up to K3
CLO4	Analyze DNA sequencing and genomic libraries	Up to K3
CLO5	Summarize the applications of gene manipulation	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 –Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make inferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	3	2	2
CLO2	2	-	3	2	2
CLO3	2	3	-	2	3
CLO4	2	2	2	2	2
CLO5	3	2	2	2	2

Advance application–3

Intermediate level–2

Basic level–1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	2	2	2	3
CLO2	2	2	2	3	-
CLO3	2	2	-	2	3
CLO4	3	2	2	2	2
CLO5	3	3	3	3	2

Advance application–3

Intermediate level–2

Basic level–1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/ or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE) Blue Print Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 – Remembering and recalling facts with specific answers

K2– Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction to gene manipulation	a)An overview-definition, scope and importance of gene manipulation.		3	Chalk and Talk,Quiz
	b)Concept of recombinant DNA technology and Gene cloning. organizations involved in gene manipulation.		3	
	c)Cloning Tools; Restriction modification systems: Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering.		5	
	d)DNA modifying enzymes and their applications: DNA polymerases, terminal deoxynucleotidyltransferase, kinases, phosphatases, and DNA ligases.		4	
II Cloning vectors	a)Cloning Vectors: Definition and Properties.		2	Chalk and Talk,Quiz
	b) Plasmid vectors: pBR322 and pUC18 series.		2	
	c) Bacteriophage -lambda and M13 based vectors, Cosmids, Phagemids, BACs and YACs.		4	
	d) Uses of linkers and adaptors. Shuttle vectors and expression vectors: <i>E.coli</i> .		3	
	e)lac and T7 promoter-based vectors, yeast YIp, YEp and YCp vectors, Baculovirus based vectors, mammalian SV40-based expression vectors.		4	
III Methods in Molecular Cloning	a)Methods in Molecular Cloning -Transformation of DNA: Chemical method, Electroporation,		3	Chalk and Talk & PPT, Quiz
	b) Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome		3	
	c) viral-mediated delivery, Agrobacterium -mediated delivery, and transfection.		3	
	d) DNA, RNA and Protein analysis: Agarose gel electrophoresis, Southern - and Northern - blotting techniques, dot blot,		3	
	e) DNA microarray analysis, SDS-PAGE and Western blotting.		3	
IV DNA sequencing and genomic libraries	a)DNA Amplification : Basics and types of PCR - RT-PCR, Real-Time PCR.		3	PPT & Chalk and Talk, Quiz
	b) DNA Sequencing: Sanger's method and Maxam-Gilbert's method,		3	
	c)primer walking, shotgun sequencing and automated sequencing.		3	
	d) Construction and uses of genomic and cDNA libraries Screening of libraries: Colony hybridization and colony PCR		4	
	e) Chromosome walking and chromosome jumping.		2	

V Applications of gene manipulation	a) Transgenic plants- Bt cotton and golden rice.			PPT & Assignment
	b) Transgenic animals – transgenic cattle and transgenic fish			
	c) Gene therapy – ex vivo and in vivo gene therapy; somatic and germ line gene therapy.			
	d) Stem cells – potency definitions; embryonic and adult stem cells;			
	e) applications of stem cells – cell based therapies and regenerative medicine.			
Total			75 Hours	

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Core - 12	20U6RMC12	Pharmaceutical & Forensic Microbiology	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To learn basics of pharmacology and microbial pharmacology
- To understand the drug contamination and validation
- To acquire knowledge on forensic microbiology, administrative role and jobs related with forensic
- To study the importance of forensic microbiology
- To interpret the results of DNA profiling for paternity and criminal investigation

Unit	Description	Hours	K-level	CLO
I	Unit I: Introduction to Microbial Pharmacology Definitions, Pharmacology, Pharmacognosy, Pharmacodynamic and Pharmacogenomics. Microbial drugs and edible vaccines. Biopharmaceuticals- source, production methods, cytokines, haemopoietic growth factors, hormones and therapeutic enzymes.	15Hrs	Up to K2	1
II	Unit II: Microbial contamination of drugs Sources of microbial contamination. Preventive measures and practices. Concepts of quality- control in Biopharmaceuticals, testing the quality of drug, validation and certification of drugs-ISO, WHO and SFDA. Criteria to assess the clinical value of drug monitoring, Methods of analysis, Measuring Toxicity: LD50 and ED50	15Hrs	Up to K3	2
III	Unit III: Forensic science and Administration History, Definition and Development of Forensic Science in India, Pioneers in Forensic Science. Administration and Organizational Setup in forensic: Central level and State level Police Organization, International Investigative Agencies - Education and Employment systems of Forensic Science in India: Teaching Courses and Research fields in Forensic Science, Scope and opportunities in Forensic Science.	15Hrs	Up to K3	3
IV	Unit IV: Forensic Microbiology Definition, Types and identification of Bacteria and Viruses in Forensic Science, Microbial profiles as identification tools, use of microorganisms in bioterrorism – biological warfare, super bug, strain escape, microbial ethics – tools and techniques involved in microbial forensic – carbon dating	15Hrs	Up to K4	4

V	Unit V: Forensic Significance of DNA profiling Applications in disputed paternity cases, child swapping, missing person's identity- crime solving using forensic technology, Forensic intelligence and Interviews, Ethics in Forensic Science. Nature & Importance of Crime Scene Reconstruction (CSR), Investigation of Road Accident crime scene: Examination of scene, Interpretations of Bloodstain Pattern Analysis (BPA) - Dactylography - Classification of Fingerprints, Methods of Development of latent fingerprints using conventional methods. Recent advancement in forensic science.	15Hrs	Up to K4	5

Total 75 Hours

Books for study:

1. Parikh C. K. (1999). Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology. Sixth Ed., CBS Publishers & Distributors Pvt. Ltd., India.
2. Hugo, W.B., Russell, A.D. (1999). Pharmaceutical Microbiology 4th edition. Blackwell scientific publications / Oxford, UK.
3. Sharma, B.R. (2005) Forensic Science in Criminal Investigation and Trials, Universal Law Publishers, Delhi.

Books for Reference:

1. Ashutosh Kar, (2008). Pharmaceutical Microbiology, New Age International Publishers, New Delhi.
2. Mehta, M.K (1980) Identification of Thumb Impression & Cross Examination of Finger Prints, N.M. Tripathi Pub. Bombay.

Web reference(s):

1. www.pharmacy.umich.edu/pharmsci
2. www.scientiaricerca.com/cops.php
3. www.crimesceneinvestigatoredu.org/what-is-forensic-science/

Rationale for Nature of the course

This paper gives students a broad perception on Pharmacology, Role of forensic science and its administration and analysis of DNA, finger print for finding out the parental analysis and thieves.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Illustrate the importance of drug validation and Forensic Microbiology. Quarantine and drug analyst, Police and forensic inspector professionals are employed by national, state and local governments and can work for international agencies such as FBI.

Pedagogy

Chalk and talk, PPT, Quiz, Assignment, Group discussion, Seminar, Screening of educational videos

Course designers

1. **Dr. K. Kannan**

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Define the pharmacology and pharmacognosy	Up to K2
CLO2	Classify the drug validation procedures	Up to K3
CLO3	Classify various administrative in forensic science	Up to K3
CLO4	Acquire the importance of forensic science in the present era	Up to K4
CLO5	Gain the basic knowledge on fingerprint analysis and DNA profiling	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	1	1	1
CLO2	1	1	1	1	1
CLO3	-	1	1	1	1
CLO4	1	2	2	-	2
CLO5	2	2	-	2	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	1	1	1	1	3
CLO2	1	1	1	2	2
CLO3	-	2	1	1	3
CLO4	2	2	2	-	2
CLO5	2	2	-	2	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	50%
K2	5	6	20	10	41	34.17	
K3	-	-	20	20	40	33.33	33.33%
K4	-	-	-	20	20	16.67	16.67%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE) Blue Print Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K4	2	K1 & K2	1	K2	2 (K2&K2)	1(K4)
5.	CLO 5	Up to K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Lesson Plan

Units	Description	Staff	Hours	Mode
I Introduction to Microbial Pharmacology	a) Definitions, Pharmacology, Pharmacognosy, Pharmacodynamic and Pharmacogenomics		4	Chalk and Talk, Quiz
	b) Microbial drugs and edible vaccines. Biopharmaceuticals		4	
	c) source, production methods, cytokines, haemopoietic growth factors, hormones		4	
	d) therapeutic enzymes		3	
II Microbial contamination of drugs	a) Sources of microbial contamination. Preventive measures and practices.		4	Chalk and Talk, Quiz
	b) Concepts of quality- control drug		4	
	c) Validation and certification of drugs- ISO, WHO and SFDA. Criteria to assess the clinical value of drug monitoring		4	
	d) Methods of analysis, Measuring Toxicity: LD50 and ED50		3	
III Forensic science and Administration	a) History, Definition and Development of Forensic Science in India, Pioneers in Forensic Science.		4	Chalk and Talk & PPT, Quiz
	b) Administration and Organizational Setup in forensic: Central level and State level Police Organization		4	
	c) International Investigative Agencies - Education and Employment systems		4	
	d) Teaching Courses and Research fields in Forensic Science, Scope and opportunities in Forensic Science		3	

IV Forensic Microbiology	a) Definition, Types and identification		4	PPT & Chalk and Talk, Quiz
	b) Microbial profiles as identification tools, use of microorganisms in bioterrorism –biological warfare		4	
	c) Super bug, strain escape, microbial ethics		4	
	d) tools and techniques involved in microbial forensic – carbon dating		3	
V Forensic Significance of DNA profiling	Applications in disputed paternity cases, child swapping, missing person's identity- crime solving using forensic technology, Forensic intelligence and Interviews		4	PPT, Assignment and Hands on training
	ethics in Forensic Science. Nature & Importance of Crime Scene Reconstruction (CSR), Investigation of Road Accident crime scene: Examination of scene		4	
	Interpretations of Bloodstain Pattern Analysis (BPA) - Dactylography - Classification of Fingerprints		4	
	Methods of Development of latent fingerprints using conventional methods.		3	
	Recent advancement in forensic science			
Total			75 Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Core Practical-VII	20U6RMP7	Major Practical-VII	2	3	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To provide basic skills and knowledge in isolation and identification of microbes from food samples
- To assess the bacteriological quality of milk
- To explore basic molecular tools for analyzing DNA and protein
- To produce ethanol and citric acid from organic wastes
- To screen bacterial strains of industrial importance

S.No.	Experiments
1	Determination of total bacterial population in food samples by serial dilution and standard plate count
2	Evaluation of microbiological quality of milk - Methylene blue and Resazurin dye reduction test
3	Estimation of Vitamin C in food samples
4	Restriction digestion analysis of genomic DNA
5	Detection of proteins by SDS - PAGE and Western blotting
6	Replica plating method for identifying antibiotic resistant mutants
7	Induction of competence in <i>E. coli</i> and confirmation for transformants
8	Production and characterization of citric acid using <i>Aspergillus niger</i>
9	Comparison of ethanol production using various organic wastes
10	Screening of bacterial strains for enzyme alpha amylase production

Books for study

1. Aneja, K.R. (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.
2. Cappuccino, J.H. and Sherman, N. (2007). Microbiology- A Lab Manual. 7th Edition. The Benjamin Publishing Company, Singapore.
3. Dubey, R.C. and Maheswari, D.K. (2004). Practical Microbiology 1st Edition, S.Chand & Company Ltd., New Delhi.

Books for Reference

1. Kannan, N. (1996). Laboratory Manual in General Microbiology. 1st Edition, Palani Paramount Publications, Tamil Nadu.
2. Madigan, M.T. and Martinko, J.M. (2014). Brock Biology of Microorganisms. 14th Edition. Prentice Hall International Inc., USA.
3. Ratledge C & Kristiansen B. (2008). Basic Biotechnology 3rd Edition, Cambridge University Press, England.
4. Gunasekaran, P. (1995). Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi.
5. Rana, A.K. (2012). Downstream Processing Techniques in Biotechnology. Global Academic Publishers, New Delhi.
6. Kulanthaivel, S. and Janarthanan, S. (2012). Practical Manual on Fermentation Technology. International publishing house. New Delhi.

Web Resources

1. <https://www.dairyknowledge.in/content/methylene-blue-dye-reduction-test-assessing-raw-milk-quality>
2. <https://www.addgene.org/protocols/restriction-digest/>
3. http://microbiology.ucdavis.edu/privalsky/sites/default/files/SDS-PAGE_0.pdf
4. <https://www.nrel.gov/docs/legosti/old/2093.pdf>
5. <https://biomedpharmajournal.org/vol12no3/isolation-and-identification-of-amylase-producing-bacteria-from-soil-in-nasinuan-community-forest-maha-sarakham-thailand/>

Rationale for Nature of the course

Hands on training on identification and characterization of microbes have greater application in food, industrial sector, research, medicine and in agriculture. Technical skills pertaining to microbiological quality of milk will be useful for evaluating and interpreting milk samples in dairy industries. The goal of this course is to provide students with knowledge on applying molecular tools for analyzing DNA and protein samples. Understanding the nature, growth requirements and culture conditions of yeasts and molds will be useful for producing ethanol and citric acid in industrial scale.

Activities having direct bearing on skill development/ employability/entrepreneurship

Technical skills on isolation and characterization of microbes will be helpful for screening and identifying microbes of economic importance. Providing practical insight on testing quality of milk. Imparting knowledge on various molecular tools and vectors which could be applied for further studies. Understanding the fermentation potential of yeasts and molds will be helpful for employing microorganisms to produce citric acid and ethanol.

Pedagogy

Demonstration and practical session

Course designers:

1. **Dr. K.Rajeswari**
2. **Mrs. N.Sumathy**
3. **Dr. P.Kiruthika Lakshmi**

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcomes	KnowledgeLevel
CLO1	Isolate and identify microorganisms found in different food specimen	Up to K4
CLO2	Determine the milk quality based on its microbiological characteristics	Up to K4
CLO3	Acquaint basic biotechnological tools and techniques involved in detection of protein and mutants	Up to K3
CLO4	Demonstrate ethanol and citric acid production by mold and yeasts	Up to K4
CLO5	Screen and select alpha amylase producer from environmental samples	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of course outcome with Programme outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	3	3	3
CLO2	3	3	2	2	-
CLO3	3	-	1	2	2
CLO4	3	3	3	3	3
CLO5	3	3	3	2	1

Advance application – 3,
level – 1.

Intermediate level – 2, Basic

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	3	2	3	2	2
CLO2	3	2	2	3	3
CLO3	-	2	2	1	-
CLO4	3	3	3	3	3
CLO5	3	2	2	2	2

Advance application – 3,

Intermediate level – 2,

Basic level –

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Practical – VIII	20U6RMP8	Major Practical – VIII	2	3	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course objectives :

- To provide students a basic understanding on the analytical techniques of pharmaceutical products
- To know the basic concepts in criminology
- To collect the digital photography of various forensic evidences
- To apply the spectroscopic characterization of nanoparticles
- To gain knowledge about the production of bio fertilisers

S.No	Experiment
1.	Microscopic study of glycoside containing powdered drugs
2.	Sampling of pharmaceutical products (syrups, suspensions, creams and ointments, ophthalmic preparations) for microbial contamination and load
3.	Demonstration of endotoxin analysis in pharmaceutical products by Limulus Amebocyte Lysate
4.	Interpretation of crime scene notes, photos, sketches and reconstruction of crime scene
5.	Detection of fingerprints by powder method, ninhydrin method, iodine method, silver nitrate method, small particle reagent method
6.	Documentation of digital photography of various forensic evidences
7.	Eco-friendly green synthesis of silver nanoparticles and analysis using UV-VIS absorption studies
8.	Preparation and characterization of ZnO nanoparticles embedded in silica matrix
9.	Evaluation of complete blood count
10.	Laboratory scale production of bio fertilizers: nitrogen fixer and phosphate solubilizer

Books for study:

1. Cappuccino, J.H. and Sherman, N. (2007). Microbiology- A Lab Manual. 7th Edition. The Benjamin Publishing Company, Singapore.
2. Gunasekaran, P. (2008). Laboratory Manual in Microbiology. New Age International (P) Ltd. Publishers, New Delhi.
3. Sharma, B.R; 2003, Forensic Science in Criminal Investigation & Trials, Universal Publishing Co., New Delhi.

Books for reference:

1. Malcolm Harris. (1964). Pharmaceutical Microbiology. Balliere Tindall and Cox, Paris.
2. H.L. Blitzer and J.Jacobia; (2002), Forensic Digital Imaging and Photography, Academic Press, London.
3. David R.Redsicker; 2001, The Practical Methodology of Forensic Photography- 2nd Ed. CRC Press, New York.

Web resources:

- 1.<https://www.milestonesrl.com/industries/pharmaceutical>
- 2.<https://www.youtube.com/watch?v=jpuNYpvBmDM>
3. <https://www.youtube.com/watch?v=jxoNqSVLZxc>
4. <https://www.youtube.com/watch?v=1ttlW0HRYYo>
- 5.<https://www.youtube.com/watch?v=jpuNYpvBmDM>

Rationale for nature of the course

The objective of the course is to enhance knowledge, in depth understanding and application of forensic science, policing and criminal investigation by teaching and research. Make students familiar with the field of forensic science which includes investigating a crime by applying forensic science principles.

Activities having direct bearing on skill development/ employability/entrepreneurship

Develop skills in forensic identification, forensic problem solving. Develop critical and analytical subject specific skills involving the principles, practices and techniques of specific field

Pedagogy

Demonstration and practical session.

Course designers:

1. Mrs.N.Sumathy
2. Dr.K.Kannan
3. Dr.S.SreeGayathri
4. Dr.A.P.AshaKannan

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Analyze the pharmaceutical products for microbiological quality	Up to K2
CLO2	Identify the fingerprints by various methods	Up to K3
CLO3	Analyze the digital photography of various forensic evidences	Up to K3
CLO4	Determine the material's structure and properties that are probed and measured	Up to K4
CLO5	Perform to produce different kinds of bio fertilizer	Up to K4

Mapping of Course Outcome with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	2	2	3
CLO2	2	2	2	2	3
CLO3	2	-	3	2	3
CLO4	2	2	2	2	3
CLO5	3	2	3	-	3

Advance application – 3

Intermediate level – 2

Basic level – 1

Mapping of Course Learning Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	3	2	1	3
CLO2	2	3	3	2	3
CLO3	2	3	-	2	3
CLO4	2	3	3	-	3
CLO5	2	3	3	2	3

Advance application – 3

Intermediate level – 2

Basic level – 1

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective -II	20U6RME2	Fermentation Technology	3	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To impart knowledge about biological and biochemical technology
- To gain knowledge on the design and operation of fermentors in industrial practices
- To perceive the use of microbes in various fermented food products for human consumption.
- To understand the production cost of fermentation process
- To learn the use of microbes in the production of alcoholic beverages

Unit	Description	Hours	K-level	CLO
I	Unit-I: Fermentation: an overview Fermentation: an overview, isolation, screening and selection of industrially important microorganisms, Crude and synthetic media; molasses, corn steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates. Types of fermentation processes - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch and continuous fermentations.	12Hrs	Up to K2	1
II	Unit-II: Bioreactors Bioreactors, design and components of basic fermentor, specialized fermentors for specific purposes – continuous, anaerobic, for gaseous nutrients, for treatment of wastes, trickle flow reactors, cyclone reactors, submerged types, tube reactors, packed bed reactors, lab scale to pilot to industrial – scale up process and online monitoring.	12Hrs	Up to K3	2
III	Unit-III: Bioprocessing Bioprocessing – Downstream processing of industrial fermentation processes, product purification and recovery, physico-chemical basis of bio-separation processes, techniques for purification of end products – chromatography, electrophoresis, distillation, crystallization and filtration.	12Hrs	Up to K3	3
IV	Unit-IV: Economics of a fermentation process Economics of a fermentation process - determination of cost for production and recovery, cost cutting strategies, cell and enzyme immobilization, biological waste treatment, hygiene and safety in fermentation industries.	12Hrs	Up to K3	4

V	Unit-V: Microbial Fermentation Modern trends in microbial fermentations - Industrial production of organic acids-citric acid, enzymes -alpha- amylase, bioplastics - PHB, biofertilizers - nitrogen fixer - <i>Azotobacter</i> , bioinsecticides - thuricide, therapeutic compounds -β lactam, single cell protein, biogas. Production of bioethanol from sugarcane molasses, starch and cellulosic materials. Ethanol recovery. Recombinant protein production –Insulin.	12Hrs	Upto K4	5

Total = 60 Hours

Books for Study

1. Crueger W, Crueger A, (1990). Biotechnology: A text Book of Industrial Microbiology, 2nd Ed., USA.
2. Stanbury, P.F. and Whitaker, A., and Hall S. J., (2007). Principles of Fermentation Technology Pergamon Press. Germany.
3. Casida L.E., (1986). Industrial Microbiology, New Age International Publishers, New Delhi.

Books for Reference

1. Doran, (2012). Bioprocess Engineering Principles P.M Academic Press, Cambridge.
2. Aiba, S., Humphrey, A.E and Millis, N.F., (1973). Biochemical Engineering Academic Press. Cambridge.
3. Bailey, J.E. and Ollis, D.F., (1986). Biochemical Engineering Fundamentals Bailey, J.E. and Ollis, D.F., McGraw-Hill. USA
4. Arnold L. Demain & Julian E. Davis., (2004). Industrial Microbiology & Biotechnology ASM Press. USA.
5. Emt. el-Mansi & CFA. (2004). Fermentation Microbiology & Biotechnology. Taylor & Francis Ltd. UK.
6. Pirt, S.J., (1957). Principles of Microbial and Cell Cultivation. Blackwell Scientific Publication, London.

Web Resources

1. <https://www.biologydiscussion.com/fermentation/fermentation-technology-meaning-methodology-types-and-procedure/17492>
2. <https://thebiologynotes.com/design-of-a-fermenter/>
3. <http://microbiologyprocesses.blogspot.com/2012/03/fermentation-economics-objective-of-any.html#>
4. <https://courses.lumenlearning.com/microbiology/chapter/fermentation/>
5. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=5158>

Rationale for Nature of the course

The purpose of this course is to share the unique knowledge in understanding basic fermentations processes, design of various fermenters and their types. Different separation techniques and application of fermentation in waste treatment and selecting industrially important microbes. Understanding economics of the fermentation for the total cost of production.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Understanding all aspects that are critical for providing microbiologically fermented products. Providing in depth learning in fermentation technology, which will serve as a focus for research into the field. Modern trends in microbial fermentations lead for self-employment.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designers :

Dr. K.Rajeswari

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO1	Outline basic fermentations processes and select industrially important microbes	Up to K2
CLO2	Design and develop various fermentors and application of fermentation in waste treatment.	Up to K3
CLO3	Classify different separation and techniques for purification of end products .	Up to K3
CLO4	Economics of the fermentation for the total cost of production.	Up to K3
CLO5	Explore modern trends in microbial fermentations in industries.	Up to K4

K1 –Remembering and recalling facts with specific answers

K2– Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make inferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	3	-	3
CLO2	2	2	3	2	2
CLO3	-	3	3	2	3
CLO4	2	2	2	3	3
CLO5	3	3	3	3	-

Advance application–3

Intermediate level–2

Basic level–1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	-	2	2	2	-
CLO2	2	2	2	3	2
CLO3	2	2	2	2	3
CLO4	3	2	-	2	2
CLO5	3	3	3	3	2

Advanceapplication–3

Intermediatelevel–2

Basic level–1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	SectionB (No Choice)	Section C (Either/or)	SectionD (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment(LOBE) Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
Unit-I Fermentation: an overview	Fermentation: an overview, isolation, screening and selection of industrially important microorganisms.		4	Chalk and Talk & Quiz
	Crude and synthetic media; molasses, corn steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates.		4	
	Types of fermentation processes - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch and continuous fermentations.		4	
	Bioreactors, design and components of basic		3	

Unit-II Bioreactors	fermentor.			Chalk and Talk & Quiz
	Specialized fermentors for specific purposes – continuous, anaerobic, for gaseous nutrients, for treatment of wastes.		3	
	Trickle flow reactors, cyclone reactors, submerged types, tube reactors, packed bed reactors.		3	
	Lab scale to pilot to industrial – scale up process and online monitoring.		3	
Unit-III Bioprocessing	Bioprocessing – Downstream processing of industrial fermentation processes.		3	Chalk and Talk, PPT & Quiz
	Product purification and recovery, Physico-chemical basis of bio-separation processes.		4	
	Techniques for purification of end products – chromatography, electrophoresis, distillation, crystallization and filtration.		5	
Unit-IV Economics of a fermentation process	Economics of a fermentation process - determination of cost for production and recovery, cost cutting strategies.		4	PPT & Chalk, Talk & Quiz
	Cell and enzyme immobilization, biological waste treatment.		4	
	Hygiene and safety in fermentation industries.		4	
Unit-V Microbial Fermentation	Modern trends in Microbial Fermentations - Industrial production of organic acids - citric acid, enzymes - alpha-amylase, bioplastics – PHB.		4	PPT & Assignment
	Industrial production of biofertilizers - nitrogen fixer - <i>Azotobacter</i> , bioinsecticides - thuricide, therapeutic compounds -β lactam.		4	
	Industrial production of single cell protein, biogas.		2	
	Industrial production of bioethanol from sugarcane molasses, starch and cellulosic materials. Ethanol recovery. Recombinant protein production – Insulin.		2	
Total			60 Hours	

DEPARTMENT OF MICROBIOLOGY				CLASS: III - B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective -II	20U6RME2	Agricultural Microbiology	3	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

- To provide a basic understanding of agricultural microbiology
- To know the applications of microbial insecticides
- To learn various aspects of nitrogen fixation, phosphate solubilization
- To gain knowledge on various microbial plant diseases
- To understand the applications of microorganisms in agriculture

Unit	Description	Hours	K-level	CLO
I	Unit – I: Soil Microbiology Nature of soil - Soil types, characteristics, soil profile and soil micro flora– bacteria (cyanobacteria and actinobacteria), algae, fungi, protozoans, nematodes and viruses –Role of microbes in soil fertility. Microbial associations in phytosphere: rhizosphere –rhizoplane - spermosphere. Mycorrhiza – types and importance to agriculture – organic matter decomposition –humus formation. Rhizosphere to non-rhizosphere ratio (R:S ratio).	12Hrs	Up to K2	1
II	Unit – II: Bioinsecticides and Biopesticides Bioinsecticides and Biopesticides -Introduction, types(Bacterial- <i>Bacillus thuringiensis</i> , <i>Beauveria bassiana</i> Viral - NPV, Baculoviral insecticides Fungal -Trichoderma, Metarhizium), mode of action, genes involved, factors influencing their action and target pests- advantages and limitations.	12Hrs	Up to K3	2
III	Unit–III: Phytostimulation and Biofertilizers Role of phytohormones- auxin, gibberellins, cytokinins (CK). Plant Growth Promoting Bacteria (PGPB) -Root exudation, effect of PGPB on plants - Biological Nitrogen fixation-symbiotic and asymbiotic, mass production by <i>Rhizobium</i> , <i>Azotobacter</i> and Cyanobacteria i.e nitrosifying, nitrifying, ammonifying and photosynthetic bacteria, Denitrification of nitrate fertilizers to N ₂ and N ₂ O (a green house gas) by denitrifying bacteria- free living and in association with Azolla, Phosphate solubilizing bacteria, IAA producers, Soil anerobic methanogens in rice field. Quality control of microbial inoculants- Methods of biofertilizer application- seed inoculation, soil amendment and nursery application.	12Hrs	Up to K3	3

IV	Unit –IV: Plant Diseases Plant diseases mode of entry of pathogens, disease symptoms - Bacterial diseases- Crown gall, Citrus cancer, Black rot . Viral diseases, virioids TMV, tomato leaf curl, potato spindle tuber. Fungal diseases- late blight of potato – <i>Phytophthora infestans</i> , loose smut of wheat – <i>Ustilago nuda</i> , rice blight – <i>Magnaporthe grisea</i> , Wilt – <i>Fusarium</i> . Control of plant diseases Principles and practices, cultural practices, chemical methods, biological methods and genetic engineering for disease resistant plants. Importance of seed-borne diseases and seed health testing methods.	15Hrs	Up to K4	4
V	Unit – V: Applications of microorganisms in agriculture Biotransformation in plant cells – Definition, process and application of biotransformation in plant cells via <i>Agrobacterium</i> mediated gene transfer. Production of antimicrobial metabolites - <i>Bacillus</i> , <i>Pseudomonas</i> , <i>Streptomyces</i> , <i>Trichoderma</i> spp., Production of agricultural important enzymes. Biopesticides - ice minus bacteria and microbial pesticides. EM (Effective Microorganisms) Technology - EM-BOKASHI, EM-COMPOST, EM-5, EM-X, Recycling. Phage therapy.	12Hrs	Up to K4	5

Total 75 Hours

Books for study:

1. Agricultural Microbiology: G.Rangaswamy and D.J. Bagyaraj 1993, 2nd Edition, Prentice Hall of India Private Limited, New Delhi.
2. Plant Pathology –R.S. Mehrotra (1993) Tata McGraw Hill Publications Limited, New Delhi.
3. Agarwal, V.K and Sinclair, J.B. 1987. Principles of Seed Pathology, CBS Publishers, Delhi.

Books for reference:

1. Rao, N.S.S. 1993. Biofertilizers In Agriculture and Forestry, 3rd edition, Oxford & IBH Publishing Pvt. Ltd, New Delhi.
2. G.Rangaswamy and D.H. Bagayraj (1994), Disease of crop plants in India –3rd Edition Prentice Hall of India Private Limited, New Delhi.
3. Srivastava, H.N. 2001. Plant Pathology, Pradeep Publications, Jalandhar.

Web resources:

1. <https://www.futuredirections.org.au/publication/living-soils-role-microorganisms-soil-health/>
2. <https://academic.oup.com/jxb/article/58/15-16/4019/454268>
3. <https://www.toppr.com/guides/biology/microbes-in-human-welfare/biofertilizers/>
4. <https://www.britannica.com/science/poison-biochemistry/Plant-poisons-phytotoxins>
5. <https://www.frontiersin.org/articles/10.3389/fmicb.2018.02213/full>

Rationale for nature of the course

To provide students a basic understanding of environmental and agricultural microbiology including; microbial diversity in the environment in relation to environment and agricultural welfare, ecosystem wellness, microbial interactions with pollutants in the soil and environment and the fate of microbial pathogens in the environment and agricultural fields.

Activities having direct bearing on skill development/ employability/entrepreneurship

Understand the production of plant growth promoting substances and inhibiting pathogens.

To make students aware with current research in environmental and agricultural microbiology.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designer: Dr.K.Rajeswari

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcomes	KnowledgeLevel
CLO1	Summarize the concept and significance of soil microbiology	Up to K2
CLO2	Outline the mode of action of microbial insecticides	Up to K3
CLO3	Analyze various aspects of biofertilizers	Up to K3
CLO4	Explain the mechanisms of microbial plant diseases	Up to K4
CLO5	Describe the applications of microorganisms in agriculture	Up to K4

Mapping of Course Learning Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	3	2	1	1	2
CLO2	-	2	2	2	2
CLO3	2	2	3	3	2
CLO4	2	3	3	3	2
CLO5	3	2	2	3	3

Advance application – 3 Intermediate level–2

Basic level –1

Mapping of Course Outcome with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5
CLO1	2	3	1	-	3
CLO2	3	3	-	2	3
CLO3	-	2	3	2	3
CLO4	3	2	3	3	-
CLO5	2	2	3	2	3

Advance application–3

Intermediate level–2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35 %
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total Marks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Learning Outcome Based Education & Assessment(LOBE) Blue Print Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either/ or Choice)	SectionD (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K2	2	K2 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K3	2	K3 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K3	2	K3 & K3	1	K2	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K4	2	K1& K1	1	K3	2 (K4&K4)	1(K4)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Soil Microbiology	Nature of soil - Soil types, characteristics, soil profile and soil micro flora.		2	Chalk and Talk & Quiz
	Bacteria (cyanobacteria and actinobacteria), algae, fungi, protozoans, nematodes and viruses –Role of microbes in soil fertility.		5	
	Microbial associations in phytosphere: rhizosphere – rhizoplane - spermosphere. Mycorrhiza – types and importance to agriculture		3	
	Organic matter decomposition – humus formation. Rhizosphere to non-rhizosphere ratio (R:S ratio).		2	
II Bioinsecticides and Biopesticides	Bioinsecticides and Biopesticides -Introduction, types - Bacterial- (<i>Bacillus thuringiensis</i> , <i>Beauveria bassiana</i>). mode of action, genes involved, factors influencing their action and target pests- advantages and limitations.		4	Chalk and Talk & Quiz
	Viral –(NPV, Baculoviral insecticides) mode of action, genes involved, factors influencing their action and target pests- advantages and limitations.		4	
	Fungal –(Trichoderma, Metarhizium), mode of action, genes involved, factors influencing their action and target pests- advantages and limitations.		4	
III Phytostimulation and Biofertilizers	Role of phytohormones- auxin, gibberellins, cytokinins (CK)		3	Chalk and Talk & Quiz
	Plant Growth Promoting Bacteria (PGPB) -Root exudation, effect of PGPB on plants - Biological Nitrogen fixation-symbiotic and asymbiotic.		2	
	Mass production by <i>Rhizobium</i> , <i>Azotobacter</i> and Cyanobacteria i.e nitrosifying, nitrifying, ammonifying and photosynthetic bacteria.		4	
	Denitrification of nitrate fertilizers to N ₂ and N ₂ O (a green house gas) by denitrifying bacteria- free living and in association with Azolla, Phosphate solubilizing bacteria, IAA producers, Soil anaerobic methanogens in rice field.		4	
	Quality control of microbial inoculants- Methods of biofertilizer application- seed inoculation, soil amendment and nursery application.		2	

IV Plant Diseases	Plant diseases mode of entry of pathogens, disease symptoms - Bacterial diseases- Crown gall, Citrus cancer, Black rot .		2	Chalk &Talk,PPT &Quiz
	Mode of entry of pathogens, disease symptoms Viral diseases, virioids TMV, tomato leaf curl, potato spindle tuber.		2	
	Mode of entry of pathogens, disease symptoms Fungal diseases- late blight of potato – <i>Phytophthora infestans</i> , loose smut of wheat – <i>Ustilago nuda</i> , rice blight – <i>Magnaporthe grisea</i> , Wilt – <i>Fusarium</i> .		3	
	Control of plant diseases Principles and practices, cultural practices, chemical methods, biological methods and genetic engineering for disease resistant plants.		3	
	Importance of seed-borne diseases and seed health testing methods.		2	
V Applications of microorganisms in agriculture	Biotransformation in plant cells – Definition, process and application of biotransformation in plant cells via <i>Agrobacterium</i> mediated gene transfer.		3	Chalk &Talk, PPT & Assignment
	Production of antimicrobial metabolites - <i>Bacillus</i> , <i>Pseudomonas</i> , <i>Streptomyces</i> , <i>Trichoderma</i> spp., .		3	
	Production of agricultural important enzymes. Biopesticides - ice minus bacteria and microbial pesticides.		3	
	EM (Effective Microorganisms) Technology - EM-BOKASHI, EM-COMPOST, EM-5, EM-X, Recycling. Phage therapy.		3	
	Total :60 Hours			

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective -III	20U6RME3	Microbial Nanotechnology	2	3	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To learn basic material science of bio-nanomaterials.
- To understand theory of ensembles required for describing nano systems.
- To optimize the synthesis of biocompatibility of nanomaterials.
- To enable the usage of various spectroscopic techniques and their application to the biomolecules.
- To identify the safety and precautionary issues in handling nanomaterials.

Unit	Description	Hours	K-level	CLO
I	Unit-I: Emergence of nanotechnology Historical Development: ancient works on Nanomaterials– emergence of nanotechnology with special reference to Feynman. Size and Scales: definition of nanostructures; insight into the nano world; intervention into the nano world, building blocks of nanotechnology. Scientific revolutions, types of nanotechnology and nano machines, basic problems and limitations; opportunities at the nanoscale, time and length scale in structures, energy landscapes.	9hrs	Up toK2	1
II	Unit-II: Nanoscale Phenomena Density of states, tunnelling; chemical bonds (types and strength). Intermolecular and inter-particle forces. Molecular and crystalline structures, particles and grain boundaries. Covalent and coulomb interactions, interactions involving polar molecules and polarization, weak intermolecular forces and total intermolecular pair potentials. Forces between solvation, hydration, polymers at surfaces, adhesion. Bulk to surface transition. Spatial and temporal scales; concept of confinement, role of surfaces in nanotechnology devices and surface reconstruction.	9hrs	Up toK3	2

III	Unit-III: Functional nanomaterials Fullerenes, carbon nanotube, graphene. Monomers and polymers. Amorphous, crystalline, semi-crystalline. Composite materials; ceramics, alloys, silicates. Quantum dot, nanofossils, smart dust, porous & nonporous inorganic materials, hydro gel and aerosols. Bio nanomaterials: bio mimetic systems, bio ceramics, dendrimers, micelles, liposome's, block copolymers. Nanomagnetic materials and superconductors- manipulation of cell and biomolecules. Cytoskeleton and cell organelles. Types of nanoparticles production – physical, chemical and biological. Microbial synthesis of nanoparticles – mechanism of synthesis – <i>Alkaligeneseutrophus</i> , <i>Aspergillus</i> sp.	9hrs	Up to K3	3
IV	Unit-IV: Structure and characterization of nanomaterials Crystal structure: crystal planes, Miller indices, crystal orientation. Morphology of materials, nanoparticles, nanowires, nanorods, nanoclusters, powders of nano crystalline materials, solid disordered nanostructures. Characterization of nanomaterials – UV-VIS spectroscopy, particle size analyzer, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD, NMR. Other tools and techniques required for nanotechnology: rDNA technology.	9hrs	Up to K4	4
V	Unit-V: Applications and risk assessment of nanomaterials Applications of nanomaterials. Energy and Environmental applications. Drug and gene delivery – protein mediated and nanoparticle mediated. Uses of nanoparticles in MRI, DNA and Protein Microarrays. Nanomedicines- Nanotechnology in food and agriculture. Toxicology in nanoparticles – Dosimetry-pollution and health risks associated with nanomaterials.	9hrs	Up to K4	5

Total 45 Hours

Books for Study

1. Parthasarathy, B.K. (2007). Introduction to Nanotechnology, Isha Publication, India.
2. Bernd Rehm. (2006). Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures. Horizon Scientific Press, UK.
3. Edelstein, A.S and Cammarata, R.C. (1998). Nanomaterials: Synthesis, Properties and Applications, Institute of Physics Pub ., England.

Books for Reference

1. Challa, S. R, Kumar, J. H. (2005). Carola Nanofabrication towards biomedical application: Techniques, tools, Application and impact: Ed., Springer, Germany.
2. Chad, A. M and Christof, M. N. (2007). Nanobiotechnology - II more concepts and applications. Wiley VCH. - (Eds)., Germany.
3. Haynes, R. Woodruff, D.P and Talchar, T.A. (1986). "Optical Microscopy of Materials", Cambridge University Press.
4. Lynn Frewer, J. Willem Norde, Arnout Fischer, Frans Kampers. (2010). "Nanotechnology in the AgriFood Sector" John Wiley and Sons, US.

- Pradeep, T. (2007). Nano Essentials understanding nanoscience and Nanotechnology. 1st edition. TMH publications, New York.

Web Resources

- <http://nupex.eu/index.php?g=textcontent/materialuniverse/sizeofthings&lang=en>
- <http://www.slideshare.net/niraliakabari3/ppt-of-phynanophysics>
- <http://www.nanoscienceworks.org/publications/books/4/9781420048056/instructors/ITNS-Lecture-1.pdf>
- www.uniroma2.it/didattica/NANOSCIENZE/deposito/L1.pptmp.misis.ru/docs/courses/17/Mats_Mo scow_2.ppt
- <http://uw.physics.wisc.edu/~himpsel/Nano/lectures.htm>

Rationale for Nature of the course

The course will provide an overview of the nano regime is so different from other regimes because both classical and quantum effects can be active thus leading to unique properties of nano devices. Nanotechnology is a highly interdisciplinary science, which will be reflected in the course by making reference to chemistry, physics, biology, pharmacy, and engineering.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Major benefits of nanotechnology include improved manufacturing methods, water purification systems, energy systems, physical enhancement, nanomedicine, better food production methods, nutrition and large-scale infrastructure auto-fabrication. Nanotechnology provides job opportunities in health industry; pharmaceutical industry; agriculture industry; environment industry; food and beverage industry as well in government and private research institutes.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos, Assignment and quiz

Course designers 1. Dr. S. Sree Gayathri

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Describe the physical and chemical aspects of nano materials.	Up to K2
CLO2	Explain the interaction between biomolecules and nanoparticle surface and its applications.	Up to K3
CLO3	Correlate properties of nanostructures with their size, shape and surface characteristics.	Up to K3
CLO4	Apply nanomaterials with novel optical behaviour.	Up to K4
CLO5	Analyze the safety and risk assessments involved in bio-nanomaterials.	Up to K4

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	3	1	2	1	1
CLO2	3	-	1	1	3
CLO3	3	3	3	3	3
CLO4	3	2	3	2	3
CLO5	1	2	2	2	-

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	2	1	-	2
CLO2	3	2	2	3	2
CLO3	2	3	3	3	2
CLO4	3	3	-	1	3
CLO5	2	2	2	3	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total Marks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Learning Outcome Based Education & Assessment (LOBE)Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K2	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K3& K3	1	K3	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 3	2	K3& K3	1	K3	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K 4	2	K4& K4	1	K4	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K 4	2	K4 & K4	1	K4	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Emergence of nanotechnology	Historical Development: ancient works special reference to Feynman.		2	Chalk and Talk, Quiz
	Size & Scales: definition of nanostructures; insight into the nano world; intervention into the nano world; building blocks of nanotechnology.		3	
	Scientific revolutions, types of nanotechnology & nano machines, basic problems & limitations		2	
	Opportunities at the nanoscale, time and length scale instrutures, energy landscapes.		2	
II Nanoscale Phenomena	Density of states; tunnelling; chemical bonds (types & strength). Intermolecular & inter-particle forces. Molecular & crystalline structures; particles & grain boundaries.		3	Chalk and Talk, Quiz
	Covalent & coulomb interactions; interactions involving polar molecules & polarization; weak intermolecular forces & total intermolecular pair potentials.		3	
	Forces between solvation, hydration; polymers at surfaces; adhesion.		1	
	Bulk to surface transition. Spatial & temporal scales; concept of confinement; role of surfaces in nanotechnology devices; surface reconstruction.		2	
III Functional nanomaterials	Fullerenes, carbon nanotube, graphene. Monomers & polymers. Amorphous, crystalline, semi-crystalline. Composite materials; ceramics, alloys, silicates.		3	Chalk and Talk & PPT, Quiz
	Quantum dot, nanofossils, smart dust, porous & nonporous inorganic materials, hydro gel & aerosols. Bio nanomaterials: bio mimetic systems, bio ceramics, dendrimers, micelles, liposome's, block copolymers. Nanomagnetic materials and superconductors- manipulation of cell and biomolecules		3	

	Cytoskeleton and cell organelles. Types of nanoparticles production – physical, chemical and biological. Microbial synthesis (bacteria, fungi and yeast) of nanoparticles – mechanism of synthesis - <i>Alkaligenes eutrophus</i> , <i>Aspergillus</i> sp.		3	
IV Structures and characterization of nanomaterials	Crystal structure: crystal planes, Miller indices, crystal orientation. Morphology of materials, nanoparticles, nanowires, nanorods, nanoclusters, powders of nanocrystalline materials, solid disordered nanostructures		5	PPT, Quiz
	Characterization of nanomaterials – UV-Vis spectroscopy, particle size analyzer, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD. Other tools and techniques required for nanotechnology: rDNA technology		4	
V Applications and risk assessment of nanomaterials	Applications of nanomaterials Energy and Environmental applications		3	PPT & Chalk and Talk, Assignment
	Drug and gene delivery – protein mediated and nanoparticle mediated. Uses of nanoparticles in MRI, DNA and Protein Microarrays. Nanomedicines- Nanotechnology in food and agriculture.		3	
	Toxicology in nanoparticles – Dosimetry-pollution and health risks associated with nanomaterials.		3	
Total			45 Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective - III	20U6RME3	Veterinary Microbiology	2	3	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To learn about spore forming bacteria and some important aerobes and anaerobes.
- To learn general and pathogenic mycology.
- To study viral properties, epidemiology, pathogenesis, diagnosis and control of diseases caused by animal viruses.
- To project the importance and to impart detailed knowledge on various aspects of protozoan parasites.
- To acquaint with emerging and re-emerging zoonotic diseases.

Unit	Description	Hours	K-level	CLO
I	Unit - I: Veterinary Bacteriology Systematic study of following pathogenic bacteria: Gram positive cocci, family <i>Micrococaceae</i> , endospore forming Gram positive rods and cocci, family <i>Bacillaceae</i> genus <i>Bacillus</i> , <i>Sporolactobacillus</i> and <i>Clostridium</i> . <i>Spirochetes</i> . Family <i>Spirochetaceae</i> and other families like <i>Spirillaceae</i> , coryneform bacteria, <i>Dermatophilaceae</i> , <i>Streptomyetaceae</i> .	9 Hrs	Up toK2	1
II	Unit- II: Veterinary mycology Systematic study of animal mycoses such as aspergillosis, candidiasis, cryptococcosis, epizootic lymphangitis, mycetomas, sporotrichosis, histoplasmosis, blastomycosis, coccidioidomycosis, haplomycosis, rhinosporidiosis, zygomycosis, mycotic abortion, mycotic mastitis, mycotic dermatitis, dermatophytoses, mycotoxicosis etc.	9 Hrs	Up toK3	2

III	Unit- III: Animal Virology Studies on animal viruses belonging to various families, and prion agents given below with reference to antigens, cultivation, pathogenesis, epidemiology, disease status in India, diagnosis, immunity and control. Capripoxvirus, avipoxvirus, cowpoxvirus; bovine herpes viruses, equine herpes viruses, infectious laryngotracheitis virus, Marek's disease virus, New castle disease virus, canine distemper virus, rinderpest virus, PPR virus; infectious bursal disease virus; rotavirus, blue tongue virus, African horse sickness virus; rabies virus, ephemeral fever virus, borna virus.	9 Hrs	Up to K3	3
IV	Unit- IV: Veterinary protozoology Morphology, epidemiology, pathogenesis, clinical signs, diagnosis and control measures of protozoan parasites belonging to the families: Trypanosomatidae, Monocercomonadidae, Trichomonadidae, Hexamitidae, Endamoebidae, Eimeriidae, Cryptosporidiidae and Sarcocystidae, Plasmodiidae, Babesiidae, Theileriidae, Haemogregarinidae and Balantidiidae.	9 Hrs	Up to K3	4
V	Unit- V: Emerging and re-emerging zoonoses Current challenges and strategies, zoonoses, xenozoonoses, nosocomial zoonoses, newer zoonotic agents viz. cat-scratch disease, rat bite fever, Creutzfeld-Jacob disease, Ebola, Marburg, Lassa, Nipah, Menangle, Herpes B, SARS. Simian and human immunodeficiency, bovine spongiform encephalopathy, hepatitis A & E, H5N1 influenza virus; re-emerging zoonoses with new pathology viz. neurocysticercosis, campylobacteriosis, rabies, GuillanBarre Syndrome, tuberculosis	9 Hrs	Up to K4	5

Total 45 Hours

Books for study

1. Prescott LM, Harley JP & Klen DA. (2005). Microbiology. Wm. C. Brown Publ., New York.
2. Glen Sonder J & Karen W Post (2005). Veterinary Microbiology: Bacterial & Fungal Agents of Animal Diseases. Cold Spring Harbor Lab. Press., USA.
3. Knipe DM, Howley PM, Griffin DE. (2006). Fields Virology. 5th Ed. Vols. I, II. Lippincott, Williams & Wilkins, USA.

Books for Reference

1. Tortora GJ, Funke BR & Case CL. (2004). Microbiology: An Introduction. Benjamin/Cummins Publ., San Francisco.
2. Murphy FA, Gibbs, EPJ, Holzmek MK & Studdert MJ. (1999). Veterinary Virology. 3rd Ed. Academic Press, USA.
3. Male D, Brostoff J, Roth DB & Roitts I. (2007). Immunology. 7th Ed. Mosby Elsevier, USA.
4. Dodds WJ & Schulz R. (Eds). (1999). Veterinary Vaccines and Diagnostics. Vol. 41 (Advances in Veterinary Medicine) 1st Ed. Academic Press, USA.
5. Kreier JP. (1991-95). Parasitic Protozoa. Ed. JR Baker. Academic Press, USA.

Web Resources

1. www.virology.com (Virology Journal)
2. www.elsevier.com/locate/vetmic (Veterinary Microbiology)
3. www.jb.asm.org (Journal of Bacteriology)
4. www.jac.oxford.journals.org (Clinical Bacteriology)
5. www.bentham.org/open/tomycj (The Open Mycology Journal)
6. www.nature.com/nrmicro (Nature Review of Microbiology)

Rationale for Nature of the course

Veterinary microbiology has helped in reducing animal sufferings, minimizing risk of zoonotic diseases threatening human health and ensuring food security. There have been unprecedented advancements in all the branches of veterinary sciences. The futuristic requirements of the society such as integrated casualty management, public health, food security and safety, healthy eco-system, containing bio-terrorism, productivity, profitability and stability of livestock farming systems etc.

Activities having direct bearing on skill development/ employability/entrepreneurship

Developing diagnostics against prevalent and emerging pathogens, prevention and control of animal diseases and zoonoses, eco-health stewardship, monitoring and surveillance of diseases of livestock and poultry. Combating bio-terrorism, genetic engineering to optimize production and develop disease resistant breeds of animals.

Pedagogy

Chalk and talk, PPT, group discussion, seminar, screening of educational videos and quiz

Course designers

1. Dr.P.N.Rajarajan

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcome	KnowledgeLevel
CLO1	Elaborate the mechanism of bacterial diseases of animals	Up to K2
CLO2	Examine various fungal diseases of animals	Up to K3
CLO3	Apprise the pathogenesis of animal viruses	Up to K3
CLO4	Explain the protozoan diseases of animals	Up to K3
CLO5	Describe the role of emerging and re emerging zoonoses	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	-	3
CLO2	3	3	3	3	3
CLO3	3	-	2	3	-
CLO4	3	3	3	3	3
CLO5	2	2	-	1	1

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	3	3	3	3	3
CLO2	-	3	3	3	-
CLO3	2	3	3	-	3
CLO4	3	2	2	2	2
CLO5	3	-	2	3	3

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35 %
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total Marks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Learning Outcome Based Education & Assessment (LOBE) Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either /or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Bacteriology	Systematic study of following pathogenic bacteria: Gram positive cocci, family Micrococaceae, endospore forming.		2	Chalk and Talk, PPT, Quiz, Group discussion
	Gram positive rods and cocci, family Bacillaceae genus Bacillus		2	
	Sporolactobacillus and Clostridium. Spirochetes. Family Spirochetaceae and other families like		2	
	Spirillaceae, coryneform bacteria, Dermatophillaceae, Streptomycetaceae.		3	

II Veterinary mycology	Systematic study of animal mycoses such as aspergillosis, candidiasis, cryptococcosis,		2	Chalk and Talk, PPT, Quiz
	epizootic lymphangitis, mycetomas, sporotrichosis, histoplasmosis, blastomycosis,		2	
	coccidioidomycosis, haplomycosis, rhinosporidiosis, zygomycosis, mycotic abortion, mycotic mastitis,		2	
	Mycotic dermatitis, dermatophytoses, mycotoxicosis etc.		3	
III Animal Virology	Studies on animal viruses belonging to various families, and prion agents given below with reference to antigens, cultivation, pathogenesis, epidemiology, disease status in India, diagnosis, immunity and control. Capripoxvirus, avipoxvirus, cowpoxvirus;		2	PPT, Seminar, Screening of educational videos, Quiz
	bovine herpes viruses, equine herpes viruses, infectious laryngeotracheitis virus,;		2	
	Marek's disease virus, New castle disease virus, canine distemper virus, rinderpest virus, PPR virus		2	
	infectious bursal disease virus; rotavirus, blue tongue virus, African horse sickness virus; rabies virus, ephemeral fever virus, borna virus.		3	
IV Veterinary protozoology	Morphology, epidemiology, pathogenesis, clinical signs, diagnosis and control measures of protozoan parasites belonging to the families: Trypanosomatidae, Monocercomonadidae,		2	PPT, Seminar, Screening of educational videos, Quiz
	Trichomonadidae, Hexamitidae, Endamoebidae, Eimeriidae		2	
	Cryptosporidiidae and Sarcocystidae.		2	
	Plasmodiidae, Babesiidae, Theileriidae, Haemogregarinidae and Balantidiidae.		3	
V Emerging and re-emerging zoonoses	Current challenges and strategies, zoonoses, xenozoonoses, nosocomial zoonoses, newer zoonotic agents viz. cat-scratch disease		2	PPT, Seminar, Screening of educational videos Assignment
	rat bite fever, Creutzfeld-Jacob disease, Ebola, Marburg, Lassa, Nipah, Menangle, Herpes B, SARS.		2	
	Simian and human immunodeficiency, bovine spongiform encephalopathy, hepatitis A & E, H5N1 influenza virus		2	
	re-emerging zoonoses with new pathology viz. neurocysticercosis, campylobacteriosis, rabies, GuillanBarre Syndrome, tuberculosis		3	
Total			45 Hours	

The Madura College, Madurai
Department of Microbiology

UG Microbiology Program Structure

Semester	Subject Code	Title of the paper	Paper	Hours	Credits	Nature of Course(Employability/ Entrepreneurship/ Skill Development)			Scope of focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision (%) /New
						Empl	Ent	Skill	Local	National	Global	
I	20U1VEN1	Value Education and Professional Ethics	VE&PE	3	3			✓	✓			Nil
	20U1RMC1	General Microbiology	MajorCore-1	3	3			✓	✓			14.20
	20U1RMC2	Basic Techniques in Microbiology	MajorCore-2	3	3			✓	✓			47.60
	20U1RMP1	Major Practical-I	Major Core practical -I	3	2			✓	✓			60
II	20U2EVS1	Environmental and Gender Studies	E&GS	3	3			✓	✓			Nil
	20U2RMC3	Microbial Taxonomy	MajorCore-3	3	3			✓	✓			50
	20U2RMC4	Cell and Molecular Biology	MajorCore-4	3	3			✓	✓			57.10
	20U2RMP2	Major Practical-II	Major Core practical -II	3	2			✓	✓			50
III	20U3RNM1	Nutrition and Health	Non Major Elective-I	2	2			✓	✓			100
	20U3RSM1	Cosmetic Microbiology	Skill based Elective(SBE-I)	2	2			✓	✓			New
	20U3RMC5	Biochemistry	MajorCore-5	5	5			✓	✓			27
	20U3RMP3	Major Core Practical-III	Major Core Practical-III	3	2			✓	✓			50
IV	20U4RNM2	Microbes in Human Welfare	Non Major Elective-II	2	2			✓	✓			40
	20U4RSM2	Immunology and Immunotechnology	Skill based Elective-II	2	2			✓	✓			New
	20U4RMC6	Microbial Physiology	Major Core-6	5	5			✓	✓			27
	20U4RMP4	Major Practical-IV	Major Core Practical-IV	3	2			✓	✓			90

V	20U5RSM3	Diagnostic Microbiology and Haematology	Skill Based Elective (SBE-III)	2	2	✓			✓			New
	20U5RMC7	Environmental Microbiology	MajorCore-7	5	5			✓	✓			40
	20U5RMC8	Medical Microbiology	MajorCore-8	5	5			✓	✓			93
	20U5RMC9	Microbial Genetics	MajorCore-9	5	5			✓	✓			63
	20U5RMP5	Major Practical-V	Major Core Practical-V	3	2			✓	✓			70
	20U5RMP6	Major Practical-VI	Major Core Practical-VI	3	2			✓	✓			20
								✓				
	20U5RIDC	Bioeconomics	Interdisciplinary	4	3			✓	✓			New
	20U5RME1	Parasitology and Entomology	Major Elective I	3	2			✓	✓			New
VI	20U5RME1	Introduction to Genomics	Major Elective I	3	2			✓	✓			New
	20U6RSM4	Entrepreneurship in Microbiology	Skill Based Elective (SBE-IV)	2	2		✓		✓			New
	20U6RMC10	Food Microbiology	MajorCore-10	5	5			✓	✓			46.60
	20U6RMC11	Principles of Gene Manipulation	MajorCore-11	5	5			✓	✓			New
	20U6RMC12	Pharmaceutical and Forensic Microbiology	MajorCore-12	5	5			✓	✓			53.30
	20U6RMP7	Major Practical-VII	Major Core Practical-VII	3	2			✓	✓			10
	20U6RMP8	Major Practical-VIII	Major Core Practical-VIII	3	2			✓	✓			100
	20U6RME2	Fermentation Technology	Major Elective II	4	3			✓	✓			90
	20U6RME2	Agricultural Microbiology	Major Elective II	4	3			✓	✓			New
	20U6RME3	Microbial Nanotechnology	Major Elective III	3	2			✓	✓			New
	20U6RME3	Veterinary Microbiology	Major Elective III	3	2			✓	✓			New

The Madura College, Madurai
Department of Microbiology

Vision:

The microbiology department seeks to achieve the global needs with highly qualified microbiologists capable of dealing with premium process and applications which will profoundly influence existing paradigm of agriculture, industry, health care and restoration of environment providing sustainable competitive edge of presence society.

Mission:

- To offer quality education in microbiology programme, to enhance intellectual foundation and preparation of students for life in a complex dynamic technological world.
- To provide graduate and research programmes in microbiology as core major in various fields such as medical, agricultural, environmental, biochemistry, biostatistics, bio informatics to prepare students with experimental learning which may build professional careers.
- A service for peoples, government agencies and industries that require expert advice about microorganisms and the roles they play in our health, economy and sustainability of our natural resources.
- To inculcate the values of honesty, responsibility and sensibility for our department students.

The Graduate Attributes

- a. Communication skills
- b. Research related skills
- c. Team work
- d. Knowledge
- e. Global Perspective
- f. Critical thinking
- g. Problem solving
- h. Analytical reasoning
- i. Scientific reasoning
- j. Reflective thinking
- k. Digital literacy
- l. Multicultural competence

Programme Educational Objectives (PEOs)

The objectives of this programme are:

PEOs	Programme Educational Objectives
PEO-1	To provide a sound exposure to students about the theory and practical aspects of microbiology for attaining academic excellence in the field of microbiology.
PEO-2	To equip students with adequate research knowledge and techniques for successful career in the field of research, industries and for pursuing higher education.
PEO-3	To analyze and interpret scientific data, to solve technical, conceptual, scientific problems and to develop effective communication skills for dissemination of research outcomes.
PEO-4	To attain leadership skills and to inculcate entrepreneurship among the students so as to start their own ventures in the field of microbiology and shall be able to develop industrial networks.
PEO-5	To make students able to attain social responsibility and to develop environmentally sustainable technologies for addressing various ethical and societal issues.

PROGRAMME OUTCOMES FOR M.Sc. GRADUATES

At the end of the programme the graduates will be able to

PO1	Employ and implement their knowledge and practical understanding in the field of science to solve various ethical, societal and environmental issues.
PO2	Attain leadership quality, to work independently and to perform collaborative scientific research as a team with effectiveness and responsibility.
PO3	Communicate effectively with other peer research groups and to write scientific articles proficiently
PO4	Engage themselves in interdisciplinary scientific research and to derive at sustainable solutions
PO5	Acquire knowledge on various advancements of science and to create themselves as an entrepreneur

Qualification for Admission

Candidate who has passed the B.Sc. degree in any Life Sciences: Microbiology/ Applied Microbiology/ Industrial Microbiology/ Botany/ Zoology/ Biochemistry/ Biotechnology/ Bioinformatics/ Biology of Madurai Kamaraj university or an examination of any other university accepted by the syndicate as equivalent thereto shall be eligible for admission to M.Sc. Degree Course in Microbiology.

Duration of the Course

The students shall undergo prescribed course of study for the period of two academic years consisting of four semesters under CBCS semester pattern with outcome based education.

Medium of Instruction: English.

System: Choice Based Credit System with Outcome Based Model.

EVALUATION (THEORY)

Internal (Formative)	: 25 marks
External (Summative)	: 75 marks
Total	: 100 marks

Continuous Internal Assessment: 25 Marks

Components	Marks
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz/ Documentation/ Case lets/ ICT based Assignment/ Mini Projects	5
Seminar	5
Total	25

BLUE PRINT FOR INTERNAL ASSESSMENT - I**Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)**

S.No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	SectionD (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K-Leve			
1	CLO 1	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	7
2	CLO 2	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	7
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

BLUE PRINT FOR INTERNAL ASSESSMENT - II
Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

S.No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO 3	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	2 (K2/K3)	7
2	CLO 4	Up to K4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	7
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers
 K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K- Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks Without choice	Consolidated
K1	2	2		--	4	6.67	50
K2	2	4	10	10	26	43.33	
K3	-	-	10	10	20	33.33	33
K4	-	-	-	10	10	16.67	17
Total Marks	4	6	20	30	60	100.00	100%

Question Paper Pattern for External Examination: 75 Marks

Section	Marks
A- Multiple Choice Questions(10 X 1mark)	10
B- Short answer type (5 X 2 mark)	10
B- Either/Or type(5X 5 marks)	25
C- Open Choice type (3out of 5 X10 marks)	30
Total	75

EVALUATION (PRACTICAL)

Internal (Formative)	: 40 marks
External (Summative)	: 60 marks
Total	: 100 marks

Question Paper Pattern for Internal practical examination (Major): 40 marks and External Practical Examination (Major) :60 Marks

Item	Internal	External
Practicals	40	60
	10 Marks : Observation & Record 30 Marks : Average of best two out of three tests	10 Marks : Viva voce 50 Marks : Practical Examinations
Project	60 => 40 Marks by Guide ; 20 Marks by Dept	40
	Guide Evaluation: 10 Marks for Student's ability and interest 10 Marks for Regularity and Punctuality 20 Marks for Quality of the work and Presentation Dept Evaluation: (Min (No.) 50% of faculty must be present) 10 Marks for Presentation using ICT tools 10 Marks for Quality and Publication/presentation in seminar/conferences	External Evaluation : 10 Marks for the Report 30 Marks for Presentation, Quality of work and Viva-voce

Irrespective of external examinations passing minimum is 50% for Post Graduate Courses and in total, aggregate of 50%.

The curriculum is revised to suit the changing trends by propagation of ideas ensuring professional growth through innovative method of teaching. The curriculum is strengthened through the latest amendments and revisions as per UGC norms.

The Madura College (Autonomous), Madurai-625011 Department of Microbiology
Curriculum structure for M.Sc., Microbiology to be implemented from 2021-2022

Sem.	Course	Subject Code	Course Title	Contact hours/Week	Credits
I	Core -1	21P1RMC1	Microbial Taxonomy	5	4
	Core -2	21P1RMC2	Biochemistry	5	4
	Core -3	21P1RMC3	Microbial Physiology	5	4
	Major Elective- 1	21P1RME1	Bioinstrumentation	5	4
			Food & Dairy Microbiology		
	Practical- 1	21P1RMP1	Lab in Microbial Taxonomy and Biochemistry	4	2
	Practical- 2	21P1RMP2	Lab in Microbial Physiology and Bioinstrumentation	4	2
	NME -1	21P1RNM1	Microbial World	2	2
			Total	30	22
II	Core -4	21P2RMC4	Cell and Molecular Biology	5	4
	Core -5	21P2RMC5	Microbial Genetics	5	4
	Core -6	21P2RMC6	Immunology	5	4
	Major Elective- 2	21P2RME2	Research Methodology	5	4
			Computational Biology		
	Practical- 3	21P2RMP3	Lab in Cell and Molecular Biology and Microbial Genetics	4	2
	Practical- 4	21P2RMP4	Lab in Immunology and Research Methodology	4	2
	NME -2	21P2RNM2	Food and Dairy Microbiology	2	2
			Total	30	22
III	Core -7	21P3RMC7	Clinical Microbiology	5	4
	Core -8	21P3RMC8	Agricultural Microbiology	5	4
	Core -9	21P3RMC9	Industrial Microbiology	5	4
	Major Multidisciplinary*	21P3RMDC	Forensic Science	6	4
	Practical- 5	21P3RMP5	Lab in Clinical Microbiology and Agricultural Microbiology	4	2
	Practical- 6	21P3RMP6	Lab in Industrial Microbiology and Nanotechnology	4	2
	Seminar		Seminar	1	-
			Total	30	20
IV	Core -10	21P4RMC10	Environmental Microbiology	5	4
	Core -11	21P4RMC11	Microbial Biotechnology	5	4
	Core -12	21P4RMC12	Genomics and Proteomics	5	4
	Major Elective- 3	21P4RME3	Entrepreneurial skill in Microbiology	5	4
			Medical Laboratory Technology		
	Practical- 7	21P4RMP7	Lab in Environmental Microbiology and Microbial Biotechnology	4	2

	Practical-8	21P4RMP8	Lab in Genomics and Proteomics & Entrepreneurial skill in Microbiology	4	2
	Seminar		Seminar	2	-
	Project	21P4RPR1	Project		6
			Total	30	26

*** Major Multidisciplinary course involves Physics, Mathematics and Computer Science**

Elective Papers* for M.Sc., Microbiology **ELECTIVES OFFERED**

Semester	Paper	Title of the paper
I	Major Elective 1 (21P1RME1)	Bioinstrumentation
		Food & Dairy Microbiology
II	Major Elective 2 (21P2RME2)	Research Methodology
		Computational Biology
III	Major Multidisciplinary (21P3RMDC)	Forensic Science
IV	Major Electives 3 (21P4RME3)	Entrepreneurial skill in Microbiology
		Medical Laboratory Technology

***Students can choose any 1 paper in each semester as elective**

Add-on Paper for M.Sc., Microbiology

Semester	Paper	Subject Code	Title of the paper	Contact hours/Week	Credits
III	Add-On	21P3RAD1	Values and Ethics in Research	2	2

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Major Core - 7	21P3RMC7	Clinical Microbiology	4	5	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To know the methods of collection and processing of clinical specimens and presumptive identification of microorganisms
- To identify the pathogenic bacteria clinically
- To understand the methods of clinical identification of pathogenic fungi
- To know the clinical significance of pathogenic animal viruses
- To learn etiology, pathogenesis and laboratory identification of pathogenic parasites

Unit	Description	Hours	K-Level	CLO
I	Unit-I: Introduction to Clinical Microbiology Clinical laboratory practices in diagnosis and infection control. Performance improvement in the Microbiology laboratory. Clinical specimen collection, transport and processing - blood, urine, sputum, CSF, pus and faeces. Microscopic examination of materials from infected sites. Use of colony morphology for the presumptive identification of microorganisms. Biochemical identification of Gram positive and Gram negative bacteria. Emerging and Re-emerging microbial diseases. Nosocomial infections. Molecular diagnosis of microbial pathogens.	15hrs	Up to K2	1
II	Unit-II: Clinical Bacteriology Classification, morphology, pathogenesis, epidemiology, laboratory diagnosis and treatment of pathogenic bacteria. Gram-positive bacteria – <i>Bacillus</i> , <i>Clostridium</i> , <i>Pneumococcus</i> , <i>Corynebacterium</i> , <i>Streptococcus</i> , <i>Staphylococcus</i> , Actinomycetes. <i>Mycobacterium tuberculosis</i> and <i>Mycobacterium leprae</i> . Infections caused by Gram-negative bacteria – Enterobacteriaceae – <i>Salmonella</i> , <i>Shigella</i> , <i>Klebsiella</i> , <i>Proteus</i> , <i>Yersinia</i> , <i>Escherichia</i> , <i>Vibrio</i> , <i>Pseudomonas</i> , <i>Neisseria</i> , <i>Haemophilus</i> , and <i>Campylobacter</i> . Mycoplasma, Spirochetes – <i>Treponema</i> , <i>Borrelia</i> and <i>Leptospira</i> . Rickettsiae and Chlamydiae.	15hrs	Up to K3	2

III	Unit-III: Clinical Mycology Classification, morphology, pathogenesis, epidemiology, laboratory diagnosis and treatment of medically important fungi. Superficial (<i>Trichophyton</i>) Systemic (<i>Candidia</i>) diseases of human. Superficial mycoses: <i>Pityriasis versicolor</i> and <i>Piedra</i> . Cutaneous mycoses - various forms of <i>Tinea</i> , <i>Microsporum</i> spp., <i>Trichophyton</i> spp., and <i>Epidermophyton floccosum</i> . Mucormycosis. Subcutaneous mycoses: Chromoblastomycosis; Sporotrichosis; Rhinosporidiosis. Systemic mycoses- true pathogenic fungi: Blastomycosis; Paracoccidioidomycosis; Histoplasmosis; Coccidioidomycosis	15hrs	Up to K3	3
IV	Unit-IV: Clinical Virology Classification morphology, pathogenesis, epidemiology, laboratory diagnosis and treatment of animal viruses. DNA viruses- Poxvirus, Herpes virus, Adeno virus, Hepatitis B virus. RNA viruses – Retrovirus - HIV, Picorna virus – Enterovirus, Poliovirus, Reo virus, Rotavirus. Rhabdo virus – Rabies virus, Toga virus, Influenza virus. Paramyxo virus- Measles and Mumps viruses. Severe Acute Respiratory Syndrome (SARS). Coronavirus.	15hrs	Up to K3	4
V	Unit-V: Clinical Parasitology Classification morphology, pathogenesis, epidemiology, laboratory diagnosis and treatment of protozoa – <i>Entamoeba histolytica</i> , <i>Giardia lamblia</i> , <i>Leishmania</i> , <i>Plasmodium</i> and <i>Cryptosporidium</i> . Nematodes – <i>Trichonella trichuris</i> , <i>Ancylostoma</i> and <i>Wuchereria bancrofti</i> . Cestodes – <i>Tinea</i> , <i>Diphyllobothrium</i> , <i>Cysticercus</i> and <i>Echinococcus</i> . Trematodes – <i>Schistosoma</i> and <i>Fasciola hepatica</i> .	15hrs	Up to K4	5

Total 75 Hours

Books for Study

1. Ananthanarayan and Jayaram Paniker. (2000). Textbook of Microbiology, 4th ed. Orient Longman, India
2. Jagdish Chander, (2002). Text book of Medical Mycology, Mehta Publishers, India
3. Parija SC, (2008). Text Book of Practical Parasitology, 3rd Ed. All India Publishers and Distributors, New Delhi.

Books for Reference

1. Chatterjee, K.D., (2009). Parasitology, Protozoology & Helminthology, CBS Publishers & Distributors Pvt. Ltd., Chennai
2. Talib, (2006). Textbook of Medical Parasitology, 2006 Jaypee Brothers Medical Publishers (P) Ltd., India
3. Brooks, Geo F Jawetz. (2001). Medical Microbiology 22nd Ed. Mc Graw Hill, USA

Web Resources

1. <https://www.atsu.edu/faculty/chamberlain/Website/links.htm>
2. <https://onlinelibrary.wiley.com/journal/14690691>
3. <https://microbiologysociety.org/members-outreach-resources/links.html>
4. <https://www.scasm.org/resources/links>

Rationale for Nature of the course

Clinical Microbiology deals with roles of clinical microbiology laboratory, identification of pathogenic microbes thus enabling to explore the methods of identification and treatment modalities for various microbial infections.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Identify and device the methods of identification pathogenic microbes. Understand the pathogenesis of various disease causing microbes. Explore the clinical importance of pathogenic microbes

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designers

Mr. P. Sasikumar

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Explain the methods of collection and processing of clinical specimens and presumptive identification of microorganisms	Up to K2
CLO2	Identify the pathogenic bacteria clinically	Up to K3
CLO3	Device the methods of clinical identification of pathogenic fungi	Up to K3
CLO4	Explain clinical significance of pathogenic animal viruses	Up to K3
CLO5	Analyze laboratory identification of pathogenic parasites	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	2	3	2	2
CLO2	2	-	3	2	3
CLO3	2	2	-	3	-
CLO4	2	2	2	2	2
CLO5	3	2	2	2	-

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	1	2	-	1
CLO2	3	2	2	-	2
CLO3	2	-	3	2	2
CLO4	2	2	2	2	2
CLO5	3	2	2	-	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)Blue Print Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction to Clinical Microbiology	Clinical laboratory practices in diagnosis and infection control. Performance improvement in the Microbiology laboratory.		3	Chalk and Talk & Quiz
	Clinical specimen collection, transport and processing - Blood, Urine, Sputum, CSF, Pus and Faeces. Microscopic examination of materials from infected sites.		5	
	Use of colony morphology for the presumptive identification of microorganisms. Biochemical identification of Gram positive and Gram negative bacteria.		5	
	Emerging and Re-emerging microbial diseases. Nosocomial infections. Molecular diagnosis of microbial pathogens.		2	
II Clinical Bacteriology	Classification, morphology, pathogenesis, epidemiology, laboratory diagnosis and treatment of pathogenic bacteria. Gram-positive bacteria – <i>Bacillus</i> , <i>Clostridium</i> , <i>Pneumococcus</i> , <i>Corynebacterium</i> , <i>Streptococcus</i> , <i>Staphylococcus</i>		5	Chalk and Talk & Quiz
	Actinomycetes. <i>Mycobacterium tuberculosis</i> and <i>Mycobacterium leprae</i> . Infections caused by Gram-negative bacteria – Enterobacteriaceae – <i>Salmonella</i> , <i>Shigella</i> , <i>Klebsiella</i> , <i>Proteus</i> , <i>Yersinia</i> , <i>Escherichia</i> , <i>Vibrio</i> , <i>Pseudomonas</i> , <i>Neisseria</i> , <i>Haemophilus</i> , and <i>Campylobacter</i> .		5	
	Mycoplasma, Spirochetes – <i>Treponema</i> , <i>Borrelia</i> and <i>Leptospira</i> . Rickettsiae and Chlamydiae.		5	
III Clinical Mycology	Classification, morphology, pathogenesis, epidemiology, laboratory diagnosis and treatment of medically important fungi.		2	Chalk and Talk & PPT & Quiz
	Superficial (<i>Trichophyton</i>) Systemic (<i>Candida</i>) diseases of human.		3	
	Superficial mycoses: <i>Pityriasis versicolor</i> and <i>Piedra</i> . Cutaneous mycoses - various forms of <i>Tinea</i> , <i>Microsporum</i> spp., <i>Trichophyton</i> spp., and <i>Epidermophyton floccosum</i> . Mucormycosis.		4	

	Subcutaneous mycoses: Chromoblastomycosis; Sporotrichosis; Rhinosporidiosis.		3	
	Systemic mycoses - true pathogenic fungi: Blastomycosis; Paracoccidioidomycosis; Histoplasmosis;Coccidioidomycosis.		3	
IV Clinical Virology	Classification morphology, pathogenesis, epidemiology, laboratory diagnosis and treatment of animal viruses. DNA viruses- Poxvirus, Herpes virus, Adeno virus, Hepatitis B virus.		5	PPT & Chalk and Talk& Quiz
	RNA viruses – Retrovirus - HIV, Picorna virus – Enterovirus, Poliovirus, Reo virus, Rotavirus. Rhabdo virus – Rabiesvirus, Toga virus, Influenza virus.		5	
	Paramyxo virus- Measles and Mumps viruses. Severe AcuteRespiratory Syndrome (SARS). Coronavirus.		5	
V Clinical Parasitology	Classification morphology, pathogenesis, epidemiology, laboratory diagnosis and treatment of protozoa – <i>Entamoeba histolytica</i> , <i>Giardia lamblia</i> , <i>Leishmania</i> , <i>Plasmodium</i> and <i>Cryptosporidium</i> .		5	signment &PPT
	Nematodes – <i>Trichonella trichuris</i> , <i>Ancylostoma</i> and <i>Wuchereria bancrofti</i> . Cestodes – <i>Tinea</i> , <i>Diphyllobottrium</i> , <i>Cysticercus</i> and <i>Echinococcus</i> .		5	
	Tremtodes – <i>Schistosoma</i> and <i>Fasciola hepatica</i> .		5	
Total		75Hrs		

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Major Core - 8	21P3RMC8	Agricultural Microbiology	4	5	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives

- To provide a basic understanding of agricultural microbiology
- To know the applications of microbial insecticides
- To learn various aspects of nitrogen fixation, phosphate solubilization and PGPR
- To gain knowledge on various microbial plant diseases
- To understand the applications of microorganisms in agriculture

Unit	Description	Hours	K-level	CLO
I	Unit – I : Introduction to Agricultural Microbiology Pedogenesis. Soil types, characteristics, soil profile and soil microflora. Classification of Soils Based on the Functions of Microorganisms (Disease-Inducing Soils, Disease-Suppressive Soils, Zymogenic Soils, Synthetic Soils). Importance of microorganisms in agriculture, influence of microorganisms in plant growth, modern concepts of microbial inoculants in agriculture. Interaction of soil microorganisms with plants: rhizosphere and rhizoplane microorganisms. Rhizosphere to non-rhizosphere ratio (R:S ratio). Phyllosphere and phylloplane.	15Hrs	Up to K2	1
II	Unit – II : Microbial Insecticides Microbial pesticides: biology and chemistry of the biocidal component, mode of action, effect on target organisms, production technology and commercial microbial pesticides. Microbial insecticides – <i>Bacillus thuringiensis</i> <i>Beauveria bassiana</i> and baculoviral insecticides- advantages of microbial insecticides and limitations. Mass production techniques; formulation of insecticides, carrier materials quality control. Compatibility of microbial and chemical insecticides; suitable insecticides for major pests; field application of microbial insecticides and its perpetuation.	15Hrs	Up to K3	2

III	Unit – III : Biofertilizers Biofertilizers- biological nitrogen fixation- symbiotic and asymbiotic, mass production of <i>Rhizobium</i> , <i>Azotobacter</i> and Cyanobacteria, <i>Anabena-Azolla</i> , Phosphate solubilizing bacteria. Soil anerobic methanogens in rice field, production - types of carrier materials, packing, storage, bench life and transportation of biofertilizers. Methods of biofertilizer application- seed inoculation, soil amendment and nursery application. Mycorrhizae: types, mass production and application of mycorrhizae. Quality control of microbial inoculants- ISI standards and quality testing at different levels.	15Hrs	Up to K3	3
IV	Unit –IV : Plant Diseases Bacterial diseases of plants - Citrus canker, blight of rice, Crown gall. Fungal diseases of plants - Cotton wilt, Tikka disease of groundnut, wheat rusts. Viral diseases of plants - Leaf curl of papaya, vein clearing of lady's finger and cucumber mosaic. Epidemiology of plant diseases: Effect of environmental factors on disease development; Dissemination of plant pathogens; Disease forecasting and its significance, Seed pathology: Importance of seed-borne diseases and seed health testing methods.	15Hrs	Up to K4	4
V	Unit – V : Applications of microorganisms in agriculture Microbial biological control agents and their mode of action – induced resistance (SAR, ISR) and priming, competition, hyperparasitism and antibiosis. Production of antimicrobial metabolites - <i>Bacillus</i> , <i>Pseudomonas</i> , <i>Streptomyces</i> , <i>Trichoderma</i> spp., siderophores and antibiotic compounds – Role of phytohormones- auxin, gibberellins, cytokinins (CK). Production of agricultural important enzymes. Biopesticides - insect bacteria and microbial pesticides. EM (Effective Microorganisms) Technology - EM-BOKASHI, EM-COMPOST, EM-5, EM-X, Recycling. Phage therapy. Microbiome engineering in agriculture.	15Hrs	Up to K4	5

Total 75 Hours

Books for study:

1. Agricultural Microbiology: G.Rangaswamy and D.J. Bagyaraj 1993, 2nd Edition, Prentice Hall of India Private Limited, New Delhi.
2. Plant Pathology –R.S. Mehrotra (1993) Tata McGraw Hill Publications Limited, New Delhi.
3. Agarwal, V.K and Sinclair, J.B. 1987. Principles of Seed Pathology, CBS Publishers, Delhi.

Books for reference:

1. Rao, N.S.S. 1993. Biofertilizers In Agriculture and Forestry, 3rd edition, Oxford & IBH Publishing Pvt. Ltd, New Delhi.
2. G.Rangaswamy and D.H. Bagayraj (1994), Disease of crop plants in India –3rd Edition Prentice Hall of India Private Limited, New Delhi.
3. Srivastava, H.N. 2001. Plant Pathology, Pradeep Publications, Jalandhar.

Web resources:

1. <https://www.futuredirections.org.au/publication/living-soils-role-microorganisms-soil-health/>
2. <https://academic.oup.com/jxb/article/58/15-16/4019/454268>
3. <https://www.toppr.com/guides/biology/microbes-in-human-welfare/biofertilizers/>
4. <https://www.britannica.com/science/poison-biochemistry/Plant-poisons-phytotoxins>
5. <https://www.frontiersin.org/articles/10.3389/fmicb.2018.02213/full>

Rationale for nature of the course

To provide students a basic understanding of environmental and agricultural microbiology including; microbial diversity in the environment in relation to environment and agricultural welfare, ecosystem wellness, microbial interactions with pollutants in the soil and environment and the fate of microbial pathogens in the environment and agricultural fields.

Activities having direct bearing on skill development/ employability/entrepreneurship

Understand the production of plant growth promoting substances and inhibiting pathogens.

To make students aware with current research in environmental and agricultural microbiology.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designer:

Mrs.N.Sumathy

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Summarize the concept and scope of agricultural microbiology	Up to K2
CLO2	Outline the process of microbial insecticides	Up to K3
CLO3	Analyze various aspects of biofertilizers	Up to K3
CLO4	Explain the mechanisms of microbial plant diseases	Up to K4
CLO5	Describe the applications of microorganisms in agriculture	Up to K4

Mapping of Course Outcome with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5
CLO1	2	3	1	2	3
CLO2	3	3	2	2	3
CLO3	3	2	-	2	3
CLO4	3	2	3	-	3
CLO5	2	2	3	2	3

Advance application–3

Intermediate level–2

Basic level –1

Mapping of Course Learning Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	3	2	1	-	2
CLO2	2	2	2	2	2
CLO3	2	2	-	3	2
CLO4	2	-	3	3	2
CLO5	3	2	2	3	3

Advance application – 3

Intermediate level–2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35 %
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total Marks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers

K2–Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Learning Outcome Based Education & Assessment(LOBE) Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either /or Choice)	SectionD (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K2	2	K2 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K3	2	K3 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K3	2	K3 & K3	1	K2	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K4	2	K1& K1	1	K3	2 (K4&K4)	1(K4)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2–Basic understanding of facts and stating main ideas with general answersK3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction to Agricultural Microbiology	a)Pedogenesis. Soil types, characteristics, soil profile and soil micro flora.		3	Chalk and Talk,Quiz
	b) Classification of Soils Based on the Functions of Microorganisms (Disease-Inducing Soils, Disease-Suppressive Soils, Zymogenic Soils,Synthetic Soils).		4	
	c)Importance of microorganisms in agriculture, influence of microorganisms in plant growth, modern concepts of microbial inoculants in agriculture.		5	
	d)Interaction of soil microorganisms with plants: rhizosphere and rhizoplane microorganisms. Rhizosphere to non-rhizosphere ratio (R:S ratio). Phyllosphere and phylloplane.		3	

II Microbial Insecticides	a) Microbial pesticides: biology and chemistry of the biocidal component, mode of action, effect on target organisms, production technology and commercial microbial pesticides.		4	Chalk and Talk, Quiz
	b) Microbial insecticides – <i>Bacillus thuringiensis</i> , <i>Beauveria bassiana</i> and baculoviral insecticides- advantages of microbial insecticides and limitations.		4	
	c) Mass production techniques; formulation of insecticides, carrier materials quality control.		3	
	d) Compatibility of microbial and chemical insecticides; suitable insecticides for major pests; field application of microbial insecticides and its perpetuation.		4	
III Biofertilizers	a) Biofertilizers- biological nitrogen fixation- symbiotic and asymbiotic, mass production of <i>Rhizobium</i> , <i>Azotobacter</i> and Cyanobacteria, <i>Anabena-Azolla</i> , Phosphate solubilizing bacteria.		3	Chalk and Talk, Quiz
	b) Soil anaerobic methanogens in rice field, production - types of carrier materials, packing, storage, bench life and transportation of biofertilizers.		3	
	c) Methods of biofertilizer application- seed inoculation, soil amendment and nursery application		4	
	d) Mycorrhizae: types, mass production and application of mycorrhizae.		3	
	e) Quality control of microbial inoculants- ISI standards and quality testing at different levels.		2	
IV Plant Diseases	a) Bacterial diseases of plants - Citrus canker, blight of rice, Crown gall.		3	Chalk & Talk, PPT, Quiz
	b) Fungal diseases of plants - Cotton wilt, Tikka disease of groundnut, wheat rusts.		3	
	c) Viral diseases of plants - Leaf curl of papaya, vein clearing of lady's finger and cucumber mosaic.		3	
	d) Epidemiology of plant diseases: Effect of environmental factors on disease development; Dissemination of plant pathogens; Disease forecasting and its significance, Seed pathology:		3	
	e) Importance of seed-borne diseases and seed health testing methods.		3	

V Applications of microorganisms in agriculture	a)Microbial biological control agents and their mode of action – induced resistance (SAR, ISR) and priming, competition, hyperparasitism and antibiosis.		3	Chalk &Talk,PPT, Assignment
	b) Production of antimicrobial metabolites - <i>Bacillus</i> , <i>Pseudomonas</i> , <i>Streptomyces</i> , <i>Trichoderma</i> spp., -siderophores and antibiotic compounds .		3	
	c) Role of phytohormones- auxin, gibberellins, cytokinins (CK).		3	
	d) Production of agricultural important enzymes. Biopesticides - ice minus bacteria and microbial pesticides.		3	
	e) EM (Effective Microorganisms) Technology - EM-BOKASHI, EM-COMPOST, EM-5, EM-X, Recycling. Phage therapy. Microbiome engineering in agriculture.		3	
Total : 75 Hours				

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	or core - 9	21P3RMC9	Industrial Microbiology	4	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To impart theoretical knowledge on the applications of microbes in industries
- To cover areas such as design, parts of bioreactors and media formulation
- To understand various factors affecting the production of microbial products of commercial importance
- To attain awareness about approaches that can be used for enhanced production and purification
- To acquire knowledge on industrial production of various microbial products

Unit	Description	Hours	K-level	CLO
I	Unit-I: Microbial strain improvement History of industrial microbiology. Screening and isolation of microorganisms, primary and secondary metabolites, enrichment, specific screening for the desired product. Strain improvement for the selected organism: mutation and screening of improved cultures, random and strategic screening methods, strategies of strain improvement for primary, secondary metabolites with relevant examples. Use of recombinant DNA technology, protoplast fusion techniques, problems associated with strain improvement programme and its application in the industry. Preservation of industrially important microbial cultures .	15hrs	Up to K2	1

II	Unit-II: Design and Types of Bioreactors Design of a basic fermenter, bioreactor configuration, design features, individual parts, baffles, impellers, foam separators, sparger, culture vessel, cooling and heating devices, probes for on-line monitoring, computer control of fermentation process, measurement and control of process. Reactors for specialized applications: Tube reactors, packed bed reactors, fluidized bed reactors, cyclone reactors, trickle flow reactors, their basic construction and types for distribution of gases. Transport phenomena in fermentation: Gas- liquid exchange and mass transfer, oxygen transfer, critical oxygen concentration, determination of K_La , heat transfer, aeration/agitation and its importance.	15hrs	Up to K3	2
III	Unit-III: Fermentation process Growth of cultures in the fermentor - Importance of media in fermentation, media formulation and modification. Kinetics of growth in batch culture, continuous culture with respect to substrate utilization, specific growth rate, steady state in a chemostat, fed-batch fermentation, yield of biomass, product calculation for productivity, substrate utilization kinetics. Fermentation process: scaling up of inoculum from shake flask to industrial fermentation. Sterilization of bioreactors, nutrients, air supply, products and effluents, process variables and control.	15hrs	Up to K3	3
IV	Unit-IV: Downstream processing and Economics Biomass separation by centrifugation, filtration, flocculation and other recent developments. Cell disintegration: physical, chemical and enzymatic methods. Extraction: solvent, two phase, liquid extraction, whole broth, aqueous multiphase extraction. Purification by different methods. Concentration by precipitation, ultra-filtration, reverse osmosis. Drying and crystallization. Economics of a fermentation process - determination of cost for production and recovery, cost cutting strategies, cell and enzyme immobilization, biological waste treatment.	15hrs	Up to K3	4

V	Unit-V: Microbial Fermentations Industrial production, recovery, purification and significance of organic acids (citric acid and lactic acid), enzymes (rennin and lipase), amino-acids (L- lysine and L-glutamic acid), therapeutic compounds (beta-lactum and peptide antibiotics), vitamins (B12 and Riboflavin), bioplastics (PHB and PHA), bioinsecticides (thuricide), biopolymer (dextran and alginate), single cell proteins (<i>Spirulina</i> and <i>Saccharomyces</i>), vinegar, alcoholic beverages (wine and rum) and biofuels (ethanol and biogas). Production of recombinant therapeutic products- Human Growth Hormone, Interferon. Production of fungal SCP- <i>Fusarium sp.</i> , <i>Aspergillus sp.</i>	15hrs	Up to K4	5

Total 75 Hours

Books for Study

1. Crueger W, Crueger A, (1990). Biotechnology: A text Book of Industrial Microbiology ,2nd Ed., USA.
2. Patel, A.H., (1996) .Industrial Microbiology, McMillan India Limited Publishing Company Ltd. New Delhi, India.
3. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology 2nd edition, Elsevier Science Ltd., Netherland.

Books for Reference

1. Aneja.K.R and Mehrotra R.S.,(2011) Fungal Diversity & Biotechnology ,New Age International Publishers, New Delhi.
2. Waites M.J. et al. (1993) Industrial Microbiology, Blackwell Science Ltd., USA
3. Casida L.E.,(1986). Industrial Microbiology, New Age International Publishers, New Delhi.
4. Prescott and Dunn's ,(1982) Industrial Microbiology. AVI Publishing Co. USA.
5. Glazer A.N and Nikaido, H.,(2007) Microbial Biotechnology by W.N. Freeman and Co.,New York.

Web Resources

1. <https://pubmed.ncbi.nlm.nih.gov/11030563/>
2. <https://microbenotes.com/bioreactor/>
3. https://www.mlsu.ac.in/econtents/2201_designandpreparationofmedia.pdf
4. <https://www.biologydiscussion.com/industrial-microbiology-2/downstream-processing-dsp-of-products/55747>
5. <http://www.uop.edu.pk/ocontents/Lec%20no%203.pdf>

Rationale for Nature of the course

This course study makes students to understand the applications of microbes in industrial sectors, design and parts of bioreactors, media formulations, microbial products of commercial importance and enhanced production, purification of various microbial products.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Understanding all aspects that are critical for providing industrially important products. Providing in depth learning in industrial microtechnology, which will serve as a focus for research into the field. Modern trends in industrial microtechnology leads for self-employment.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos, Assignment and quiz

Course designers

Dr. K.Rajeswari

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Recognize industrially important micro-organisms involved in production to get desired yield.	Up to K2
CLO2	Identify different bioreactor designs, specialized features of fermenters and transport phenomenon in fermentation.	Up to K3
CLO3	Develop inoculum for industrial fermentations, microbial growth and product formation kinetics, media formulation and sterilization, storage of inoculums.	Up to K3
CLO4	Classify various downstream processing that has to be adapted on the basis of the product to be recovered.	Up to K3
CLO5	Rationalize the processes of industrial production and purification of various microbial products	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make inferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	-	2	3	2	2
CLO2	2	1	3	2	3
CLO3	2	2	-	3	3
CLO4	2	2	2	2	-
CLO5	3	2	3	3	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	1	2	1	1
CLO2	-	2	2	2	2
CLO3	2	2	3	-	2
CLO4	2	2	2	2	2
CLO5	3	2	2	3	-

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Microbial strain improvement	History of industrial microbiology .Screening and isolationof microorganisms, primary and secondary metabolites, enrichment, specific screening for the desired product.		4	Chalk and Talk & Quiz
	Strain improvement for the selected organism: mutation and screening of improved cultures, random and strategic screening methods, strategies of strain improvement for primary, secondary metabolites with relevant examples.		5	
	Use of recombinant DNA technology, protoplast fusion techniques, problems associated with strain improvementprogramme and its application in the industry.		3	
	Preservation of industrially important microbial cultures		3	

II Design and Types of Bioreactors	Design of a basic fermenter, bioreactor configuration, design features, individual parts, baffles, impellers, foam separators, sparger, culture vessel, cooling and heating devices, probes for on-line monitoring, computer control of fermentation process, measurement and control of process.		5	Chalk and Talk & Quiz
	Reactors for specialized applications: Tube reactors, packed bed reactors, fluidized bed reactors, cyclone reactors, trickle flow reactors, their basic construction and types for distribution of gases.		5	
	Transport phenomena in fermentation: Gas- liquid exchange and mass transfer, oxygen transfer, critical oxygen concentration, determination of $K_L a$, heat transfer, aeration/agitation and its importance.		5	
III Fermentation process	Growth of cultures in the fermentor - Importance of media in fermentation, media formulation and modification.		5	Chalk and Talk ,PPT & Quiz
	Kinetics of growth in batch culture, continuous culture with respect to substrate utilization, specific growth rate, steady state in a chemostat, fed-batch fermentation, yield of biomass, product calculation for productivity, substrate utilization kinetics.		5	
	Fermentation process: scaling up of inoculums from shake flask to industrial fermentation. Sterilization of bioreactors, nutrients, air supply, products and effluents, process variables and control.		5	
IV Downstream processing and Economics	Biomass separation by centrifugation, filtration, flocculation and other recent developments.		4	PPT & Quiz
	Cell disintegration: physical, chemical and enzymatic methods. Extraction: solvent, two phase, liquid extraction, whole broth, aqueous multiphase extraction.		5	
	Purification by different methods. Concentration by precipitation, ultra-filtration, reverse osmosis. Drying and crystallization. Economics of a fermentation process - determination of cost for production and recovery, cost cutting strategies, cell and enzyme immobilization, biological waste treatment.		6	
	Industrial production, recovery, purification and significance of organic acids (citric acid and lactic acid), enzymes (rennin and lipase), amino-acids (L-lysine and L-glutamic acid).		5	PPT, Chalk, Talk & Assignment

V Microbial Fermentations	Industrial production, recovery, purification and significance of therapeutic compounds (beta-lactum and peptide antibiotics), vitamins (B12 and Riboflavin), bioplastics (PHB and PHA), bioinsecticides (thuricide),		4
	Industrial production, recovery, purification and significance of biopolymer (dextran and alginate), single cell proteins (<i>Spirulina</i> and <i>Saccharomyces</i>), vinegar, alcoholic beverages (wine and rum) and biofuels (ethanol and biogas). Production of recombinant therapeutic products-Human Growth Hormone, Interferon. Production of fungal SCP- <i>Fusarium sp</i> , <i>Aspergillus sp</i> .		5
Total			75 Hrs

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Major Multidisciplinary	21P3RMDC	Forensic Science	4	6	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

1. To learn basics of Forensic Science
2. To understand the personnel identification tools and techniques for the identification of accused and victim
3. To analyse toxic substances used in crime scene, digital and physical evidences involved in crime
4. To describe different approaches used in forensic photography
5. To study the various mathematical methods to identify and infer the crime scene

Course Learning Outcomes:

On successful completion of the programme, the students will be able to

1. Discern the basic concepts and techniques applied in forensic science
2. Analyse and Infer the various identification marks in crime
3. Identify and estimate the relationship among the toxic substances used and analyse the digital and physical evidences
4. Formulate and assess the evidences in the crime scene using the different photography methods
5. Explain different methods that are used to study the blood patterns and fire arms used in crime scene.

Unit	Description	Hours	K-level	CLO
I	Introduction to Legal Procedure – Legal Medicine – Forensic Medicine – Forensic Pathology – Forensic nursing – Medical jurisprudence – coroner – inquest- coroner inquest – police inquest – magistrate inquest – criminal courts and their powers in India – Evidence record.	16	K2	1
II	Personnel identification and Forensic Examination Identity – types of identity – dactylography (Finger Print) patterns of fingerprint – Podogram – tattoo marks – scars – photographs – forensic examination of biological fluids –blood- hair – DNA fingerprinting – collection and Preservation of bacterial materials.	18	K2	2
III	Forensic toxicology, Digital and physical evidences Toxicology – regulations to control of drugs – Poisoning - classification of poisons according to mode of action – toxicokinetics – bacterial food poisoning –bioterrorism. Physical evidences: Types of glass and their composition, Glass fracture analysis - Forensic examination of soil and Interpretation of soil evidence. Forensic examination and Interpretation of paint evidence.	18	K2	3

IV	Computer Forensics Digital Forensics - Computer Crimes – Cyber Crimes – Computer Forensic Investigations. Forensic Intelligence. Role of forensic intelligence in crime analysis. Methods of crime analysis. Databases in forensic intelligence. Management of serial crimes by application of forensic intelligence.	18	K2	4
V	Trigonometric methods in forensic science Introduction - Pythagoras's theorem- The trigonometric functions- Trigonometric rules-Application: heights and distances- ricochet analysis- aspects of ballistics-bloodstain shape-Bloodstain pattern analysis.	18	K2	5
		Total	90	Hours

Books for Reference:

1. Subrahmanyam B.V. (2016). Text book of Forensic Medicine, Toxicology and Medical Jurisprudence. For classrooms and courtrooms. Seventh edition. CBS Publishers and Distributors Pvt Ltd.
2. Eoghan Casey BS.MA. (2001). Handbook of Computer Crime Investigation: Forensic Tools and Technology.
3. Marjie T. Britz. (2003). Computer Forensics and Cyber Crime: An Introduction
4. James H., Wouldiam G. Eckert. (1999). Interpretation of Blood stain evidence at crime scene stuart Second edition, CRC Press.
5. Craig Adam. (2010). Essential Mathematics and Statistics for Forensic Science. Wiley blackwell, A John Wiley & Sons, Ltd., Publication.
6. Warren G. Kruse II and Jay G. Heiser, 2002. "Computer Forensics: Incident Response Essentials", Addison Wesley.

Web sources:

<https://www.youtube.com/watch?v=jnVnllElKFI>
<https://www.youtube.com/watch?v=w-i4NhLx1fI>
<https://www.youtube.com/watch?v=lprj9tGxzNY>
<https://www.youtube.com/watch?v=phd2vbGw1LI>
<https://www.youtube.com/watch?v=oM5uhFujtVM>

Rationale for Nature of the course

This paper give students a broad perception over forensic science, tools and techniques involved in crime scene confirmation and preparation of evidence record.

Activities having direct impact on Skill development/Employability / Entrepreneurship

- Illustrate the importance of forensic science and criminal laws behind the murders.
- Police official and forensic laboratory professionals are employed by governments and private institutions and can work as researchers and scientists for the confirmation of victim and crime involved.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, forensic lab visit, Screening of educational videos and quiz

Course designer

1. Department of Microbiology
2. Department of Mathematics
3. Department of Physics

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Distinguish the basic concepts involved in the forensic science	Up to K2
CLO2	Analysis and Infer the crimes using various identification techniques	Up to K2
CLO3	Identify and estimate the toxic substances involved in crime, identify the digital evidences of crime and identify the physical trace evidences.	Up to K2
CLO4	Analyse the basic principles of computer forensics and capture the crime scene evidences through digital evidences.	Up to K2
CLO5	Explain and analyse the firearm usage and blood stain pattern analysis using forensic mathematics.	Up to K2

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	1	1	1	1	3
CLO2	1	1	1	2	2
CLO3	1	2	1	1	3
CLO4	2	2	2	1	2
CLO5	2	2	2	2	2

Advance application – 3

Intermediate level – 2

Basic level – 1

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	1	1	1
CLO2	1	1	1	1	1
CLO3	1	1	1	1	1
CLO4	1	2	2	2	2
CLO5	2	2	2	2	2

Advance application – 3

Intermediate level – 2

Basic level – 1

Learning Outcome Based Education & Assessment (LOBE) Formative Exam – Blue Print (CIA I & II)

Articulation Mapping - K Levels with Courses Learning Outcomes (CLOs)

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
CLO x	Up to K2	3	K1	1	2(K2/K2) 2(K2/K2)	1	3(K2)
No. of Questions to be asked		3		4		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		6		14		20	

- CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Distribution of Section-wise Marks with K Levels (CIA I & II)

Internal	K Levels	Section A Short Answers	Section B (Either or Choice)	Section C (Open Choice)	Total Marks	% of Mark without choice
CIA I	K1	6	-	-	6	9.38%
	K2	-	28	30	58	90.62%
Marks		6	28	30	64	100%
CIA II	K1	6	-	-	6	9.38%
	K2	-	28	30	58	90.62%
Marks		6	28	30	64	100%

Lesson Plan

UNITS	DESCRIPTION	STAFF	HOURS	MODE
I Introduction to Legal Procedure	Legal Medicine – Forensic Medicine – Forensic Pathology – Forensic nursing		4	Chalk and Talk and PPT
	Medical jurisprudence – coroner – inquest-		4	
	Coroner inquest – police inquest – magistrate inquest		5	
	Criminal courts and their powers in India – Evidence record		5	
II Personnel identification and Forensic Examination	Identity – types of identity – dactylography (Finger Print) patterns of fingerprint		6	Chalk and Talk, PPT, Videos, Model Crime scene Investigation session
	Podogram – tattoo marks – scars – photographs – forensic examination of biological fluids - blood- hair – DNA fingerprinting –		6	
	Collection and Preservation of bacterial materials.		6	
III Forensic toxicology, Digital and physical evidences	Toxicology – regulations to control of drugs – Poisoning - classification of poisons according to mode of action		4	Chalk and Talk & PPT
	toxicokinetics – bacterial food poisoning – bioterrorism.		4	
	Physical evidences: Types of glass and their composition, Glass fracture analysis.		5	
	Forensic examination of soil and Interpretation of soil evidence. Forensic examination and Interpretation of paint evidence.		5	
IV Computer Forensics	Digital Forensics - Computer Crimes – Cyber Crimes – Computer Forensic Investigations.		6	PPT & Chalk and Talk
	Forensic Intelligence Role of forensic intelligence in crime analysis. Methods of crime analysis.		6	

	Databases in forensic intelligence. Management of serial crimes by application of forensic intelligence.		6	
V Trigonometric methods in forensic science	Introduction - Pythagoras's theorem- The trigonometric functions-		6	PPT & Chalk and Talk
	Trigonometric rules-Application: heights and distances- ricochet analysis		6	
	Aspects of ballistics-bloodstain shape- Bloodstain pattern analysis.		6	
Total			90 Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Practical -5	21P3RMP5	Lab in Clinical Microbiology and Agricultural Microbiology	2	4	40	60	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To provide the knowledge on the collection, transport and analysis of clinical specimens
- To identify the etiological agents of bacterial diseases
- To know the antibiotic sensitivity pattern of pathogenic isolates
- To familiarize with molecular diagnosis of pathogens
- To isolate beneficial micro organisms from soil

S.No.	Experiments
1	Isolation and identification of microorganisms from urine sample(<i>E.coli</i> , <i>Proteus</i> , <i>Pseudomonas</i>)
2	Clinical processing of throat swabs and nasal scrapings: <i>Staphylococci</i> and <i>Streptococci</i> : Isolation and Identification
3	Wet mount examination of stool for parasites and Stain for Amoeba / Intestinal protozoa / Malarial parasites – Leishman's stain, Giemsa stain.
4	Serodiagnosis of bacterial infection using Widal Test and Antimicrobial activity by Kirby – Bauer disc diffusion technique
5	Identification of dermatophytic fungi (<i>Candida albicans</i> , <i>Microsporum</i> , <i>Epidermophyton</i> , <i>Trichophyton</i>)
6	Molecular diagnosis of pathogenic bacteria and viruses by PCR (Demo)
7	Isolation of <i>Rhizobium</i> from root nodules
8	Isolation of phosphate solubilizing microorganisms from soil
9	Isolation and enumeration of bacteria and fungi from soil
10	Identification of microbial diseases of plants
11	Screening of indole acetic acid producing rhizobacteria
12	Microscopic examination of bacteroids from root nodules and mycorrhizae from root

Books for study

1. Cappuccino, J.H. and Sherman, N. (2007). Microbiology- A Lab Manual. 7th Edition. The Benjamin Publishing Company, Singapore.
2. Gunasekaran, P. (2008). Laboratory Manual in Microbiology. New Age International (P) Ltd. Publishers, New Delhi.
3. Benson, H.J. (1998). Microbiological Applications- Laboratory Manual in General Microbiology. 7th International Edition, McGraw-Hill, Boston.

Books for Reference

1. Kannan, N. (1996). Laboratory Manual in General Microbiology. 1st Edition, Palani Paramount Publications, Tamil Nadu.
2. Madigan, M.T. and Martinko, J.M. (2014). Brock Biology of Microorganisms. 14th Edition. Prentice Hall International Inc., USA.
3. Dubey RC and Maheswari DK (2004). Practical Microbiology 1st Edition, S.Chand & Company Ltd., New Delhi.
4. Subba Rao, N.S. (1995). Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt.Ltd., New Delhi.
5. Ratledge C & Kristiansen B.(2008). Basic Biotechnology 3rd Edition, Cambridge University Press, England.
6. Aneja, K.R. (2003). Experiments in Microbiology: Plant Pathology and Tissue Culture. WishwaPrakashan, New Delhi.

Web Resources

1. <https://www.biocourseware.com>
2. <https://www.microbiologyonline.com>
3. <https://www.ncbi.network.com>
4. <https://www.introduction to microbiology culture.m.youtube.com>
5. <https://www.practical microbiology.m.youtube.com>

Rationale for Nature of the course

Technical skills pertaining to isolation, identification and characterization of microbes will be useful for handling, analyzing and interpreting various biological samples. The goal of this course is to provide students in identifying various pathogenic microorganisms. Students will also be trained on isolation and identification of various microorganisms from soil, techniques to assess physico-chemical parameters of various organisms. It also helps them to identify eco-friendly organisms of our environment.

Activities having direct bearing on skill development/ employability/entrepreneurship

Technical skills on isolation and characterization of microbes will be helpful for screening and identifying medical important microbes. Identify beneficial organisms from different ecosystems. Utilize their skill based techniques in agricultural field. Design experiments to study various environments

Pedagogy

Demonstration and practical session

Course designers:

Dr.P.N.Rajarajan

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Apply different clinical laboratory techniques for collection and analysis of body fluids	Up to K4
CLO2	Isolate and identify pathogenic bacteria from clinical specimens	Up to K3
CLO3	Prepare antibiogram for pathogenic isolates	Up to K3
CLO4	Perform molecular diagnosis of pathogens	Up to K3
CLO5	Examine plant-growth promoting efficiency of microbes	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidence

Mapping of course outcome with Programme outcome

	PO1	PO2	PO3	PO4	PO5
CL1	3	3	2	3	2
CL2	-	3	2	3	2
CL3	3	2	1	1	3
CL4	2	2	-	3	-
CL5	2	-	3	3	2

Advance application – 3, Intermediate level – 2, Basic level – 1.

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	-	3	3	3	-
CLO2	3	3	3	-	2
CLO3	3	-	2	3	3
CLO4	3	3	-	2	2
CLO5	3	3	2	1	2

Advance application – 3, Intermediate level – 2, Basic level – 1

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Major Core Practical -6	21P3RMP6	Lab in Industrial Microbiology and Nanotechnology	2	4	40	60	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To familiarize with the role industrial important microorganisms
- To perform various industrially important enzyme productions
- To determine the estimation of ethanol production
- To synthesis nano material from microorganisms
- To characterize nanoparticles using spectroscopic techniques

S.No.	Experiments
1.	Screening, production, extraction and assay of citric acid and lactic acid by microorganisms
2.	Microbial production of penicillin by fermentation process
3.	Estimation of ethanol produced from grape juice by yeast cells
4.	Enzymatic assay of industrially important enzyme-lignolytic enzyme
5.	Screening, optimization and production of α - amylase by soil bacteria
6.	Screening, isolation and characterization of microbial biosurfactant
7	Isolation, characterization and scaling up of siderophore producing bacteria from rhizosphere soil
8.	Synthesis of silver nanoparticles by chemical reduction method and their UV-VIS absorption studies
9.	Analyzing the functional group of some polymers by FTIR spectroscopy
10.	Synthesis of nanoparticles by Sol-Gel Method and characterization (XRD and SEM analysis)
11	Antibacterial studies of nanoparticles by MIC method
12	Screening of Nanoparticles for antioxidant properties

Books for study

1. Kannan, N. (2003). Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers. Panima Publishing Co., New Delhi.
2. Dubey, R.C and Maheshwari, D.K. (2012) Practical Microbiology. S.Chand & Co., India
3. Rajagopal, K and Deepa Parvathi, V. (2017). A Practical Manual on Synthesis of Nanoparticles and its Applications in Biology, Elsevier, Netherland

Books for reference

1. Murugesan, A.G. and Rajakumari, C. (2021). Environmental Science and Biotechnology: Theory and Techniques by MJP Publishers, Tamilnadu
2. Edelstein, A. S and Cammarata, R. C. (2012). “Nanomaterials: Synthesis, Properties and Applictions”, Taylor and Francis, UK

Web Resources

1. <https://www.scielo.br/j/babt/a/X6KhHqWHCkSn3qrjYnLxyZv/?lang=en#:~:text=Citric%20acid%20is%20the%20most,molasses%20and%20starch%20based%20media.>
2. <https://www.sciencedirect.com/science/article/pii/S2405580816302424>
3. <https://biomedpharmajournal.org/vol12no3/isolation-and-identification-of-amylase-producing-bacteria-from-soil-in-nasinuan-community-forest-maha-sarakham-thailand/>
4. [http://www.nanoscienceworks.org/publications/books/4/9781420048056/instruct ors/ITNS-Lecture-1.pdf](http://www.nanoscienceworks.org/publications/books/4/9781420048056/instruct%20ors/ITNS-Lecture-1.pdf)

Rationale for Nature of the course

Industrial microbiology is a branch of applied microbiology in which microorganisms are used in industrial processes; for example, in the production of high-value products such as drugs, chemicals, fuels and electricity. Nanotechnology includes improved manufacturing methods, water purification systems, energy systems, physical enhancement, nanomedicine, better food production methods, nutrition and large-scale infrastructure auto-fabrication.

Activities having direct bearing on skill development/employability/entrepreneurship

Students will be able to utilize microbial sciences to derive industrial products and manipulation of microorganisms to increase yield. Students can occupy a strategic position in industries, in areas like Quality control/assurance, production line monitoring, fermentation, raw materials and finished product testing.

Nanotechnology provides job opportunities in health industry; pharmaceutical industry; agriculture industry; environment industry; food and beverage industry as well in government and private research institutes.

Pedagogy

Demonstration and practical session.

Course designers: Dr.S. Sree Gayathri

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

CLOs	Course Learning Outcomes	KnowledgeLevel
CLO1	Utilize the microbes for production of industrial products	UptoK2
CLO2	Screen and produce antibiotic using microorganism	UptoK3
CLO3	Outline the fermentation process and estimation of ethanol	UptoK3
CLO4	Synthesize nanomaterials using biological methods	UptoK3
CLO5	Characterize synthesized nano materials using various analytical methods	UptoK4

K1–Remembering and recalling facts with specific answers

K2-Basic understanding of facts and stating main ideas with general answers.K3–Application oriented–Solving Problems

K4–Examining, analyzing, presentation and make interferences with evidence.

Mapping of course outcome with Programme outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	3	2	2
CLO2	2	3	2	2	2
CLO3	1	2	3	3	3
CLO4	2	3	2	2	2
CLO5	2	2	2	3	3

Advance application–3, Intermediate level–2, Basic level–1

Mapping of course outcome with Programme Specific outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	1	2	2	3	3
CLO2	2	3	3	2	2
CLO3	2	2	2	2	3
CLO4	3	3	3	3	2
CLO5	2	2	2	2	2

Advanceapplication–3, Intermediatelevel–2, Basiclevel–1

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major Core-10	21P4RMC10	Environmental Microbiology	4	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To understand the role of microbes in different spheres of life
- To identify the roles of microbes in the nutrient cyclic processes and to study the different factors between climate change.
- To evaluate the types of microbial interactions with flora and fauna
- To know the microbial analysis of air and water
- To acquire knowledge on bioremediation and microbial leaching

Unit	Description	Hours	K-level	CLO
I	Unit-I: Scope of Microbial Ecology Origin of life, chemical evolution, cellular evolution, ribosomal RNA analysis for tracing microbial evolution, genetic basis for evolution, microbial biodiversity- bacterial, archaeal and eukaryal biodiversity. Extreme Habitats: Extremophiles: Microbes thriving at high and low temperatures, pH, high hydrostatic and osmotic pressures, salinity, and low nutrient levels. Ecological succession: Types; mechanisms; changes involved in succession; concept of climax. Contributions of G. Rangaswamy, Beijerinck, Winogradsky and Winogradsky's column.	15hrs	Up to K2	1
II	Unit-II: Biogeochemical cycles The carbon cycle, methanogenesis and methylotrophic, hydrogen cycle, oxygen cycle, nitrogen cycle-fixation of molecular nitrogen, ammonification, nitrification, nitrate reduction and denitrification. Sulphur cycle, Phosphorus cycle, Iron cycle and Manganese cycle. Climate change: Global warming and green house effects, sources and sinks of green house gases, Acid rain. Global environmental change; adaptation and mitigation strategies of climate change, global check, carbon sequestration and clean development mechanism.	15hrs	Up to K3	2
III	Unit-III: Microbial Interactions Interactions between microorganisms and plants, the rhizosphere, mycorrhizae, nitrogen fixation, nodules, nitrogen fixing associations between rhizobia and legumes, non-leguminous nitrogen fixing mutualistic relationship. Microbial interactions with animals- Predation on microorganisms by animals, commensal and mutualistic intestinal symbionts.	15hrs	Up to K3	3

IV	Unit-IV: Microbiology of air and water The atmosphere as habitat and medium for microbial dispersal, microorganisms in the atmo-ecosphere. Aeromicrobial pathways – Enumeration of bacteria from air – Air sampling devices – Air sanitation. Microbiology of water- Potability of water quality – Indicator organisms – Water purification – Waterborne diseases – Typhoid, Cholera, Hepatitis and Amoebic dysentery and their control measures. Waste water treatment.	15hrs	Up to K3	4
V	Unit-V: Bioremediation Ecological aspects of biodeterioration, control of biodeterioration, fouling of biofilms, treatment of solid waste, landfills and composting. Treatment of liquid waste- BOD, fixed film sewage treatment system, suspended cell sewage treatment system and tertiary treatment system. Biomagnification and its impact on loss of biodiversity. Biodegradation and Bioconversion of organic wastes; Biodegradation of hydrocarbons and plastics. Microbiological and public health aspects of waste disposal; Bioleaching of heavy metals - heavy metal contamination of environments, source and sinks of heavy metals.	15hrs	Up to K4	5

Total 75 Hours

Books for Study

1. Atlas, R.A. and Bartha, R. (2000). Microbial Ecology. Fundamentals and Application, Benjamin Cummings, New York.
2. Mara. D and Horan. N 2003. The Handbook of Water and Waste Water Microbiology. Academic Press, California.
3. Clescri, L.S., Greenberk, A.E. and Eaton, A.D. 1998. Standard Methods for Examination of Water and Waste Water, 20th Edition, American Public Health Association. US.

Books for Reference

1. Rangasami G and Bagyaraj D.J (1993). Agricultural Microbiology, Prentice-Hall publications.
2. Alexander. (1997). Introduction to soil Microbiology. John Wiley and Sons. New York.
3. Subba Rao, N.S. (1995). Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd. UK
4. Prescott L.M, Harley J.P. and Klein D.A., (2006). Microbiology, McGraw Hill Publishers. New York
5. Madigan M.T., Martinko J.M. & Brock P.J. (1997). Biology of Microorganisms, Prentice-Hall Inc. US.
6. Kanika Sharma, (2011). Textbook of Microbiology – Tools and Techniques. 1st Edition, Ane Books Pvt. Ltd., New Delhi.

Web Resources

- 1.www.highveld.com/microbiology/environmental-microbiology.
- 2.www.sfam.org.uk/en/journals/environmental-microbiology.cfm
- 3.https://content.kopykitab.com/ebooks/2016/02/5630/sample/sample_5630.pdf
- 4.[https://repository.dinus.ac.id/docs/ajar/%5b%5d_Environmental_Microbiology,_Second_Edition\(BookZZ.org\).pdf](https://repository.dinus.ac.id/docs/ajar/%5b%5d_Environmental_Microbiology,_Second_Edition(BookZZ.org).pdf)

Rationale for Nature of the course

This course study makes students to understand how microbes interact with the environment and each other, including their effects on the landscape, the spread of viruses and bacteria, the distribution of algae, fungi and parasitical organisms and the associated implications for human health and the environment.

Activities having direct impact on Skill development/Employability / Entrepreneurship

A career in Environmental Microbiology may work for private companies in the pharmaceutical industry, agricultural, petroleum, environmental remediation, or waste management sectors. They may also work for the government at agencies like the Environmental Protection Agency.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos, Assignment and quiz.

Course designers Dr.N.PanneerSelvam

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Explain the concept of omnipotence of microorganisms	Up to K2
CLO2	Elaborate the role and interaction of microbes in biogeochemical cycles	Up to K3
CLO3	Analyze the role of microbes in the air and their sampling	Up to K3
CLO4	Apply analytical techniques of quality control sector in microbiological industry	Up to K3
CLO5	Summarize the bioremediation and microbial leaching techniques	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	-	1	1	1
CLO2	2	2	3	2	2
CLO3	2	2	1	2	-
CLO4	2	2	2	2	2
CLO5	3	2	3	3	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	3	2	1	3
CLO2	1	1	3	2	2
CLO3	-	2	1	1	2
CLO4	2	2	-	1	2
CLO5	1	3	2	3	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE) Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K 3	2	K3& K3	1	K3	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 3	2	K3& K3	1	K3	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K3& K3	1	K3	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K4& K4	1	K4	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Scope of Microbial Ecology	Origin of life, chemical evolution, cellular evolution, Ribosomal RNA analysis for tracing microbial evolution.		4	Chalk and Talk, Quiz
	Genetic basis for evolution, microbial biodiversity. Bacterial, archaeal and eucaryal biodiversity.		5	
	Extreme Habitats: Extremophiles: Microbes thriving at high and low temperatures, pH, high hydrostatic and osmotic pressures, salinity, and low nutrient levels.		3	
	Ecological succession: Types; mechanisms; changes involved in succession; concept of climax. Contributions of G. Rangaswamy, Beijerinck, Winogradsky and Winogradsky's column.		3	

II Biogeochemical cycle	The carbon cycle, methanogenesis and methylotrophic. Hydrogen cycle, oxygen cycle, nitrogen cycle-fixation of molecular nitrogen		4	Chalk and Talk, Quiz
	Ammonification, nitrification, nitrate reduction and denitrification.		4	
	Sulphur cycle, phosphorus cycle, iron cycle and manganese cycle.		3	
	Global warming and green house effects, sources and sinks of green house gases, Acid rain. Global environmental change; adaptation and mitigation strategies of climate change, global dimming, carbon sequestration and clean development mechanism.		4	
III Microbial interaction	Interactions between microorganisms and plants, the rhizosphere, mycorrhizae, nitrogen fixation, nodules		5	Chalk and Talk & PPT, Quiz
	Nitrogen fixing associations between rhizobia and legumes, non-leguminous nitrogen fixing mutualistic relationship.		5	
	Microbial interactions with animals- Predation on microorganisms by animals, commensal and mutualistic intestinal symbionts.		5	
IV Microbiology of air and water	The atmosphere as habitat and medium for microbial dispersal, microorganisms in the atmo-ecosphere.		5	PPT , Quiz
	Aeromicrobial pathways – Enumeration of bacteria from air – Air sampling devices – Air sanitation.		5	
	Microbiology of water- Potability of water quality – Indicator organisms – Water purification – Waterborne diseases – Typhoid and Amoebic dysentery and their control measures. Waste water treatment.		5	

V Biodeterioration	Ecological aspects of biodeterioration, control of biodeterioration, fouling of biofilms, treatment of solidwaste.		5	PPT& Chalk and Talk, Assignment
	Landfills and composting. Treatment of liquid waste- BOD, fixed film sewage treatment system.Suspended cell sewage treatment system and tertiary treatment system.		6	
	Biomagnification and its impact on loss of biodiversity. Biodegradation and Bioconversion of organic wastes; Biodegradation of hydrocarbons and plasticsMicrobiological and public health aspects of waste disposal; Bioleaching of heavy metals - heavy metal contamination of environments, source and sinks of heavy metals.		4	
Total		75 Hrs		

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major Core-11	21P4RMC11	Microbial Biotechnology	4	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To introduce the basic aspects of biotechnology and to highlight the role of microorganisms in the field of biotechnology
- To provide an overview of cloning, vectors and other molecular tools
- To impart knowledge on principles and mechanism of gene modification and gene transfer
- To explore the importance, mechanism and application of genetic engineering in animals
- To emphasize the significance, techniques and application of genetic engineering in plants

Unit	Description	Hours	K-level	CLO
I	Unit - I: Introduction to biotechnology Definition, scope, traditional and modern biotechnology, branches of biotechnology, biotechnology research institutions in India. Importance of microbes in biotechnology. Microorganisms as source of novel compound production- biopolymer, bioplastics, biofuel and bioweapons. Pros and cons of biotechnological applications in crop and livestock improvements, ethics in biotechnology and IPR.	15 Hrs	Up to K2	1
II	Unit- II: Gene cloning Definition and steps involved in gene cloning. Cloning vectors- introduction, types and properties - pBR322, pUC18, lambda phage, M13, cosmids, phagemids, episomes, shuttle vectors, BAC vectors, YAC vectors and expression vectors. Enzymes involved in gene cloning: ligases, reverse transcriptases and restriction endonucleases- types, nomenclature, recognition sequences, cut end modification, restriction mapping.	15 Hrs	Up to K3	2
III	Unit- III: Gene modification and transfer Random mutagenesis and site directed mutagenesis -cassette mutagenesis, oligonucleotide-directed mutagenesis using plasmids, M13 DNA and PCR-based mutagenesis. Gene transfer techniques- microinjection, electroporation, microprojectile, ultrasonication, liposome fusion, microlaser. Identification and selection of recombinant clones.	15 Hrs	Up to K3	3

IV	Unit- IV: Genetic engineering in animals Introduction, objectives, vectors, gene transfer in animal cells- DNA mediated transformation, viral transduction, expression systems for animal cells, role of stem cells. Production of transgenic mice, sheep, pigs, cattle and fish. Applications of animal genetic engineering- monoclonal antibodies, hormones, immune modulator, vaccines and proteins of pharmaceutical value.	15 Hrs	Up to K4	4
V	Unit- V: Genetic engineering in plants Introductions, objectives, vectors, gene transfer in plant cells- <i>Agrobacterium</i> -mediated transformation, use of <i>arhizogenes</i> , Ti plasmids, direct DNA transfer. Gene targeting in plants, use of plant viruses as episomal expression vectors. Production of GM tomato, GM papaya, BT cotton, BT brinjal and golden rice. Applications of plant genetic engineering- crop improvement, herbicide, pest and drought resistance, plant as bioreactors.	15 Hrs	Up to K4	5

Total 75 Hours

Books for study

1. Ratledge C & Kristiansen B.(2008). Basic Biotechnology 3rd Edition, Cambridge University Press, England.
2. Darnell J. Lodish H. & Baltimore D.(2006). Molecular Cell Biology, Scientific American Books Inc., Iowa.
3. Glick B.R. & Pasternak, J.J., (2006). Molecular Biotechnology- Principles and Applications of Recombinant DNA technology, ASM press, Washington.

Books for Reference

1. Winnacker E.L.(1987) From Genes to Clones: Introduction to Gene Technology, VCH Publications, Germany.
2. Mitra S., (2001) Genetic Engineering, Macmillan, India Limited, New Delhi.

Web Resources

1. <https://microbenotes.com/category/biotechnology/>
2. <https://biotechnologyall4u.weebly.com/biotechnology-notes.html>
3. <https://www.britannica.com/science/cloning>
4. <https://www.onlinebiologynotes.com/gene-cloning-steps-involved-gene-cloning/>

Rationale for Nature of the course

The goal of this course is to provide students with information and skills that will allow them to understand the fundamentals of microbial biotechnology and to provide an overview of how microbes (e.g., bacteria, viruses and yeasts) are manipulated to solve practical problems through biotechnology. This course also highlights the technical aspects of biotechnology with special emphasis on transgenic animals, plants and their significance.

Activities having direct bearing on skill development/ employability/ entrepreneurship

Imparting knowledge on various molecular tools and vectors which could be applied for further studies. Critical reasoning and analysis of restriction maps through problem solving. Applying

the techniques pertaining to random mutagenesis, screening of mutant strains and characterization of mutants for industrial applications.

Pedagogy

Chalk and talk, PPT, group discussion, seminar, screening of educational videos, assignment and quiz.

Course designers

Dr.P.Kiruthika Lakshmi

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO1	Elaborate the importance of microbes in biotechnology and discuss the pros and cons and other ethical issues pertaining to biotechnology	Up to K2
CLO2	Differentiate various cloning vectors, other molecular tools and their applicability in gene cloning	Up to K3
CLO3	Apprise the mechanism of mutagenesis and various techniques for transferring recombinant genes to the host cell	Up to K3
CLO4	Explain the principle, procedure for producing transgenic animals and its biological significance	Up to K4
CLO5	Describe various methods involved in transformation of plant cells and the importance of GM crops	Up to K4

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	3	1	2	3	3
CLO2	3	3	3	3	3
CLO3	3	2	-	3	3
CLO4	3	3	3	3	3
CLO5	2	2	2	1	-

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	3	3	3	3	3
CLO2	3	-	3	3	2
CLO3	2	3	3	3	3
CLO4	3	2	2	2	-
CLO5	3	1	2	3	3

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35 %
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE) Blue Print

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either or Choice)	SectionD (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K2	2	K2 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K3	2	K3 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K3	2	K3 & K3	1	K2	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K4	2	K1& K1	1	K3	2 (K4&K4)	1(K4)
. of Questions tobe asked			10		5		10	5
No. of Questions tobe answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction to biotechnology	a) Definition, traditional and modern biotechnology, branches of biotechnology, biotechnology research institutions in India		4	Chalk and Talk, PPT, Quiz, Group discussion
	Importance of microbes in biotechnology. Microorganisms as source of novel compound production- biopolymer		3	
	c) Bioplastics, biofuel and bioweapons		3	
	d) Pros and cons of biotechnological applications in crop and livestock improvements		3	
	e) Ethics in biotechnology and IPR		2	
II Gene cloning	a) Definition and steps involved in gene cloning. Cloning vectors- introduction, types and properties		3	Chalk and PPT, Quiz
	b) pBR322, pUC18, lambda phage, M13, cosmids, phasmids		4	
	c) Episomes, shuttle Vectors, YAC vectors, and expression vectors		2	
	d) Enzymes involved in gene cloning: ligases, reverse transcriptases		2	
	Restriction endonucleases-types, nomenclature, recognition sequences, cutend modification, restriction mapping		4	
III Gene modificationand transfer	Random mutagenesis and site directed mutagenesis -cassette mutagenesis, oligonucleotide-directed mutagenesis using plasmids, M13 DNA and PCR-based mutagenesis		5	PPT, Seminar, Screening of educational videos, quiz
	b) Gene transfer techniques-microinjection, electroporation, microprojectile		3	
	c) Shot gun method, ultrasonication, liposome fusion, microlaser		4	
	Identification and selection of recombinant clones		3	

IV Genetic engineering in animals	a) Introduction, objectives, vectors, gene transfer in animal cells-DNA mediated transformation		3	PPT, Seminar, Screening of educational videos, quiz
	b) Viral transduction, expression systems for animal cells, role of stem cells		4	
	Applications of animal genetic engineering-monoclonal antibodies, hormones, immune modulator, vaccines and proteins of pharmaceutical value.		4	
	Production of transgenic mice, sheep, pigs,cattle and fish		4	
	Introduction, objectives, vectors, gene transfer in plant cells- <i>Agrobacterium</i> -mediated transformation		5	PPT, Seminar, Screening of
V Genetic engineering in plants	Use of arhizogenes, Ti plasmids, direct DNA transfer. Gene targeting in plants, use of plant viruses as episomal expression vectors		3	educational videos, assignment
	c) Applications of plant genetic engineering-crop improvement, herbicide, pest and drought resistance, plant as bioreactors		4	
	d) Production of GM tomato, GM papaya, BT cotton, BT brinjal and golden rice		3	
Total			75 Hours	

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major Core - 12	21P4RMC12	Genomics and Proteomics	4	5	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives:

- To learn the genetic makeup of prokaryotes and eukaryotes
- To understand the various sequencing techniques
- To learn phylogenetic tree and molecular phylogeny
- To study the basics of proteomics
- To study different tools involved in genomics and proteomics.

Unit	Description	Hours	K-level	CLO
I	Unit- I :Genome of prokaryotes and eukaryotes Structure and organization of prokaryotic and eukaryotic genome - repetitive DNA content. Eukaryotic organelle genomes – Mitochondria and Chloroplast. Epigenetics- mapping of genomes:DNA chip and microarrays, physical mapping, restriction mapping. FISH, STS mapping. Human genome project. Different types of model organisms -Yeast (<i>Saccharomyces cerevisiae</i>), Fruit fly (<i>Drosophila melanogaster</i>), Nematode worm (<i>Caenorhabditis elegans</i>), Western clawed frog (<i>Xenopus tropicalis</i>), Mouse (<i>Mus musculus</i>), Zebrafish (<i>Danio rerio</i>).	15 Hrs	Up to K2	1
II	Unit II :Sequencing Techniques Polymerase Chain Reaction (PCR) techniques – gene amplification. PCR primer designing -Thermal cycle sequencer - RT-PCR and other types of PCR, Molecular markers.-DNA foot printing- Methods of DNA sequencing - Sangers and MaxamGilbert methods. Automated DNA sequencing with fluorescent labeled ddNTPs. Second generation sequencing techniques – pyrosequencing, virtual terminator sequencing, Introduction to third generation sequencing techniques – nanopore and ion torrent. Applications - personal genomics, metagenomics.	15 Hrs	Up to K3	2

III	Unit III :Phylogenetics Clone contig approach by chromosome walking and whole genome – shotgun approach. Gene identification, location and computer analysis of gene function. Molecular phylogenetics – DNA based phylogenetic trees- Tree construction and application of molecular phylogenetics. Transcriptome analysis- Northern blot, SAGE, transcript sequencing vs. hybridization. Functional genomics using RNAi - phylogenetic analysis using CLUSTAL W, PHYLIP.	15Hrs	Up to K3	3
IV	Unit IV: Proteomics Definition, classification, SDS-PAGE-2D – SDS-PAGE. Detection and quantification of proteins in gels, pros and cons of various staining methods. Basics of mass spectrometry. MALDI TOF and ESI and their application in proteomics. Affinity purification of protein. TAP tag. Gel based proteome profiling - Application of proteome analysis- drug development and toxicology, Pharmaceutical Applications.	15Hrs	Up to K4	4
V	Unit V: Tools and Techniques involved in genomics and proteomics Genome editing -CRISPR system, Tandem MS/MS spectrometry. Peptide sequencing by tandem mass spectrometry. FTIR and GC-MS, LC-MS, XRD patterns, RAPD, RFLPs, SSLPs, SNPs detection. Molecular visualizing tools – RASMOL, Docking, homology modeling Ramachandran Plot- Genome alignment and analysis tools – pathway analysis - Databases and data retrieval systems (DBMS, SQL) – primary and secondary databases, biological databases – NCBI, UniProt, PDB, KEGG.	15Hrs	Up to K4	5

Total 75Hours

Books for study:

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). VIII ed. Principles of Genetics, Wiley, India.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc. USA.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. XI Edition. Benjamin Cummings. USA.

Books for Reference:

1. Ghosh, Z. and Mallick, V. (2008). Bioinformatics-principles and applications Oxford university press. England
2. Rastogi, S. C., Parag Rastogi, and Namita Mendiratta. (2008). Bioinformatics Methods And Applications: Genomics Proteomics And Drug Discovery 3Rd Ed. PHI Learning Pvt. Ltd. New Delhi.

Web resources:

1. <https://www.isaaa.org/resources/publications/pocketk/15/default.asp#:~:text=Genomics%20provides%20an%20overview%20of,in%20understanding%20organism's%20entire%20metabolism.>
2. <https://www.sciencedirect.com/book/9781907568107/concepts-and-techniques-in-genomics-and-proteomics>

3. <https://www.nature.com/articles/s41392-019-0089-y>
4. <https://www.sciencedirect.com/science/article/pii/B9780128149195000099>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122955/>

Rationale for Nature of the course

This paper give students a broad perception over genomes and proteomes, techniques involved, structure and molecular weight prediction and applying various tools and techniques for the confirmation of structure.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Illustrate the importance of genomes and proteomes and its structure. Health care, Medical research, Pharma professionals are employed by governments and private institutions and industries and can work as researchers and scientists for the discover of new medicine and vaccines.

Pedagogy

Chalk and talk, PPT, Group discussion, hands on software training, Seminar, Screening of educational videos and quiz

Course designer

Dr. K. Kannan

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Discern the structure and organization of prokaryotic and eukaryotic genome	Up to K2
CLO2	Analysis and Infer the various sequencing technologies	Up to K3
CLO3	Construct phylogenetic tree and explain molecular phylogeny	Up to K3
CLO4	Formulate and assess proteomic tools for detection and quantification of proteins	Up to K4
CLO5	Explain different tools involved in genomics and proteomics	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	1	1	1
CLO2	1	1	1	1	1
CLO3	-	1	1	1	1
CLO4	1	2	2	-	2
CLO5	2	2	-	2	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	1	1	1	1	3
CLO2	1	1	1	2	2
CLO3	-	2	1	1	3
CLO4	2	2	2	-	2
CLO5	2	2	-	2	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	30	20	50	41.7	41.7%
K4	-	-	-	20	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE) Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
5.	CLO 5	Up to K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Lesson Plan

Units	Description	Staff	Hours	Mode
I Genome of prokaryotes and eukaryotes	Structure and organization of prokaryotic Eukaryotic organelle genomes – Mitochondria and Chloroplast.		4	Chalk and Talk, Quiz
	Epigenetics - mapping of genomes: DNA chip and microarrays, physical mapping, restriction mapping, FISH, STS mapping. Human genome project.		4	
	Different types of model organisms - Yeast (<i>Saccharomyces cerevisiae</i>), Fruit fly (<i>Drosophila melanogaster</i>), Nematode worm (<i>Caenorhabditis elegans</i>)		4	
	Western clawed frog (<i>Xenopus tropicalis</i>), Mouse (<i>Mus musculus</i>), Zebrafish (<i>Danio rerio</i>).		3	

II Sequencing Techniques	Polymerase Chain Reaction (PCR) techniques – gene amplification. PCR primer designing -Thermal cycle sequencer - RT-PCR and other types of PCR, Molecular markers		4	Chalk and Talk, Quiz
	DNA foot printing- Methods of DNA sequencing - Sangers and Maxam Gilbert methods. Automated DNA sequencing with fluorescent labeled ddNTPs.		4	
	Second generation sequencing techniques pyrosequencing, virtual terminator sequencing, Introduction to third generation sequencing techniques		4	
	nanopore and ion torrent. Applications - personal genomics, metagenomics.		3	
III Phylogenetics	Clone contig approach by chromosome walking and whole genome – shotgun approach. Gene identification, location and computer analysis of gene function.		4	Chalk and Talk, Quiz,& PPT
	Molecular phylogenetics – DNA based phylogenetic trees-Tree construction and application of molecular phylogenetics. Transcriptome analysis		4	
	Northern blot, SAGE, transcript sequencing		4	
	phylogenetic analysis using CLUSTAL W, PHYLIP		3	
IV Proteomics	Definition, classification, SDS-PAGE- 2D – SDS-PAGE.		3	PPT, Quiz& Chalk and Talk
	Detection and quantification of proteins in gels, pros and cons of various staining methods.		4	
	Basics of mass spectrometry. MALDITOF and ESI and their application in proteomics. Affinity purification of protein. TAP tag..		4	
	Gel based proteome profiling - Application of proteome analysis- drug development and toxicology, Pharmaceutical Applications		4	

V Tools and Techniques involved in genomics and proteomics	Applications and tools involved in genomics and proteomics:Genome editing -CRISPR system, Tandem MS/MS spectrometry. Peptide sequencing by tandem mass spectrometry.		5	PPT, Assignment & Chalk and Talk
	FTIR and GC-MS, LC-MS, XRD patterns, RAPD, RFLPs, SSLPs, SNPs detection. Molecular visualizingtools –RASMOL		5	
	Docking, homology modeling Ramachandran Plot-Genome alignment and analysis tools –pathway analysis - Databases and data retrieval systems (DBMS,SQL)			
	Primary and secondary databases, biological databases – NCBI, UniProt, PDB, KEGG.		2	
Total			75 Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major elective 3	21P4RME 3	Entrepreneurial skillin Microbiology	4	5	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	✓

Course Objectives:

- To understand the concept of entrepreneurship and its development
- To impart basic skills required for a successful entrepreneur
- To learn t h e basic concepts of management such as planning, decision making, leadership, organization and authority
- To attain expertise in managing the start-up and to run an organization
- To identify the various entrepreneurial avenues in microbiology

Unit	Description	Hours	K-level	CLO
I	Unit-I: Introduction to Entrepreneurship and Entrepreneurial development Introduction, Concept and classification of Entrepreneur, Definition , Characteristics, Objectives and Role of Entrepreneurship and Enterprise ,Entrepreneurial scenario in India. Factors influencing Entrepreneurship. Meaning and Types of Entrepreneurial skills, management skills, Teamwork and leadership skills, Communication and listening, Strategic thinking and planning skills, Technical skills, Time management and organizational skills, Entrepreneurial skills in the workplace.	15 hrs	Up to K2	1
II	Unit-II: Dimensions of Entrepreneurship and Planning for a smallbusiness Women Entrepreneurship- Meaning- Need- Scope- Growth of women entrepreneurship - Problems faced by women entrepreneurs- Special Scheme for women entrepreneurs, Role of SHG in women entrepreneurship development. Rural Entrepreneurship- Meaning- Need- Scope- Problems faced by Rural Entrepreneurs- Entrepreneurship development in rural area- Special Schemes for Rural Entrepreneurs. Identification of project, Finance- need for financial planning, sources of finance & term loans. Marketing- concept-problems.Marketing Mix- Test. Commercialisation of the product, market structure, price feasibility	15hrs	Up to K3	2

III	Unit-III: Entrepreneurship in Clinical and Diagnostic Microbiology Scope and need of clinical/diagnostic Microbiology laboratories. Facilities required for the set up of a clinical laboratory. Area required and infrastructure - equipment and their cost. Govt approval/licences. Interaction with physicians and their consensus. Specimen types and collection. Processing of specimens and interpretation. Reporting results. Ethics in clinical practice.	15hrs	p to K4	3
IV	Unit-IV: Entrepreneurship in Agricultural Microbiology- Bio- fertilizer and biopesticides. Scope of Bio-fertilizers and biopesticides. Facilities required to set up a Bio-fertilizer and biopesticides company - area required, infrastructure - equipment and their cost. Mandatory licences - TNAU certificate, and approval from government agencies. Inoculum development and scale up. Mass production. Field efficacy studies - NABL studies. Packing and Marketing. End user interaction, sales, feed-back and follow-up. Case study-Mushroom cultivation	15hrs	p to K4	4
V	Unit-V: Entrepreneurship in Industrial Microbiology- Bio-waste management- biofuel and bio-composting, Facilities required to set up a Bio- waste plant - area required, infrastructure - equipment and their cost. Mandatory licences –National Dairy Development Board's (NDDB) or Khadi and Village Industries Commission (KVIC) State Office/ Regional Offices for installation of biogas plants under “New National Biogas and Organic Manure Programme (NNBOMP)” approval from government agencies. Inoculum development and scale up. Mass production. Field efficacy studies - NABL studies. Packing and Marketing. End user interaction, sales, feed-back and follow-up Case study- Biofertilizer- Rhizobium	15hrs	p to K3	5

Total – 75 hours

Books for study

1. Dr. Jayashree Suresh, (2003), Entrepreneurial Development , Margham Publication. India

Books for reference:

1. Ramachandran , (2008). Entrepreneurship Development, McGraw Hill, UK
2. Katz ,(2021) Entrepreneurship Small Business, McGraw Hill, UK
3. Byrd Megginson, (2006). Small Business Management An Entrepreneur's Guidebook 7th ed, McGraw Hill, UK
4. Fayolle A (2007). Entrepreneurship and new value creation. Cambridge, Cambridge University Press, UK
5. Hougard S. (2005). The business idea. Berlin, Springer, Netherland
6. Lowe R & S Mariott (2006) Enterprise: Entrepreneurship & Innovation. Burlington, Butterworth Heinemann, UK
7. Léo-Paul Dana ,(2011). World Encyclopedia of Entrepreneurship, Edward Elgar publication, UK

Web Resources

1. <https://www.biospace.com/article/microbiology-a-field-ripe-for-entrepreneurship/>
2. <https://sme.snu.edu.in/node/8161>
3. <https://www.zippia.com/microbiologist-jobs/skills/>
4. <https://biooekonomie.de/en/actors/portraits/microbiologist-entrepreneurial-vision>

Rationale for nature of the course

Entrepreneurial skills in Microbiology course will help to understand the concept of entrepreneurship and the objectives of Entrepreneurship Development. This field will impart basic understanding and skills required for a successful entrepreneur. The study of entrepreneurship development will enable the students to understand the basic concepts of management and entrepreneurship such as planning decision making, leadership, organizations and authority. This course will help the students to attain skills to manage the start-up and run an organization. This course will help the students to explore the various entrepreneurial avenues in Microbiology.

Activities having direct bearing on skill development/ employability/entrepreneurship

Entrepreneurial skills in Microbiology course will help to start a company and also help to become an entrepreneur.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Assignment, Screening of educational videos and quiz

Course designers

Dr.AshaKannan A.P Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Comprehend the concept of entrepreneurship and its development	Up to K2
CLO2	Apply the basic skills to become an entrepreneur	Up to K3
CLO3	Explain the concepts of entrepreneurial management	Up to K4
CLO4	Utilize the skills needed to manage the start-up and run an organization	Up to K4
CLO5	Explore the various entrepreneurial avenues in microbiology	Up to K3

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	-	1	1	1
CLO2	1	1	1	1	1
CLO3	1	1	1	-	1
CLO4	1	-	2	2	2
CLO5	2	2	2	2	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	1	2	1	3
CLO2	1	2	-	2	3
CLO3	2	-	1	1	3
CLO4	2	2	2	-	2
CLO5	2	2	3	2	-

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	3	6	10	-	19	15.83	37.5%
K2	2	4	10	10	26	21.67	
K3	2	-	20	20	42	35.0	35%
K4	3	-	10	20	33	27.5	27.5%
Total Marks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Learning Outcome Based Education & Assessment (LOBE) Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K3	2	K2 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K4	2	K3 & K4	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K4	2	K1& K1	1	K1	2 (K1&K1)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidence

Lesson Plan

Units	Description	Staff	Hours	Mode
I Introduction to Entrepreneurship and Entrepreneurial development	Introduction, Concept and classification Entrepreneur, Definition ,Characteristics, Objectives		3	Chalk and Talk PPT Quiz
	Role of Entrepreneurship and Enterprise,Entrepreneurial scenario in India. Factors influencing Entrepreneurship.		4	
	Meaning and Types of Entrepreneurial skills, management skills, Teamwork and leadership skills, Communication and listening, Strategic thinking and planning skills, Technical skills,		4	
	Time management and organizational skills,Entrepreneurial skills in the workplace.		4	

II Dimensions of Entrepreneurship and Planning for a small business	Rural Entrepreneurship- Meaning- Need- Scope- Problems faced by Rural Entrepreneurs- Entrepreneurship development in rural area- Special Schemes for Rural Entrepreneurs.		3	Chalk and Talk PPT Quiz
	Women Entrepreneurship- Meaning- Need- Scope-Growth of women entrepreneurship - Problems faced by women entrepreneurs-		3	
	Special Scheme for women entrepreneurs, Role of SHG in women entrepreneurship development.		3	
	Identification of project, Finance- need for financial planning, sources of finance & term loans. Marketing- concept- problems.		3	
	Marketing Mix- Test. Commercialisation of the product, market structure, price feasibility		3	
III Entrepreneurship in Clinical and Diagnostic Microbiology	Scope and need of clinical/diagnostic Microbiology laboratories. - Interaction with physicians and their consensus.		2	Chalk and Talk & PPT Quiz
	Facilities required for the set up of a clinical laboratory. Area required and infrastructure		3	
	Equipment and their cost. Govt approval/licences.		3	
	Specimen types and collection. Processing of specimens and interpretation. Reporting results.		3	
	Ethics in clinical practice.		4	
IV Entrepreneurship in Agricultural Microbiology-Bio- fertilizer and biopesticides	Scope of Bio-fertilizers and biopesticides. Facilities required to set up a Bio-fertilizer and biopesticides company - area required, infrastructure		4	PPT & Chalk and Talk Quiz
	Equipment and their cost. Mandatory licences - TNAU certificate, and approval from government agencies.		3	
	Inoculum development and scale up. Mass production. Field efficacy studies - NABL studies. Packing and Marketing.		2	
	End user interaction, sales, feed-back and follow-up. Case study- Mushroom cultivation		6	

V Entrepreneurship in Industrial Microbiology- Bio- waste management- biofuel and bio- composting	Facilities required to set up a Bio- waste plant - area required, infrastructure - equipment and their cost. Inoculum development and scale up.		4	PPT &Chalk and Talk Assignment
	Mandatory licences –NDDB or KVIC, State Office/ Regional Offices for installation of biogas plants under NNBOMP approval from government agencies.		3	
	Mass production. Field efficacy studies - NABL studies. Packing and Marketing. End user interaction, sales, feed-back and follow-up		4	
	Case study- Biofertilizers- Azolla		4	
Total			75Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major Elective-3	21P4RME3	Medical Laboratory Technology	4	5	25	75	100

Nature of Course				
Knowledge and skill			Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To enhance knowledge and skills in several major categorical areas of medical laboratory technology.
- To explain the staining and culturing techniques to identify the microbial pathogens.
- To define the metabolism of protein, lipids and serum and serological analysis.
- To recite the basic concepts of hematology with principles of blood testing.
- To correlate the morphology with the function of cells and tissues.

Unit	Description	Hours	K-Level	CLO
I	Unit-I: Basic Laboratory technology and ethics Sterilization: General principle of sterilization, classification, physical, mechanical, chemical method -sterilization of media, glassware and apparatus. Microscope-Principal, operation, care and use. Health duties and responsibility of lab technician-General duties, specific duties – aim, type and diagnosis of first aid, safety Measures- Code of professional conducts -Immunity: Types, Factor effecting immunity – collection, preservation and storage of different specimens - communication: Public relation, Patient relation and physician, nursing staff relation, report and record - Quality control - Instrument (Internal): pH meter, Hot air Oven, Auto-Clave, incubator, colorimeter, centrifugeRadiography techniques-X-Ray, CT, USG & MRI–World Health Organization (WHO) and Primary Health Care (PHC) - Ethics: Importance, Principle, Consideration.	15hrs	Up to K2	1

II	Unit-II: Bacteriology and Parasitology Morphology, isolation and identification of the pathogen's-cocci, bacilli, vibrios, spirochetes, actionnomycetes. Laboratory diagnosis. Principles of antimicrobial therapy and biotic susceptibility tests. Staining of Bacteria- Gram stain, Negative Stain, Ziehl – Neelsen, Albert, Spore Stain, Preparation of staining reagents and their composition. Bacterial metabolism -Requirements of bactria ,Aerobic, Anaerobic, Growth-Cultivation of microorganism -Culture Media (i) Isolation and Inoculation according Techniques. Normal flora, opportunistic pathogens, nosocomial infections-Definitions. Causes, symptoms, treatment and prevention of Bacterial diseases- Staphylococcal, Streptococcal infections, Tuberculosis. Morphology, Life Cycle, Symptoms Clinical Diagnosis & Laboratory Diagnosis- Hook Worm, Round worm, Tape worm, <i>Entamoeba histolytica</i> , <i>Giardia lambila</i> .	15hrs	Up to K3	2
III	Unit-III: Biochemistry and clinical pathology Introduction of Biochemistry - Definition, Classification and Importance. Metabolism of protein, serum, lipids -analysis and collection of gastric juice - Estimation of Total protein, serum albumin, Globulin and A.G ratio, serum creatinine, Blood sugar (God-Pog-Ortho-toludine & Folin-wu Method) - Hormones – definition, function, importance of hormones,T3, T4, T5 H - Enzymes and Co- Enzymes -Serum amylase - Serum electrolytes- Glucose Tolerance test (G.T.T.) - Liver Function test- Bilirubin estimation (Direct & Indirect)- Estimation of acid phosphatase and Alkaline phosphatase- Jaundice Classification - D.N.A & R.N.A their importance – Specimen AnalysisUrine-Normal, abnormal and Constituents of Urine -Throat swab, stool and sputum.	15hrs	Up to K3	3
IV	Unit-IV: Haematology and Blood Banking Introduction of Haematology -Collection of blood -Red Cell Count, method, calculation, Haemocytometer - White cell count method and calculation - Differential Leukocyte Count (D.L.C)- Staining procedures - Packed cell volume- Normal Values, Macro and Micro method - Estimation of Haemoglobin method-S.G, Chemical, Colorimetric and Gasometric and clinical importance- Anticoagulation, MCV,MCH & MCHC and its importance- Coagulation tests, Total Platelet Count (T.P.C) with direct & indirect method. ABO and Rh Blood Group system – ABO Grouping by slide Method and tube method, antigen and type of antibodies, Rh system with slide method, type of antibodies, One/Two stage albumin technique for Rh Factor. Coomb's Test- Direct and Indirect method.	15hrs	Up to K3	4

V	Unit-V: Histotechnology and cytology Introduction - Examination method of cell and tissue -Tissue Processing, Collection of specimen, fixation, labelling and clearing, dehydration, Fixation of Tissue - Simple fixative and cytological fixative, Micro anatomical fixative, Staining - Staining of tissues section, theory of staining, mounting of section, Staining technique, Section cutting- Microtome and their Knives, mounting section, Techniques of section cutting -Reception of specimen, preparation & Fixation and Restoration of colour according Museum technique, Autopsy techniques - Processing of Tissues, Preservation of Orange.Principal of exfoliate cytology fixation of smears PAP staining and identification of cells in a normal vaginal smear, Preparations of smear of fine needle aspiration cytology.	15hrs	Up to K4	5

Total 75 Hours

Books for Study

1. **Ananthanarayanan R. and Jayaram Panicker C.K. (1994). Text book of Microbiology. Orient Longman, UK.**
2. Dubey RC & Maheswari DK (2005). A text book of Microbiology, Revised Multicolour Edition, Published by S. Chand & Company Limited, New Delhi.
3. **Roitt, I.M (1998) Essential Immunology Blackwell Scientific Publishers, England.**

Books for Reference

1. **Baron, E.J. and Finegold S.M. (1995). Scientific Company. Diagnostic Microbiology. Blackwell Scientific Company, England**
2. Prescott M (2005). Microbiology. 6th Edition, Tata McGraw – Hill, New Delhi. Publishing Co. Ltd., New York.
3. **Kuby, J. (1994). Immunology, 2nd edition, W.H. Freeman and Company. New York.**
4. Rajan, S. 2009. Medical Microbiology, MJP Publishers, Chennai
5. **James G Cappuccino & Natalie Sherman (2004). Microbiology: A Laboratory Manual. 6th Edition, Published by Pearson Education, London.**

Web Resources

1. <https://nios.ac.in/online-course-material/vocational-courses/dmlt.aspx>
2. <https://www.jaypeedigital.com/book/9789386261182>
3. <https://chandanmlt.com/home/course/dmlt-1st-year-batch-january-2021/27>

Rationale for Nature of the course

This specialization opens up many opportunities for them on the professional front. These specialisations help students to explore more career opportunities in various fields of the healthcare sector like hospitals, pathology labs, research and development organizations.

Activities having direct impact on Skill development/Employability / Entrepreneurship

The MLT course aims at improving the quality of the healthcare system by training students in how to identify, inspect and test cells, tissues, and body fluids, and aid in the diagnosis, treatment, and prevention of diseases through the use of various procedures and laboratory equipment.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designers

Dr.S.Sree Gayathri

Course Learning Outcomes (CLO)

On successful completion of the programme, the students will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Emphasize basic laboratory technology, instrument and their role as a medical laboratory technician.	Up to K2
CLO2	Summarize the epidemiological and ecological aspects of parasites causing diseases to humans.	Up to K3
CLO3	Demonstrate knowledge and understanding of the principles that govern the structures of macromolecules and their participation in molecular recognition.	Up to K3
CLO4	Perform clinical laboratory procedures within acceptable quality control parameters in Haematology.	Up to K3
CLO5	Appraise the basic structure of cells, tissues and organs and describe their contribution to normal function	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	-	1	1
CLO2	2	2	3	2	2
CLO3	2	2	1	2	1
CLO4	2	2	2	2	2
CLO5	3	-	3	3	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	3	2	1	3
CLO2	1	1	3	2	2
CLO3	1	-	1	1	2
CLO4	2	2	-	1	2
CLO5	1	3	2	3	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.8	41.6%
K2	5	6	10	10	31	25.8	
K3	-	-	20	30	50	41.7	41.7%
K4	-	-	10	10	20	16.7	16.7%
Total Marks	10	10	50	50	120	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K 3	2	K3& K3	1	K3	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 3	2	K3& K3	1	K3	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K3& K3	1	K3	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K4& K4	1	K4	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Basic Laboratory technology and ethics	Sterilization: General principle of sterilization,classification, physical, mechanical, chemical method - sterilization of media, glassware and apparatus		4	Chalk and Talk, Quiz
	Microscope-Principal, operation, care and use. Health duties and responsibility of lab technician-General duties, specific duties – aim, type and diagnosis of first aid, safety Measures-		5	
	Code of professional conducts -Immunity: Types, Factor effecting immunity – collection, preservation and storage of different specimens - communication: Public relation, Patient relation and physician, nursing staff relation, report and record		3	

	Quality control - Instrument (Internal): pH meter, Hot air Oven, Auto-Clave, incubator, colorimeter, centrifuge Radiography techniques-X-Ray, CT, USG & MRI– WorldHealth Organization (WHO) and Primary Health Care (PHC) - Ethics: Importance, Principle, Consideration.		3	
II Bacteriology and Parasitology	Morphology, isolation and identification of the pathogen's- cocci, bacilli, vibrios, spirochetes, actionnomyces. Laboratory diagnosis. Principles of antimicrobial therapy and biotic susceptibility tests.		4	Chalk and Talk, Quiz
	Staining of Bacteria- Gram stain, Negative Stain, Ziehl –Neelsen, Albert, Spore Stain, Preparation of staining reagents and their composition.		4	
	Bacterial metabolism -Requirements of bacteria , Aerobic, Anaerobic, Growth -Cultivation of microorganism -Culture Media (i) Isolation and Inoculation according Techniques. Normal flora, opportunistic pathogens, nosocomial infections-Definitions. Causes, symptoms, treatment and prevention of Bacterial diseases- Staphylococcal, Streptococcal infections, Tuberculosis.		3	
	Morphology, Life Cycle, Symptoms Clinical Diagnosis & Laboratory Diagnosis- Hook Worm, Round worm, Tape worm, <i>Entamoeba histolytica</i> , <i>Giardia lamblia</i> .		4	
III Biochemistry and clinical pathology	Introduction of Biochemistry - Definition, Classification and Importance. Metabolism of protein, serum, lipids - analysis and collection of gastric juice - Estimation of Total protein, serum albumin, Globulin and A.G ratio, serum creatinine,		5	Chalk and Talk & PPT, Quiz
	Blood sugar (God-Pog-Ortho-toludine & Folin-wu Method) - Hormones – definition, function, importance of hormones, T3, T4, T5 H - Enzymes and Co- Enzymes - Serum amylase -Serum electrolytes- Glucose Tolerance test (G.T.T.)		5	
	Liver Function test- Bilirubin estimation (Direct & Indirect)-Estimation of acid phosphatase and Alkaline phosphatase- Jaundice Classification - D.N.A & R.N.A their importance – Specimen Analysis Urine-Normal, abnormal and Constituents of Urine -Throat swab, stool and sputum.		5	

IV Haematology and Blood Banking	Introduction of Haematology -Collection of blood -Red Cell Count, method, calculation, Haemocytometer - White cell count method and calculation - Differential Leucocyte Count (D.L.C)- Staining procedures - Packed cell volume- Normal Values, Macro and Micro method		5	PPT , Quiz
	Estimation of Haemoglobin method-S.G, Chemical, Colorimetric and Gasometric and clinical importance-Anticoagulation, MCV,MCH & MCHC and its importance-Coagulation tests, Total Platelet Count (T.P.C) with direct & indirect method.		5	
	ABO and Rh Blood Group system – ABO Grouping by slide Method and tube method, antigen and type of antibodies, Rh system with slide method, type of antibodies, One/Two stage albumin technique for Rh Factor. Coomb's Test- Direct and Indirect method.		5	
V Histo- technology and cytology	Staining - Staining of tissues section, theory of staining, mounting of section		5	PPT & Chalk and Talk, Assignment
	Staining technique, Section cutting- Microtome and their Knives, mounting section		6	
	Techniques of section cutting -Reception of specimen, preparation & Fixation and Restoration of colour according Museum technique, Autopsy techniques		4	
Total			75 Hrs	

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major Practical-7	21P4RMP7	Lab in Environmental Microbiology and Microbial Biotechnology	2	4	40	60	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To provide knowledge to isolate and identify microbes from environmental samples
- To assess the potability of water samples
- To impart knowledge on converting organic wastes into useful byproducts
- To explore basic aspects of biotechnology and other molecular tools
- To perform and verify gene expression in recombinant strains

S.No.	Experiments
1	Isolation of cellulose degrading microorganism from organic wastes
2	Screening of antibiotic producing microbes from environmental sample
3	Estimation of BOD and bacteriological index of water sample using MPN technique
4	Estimation of TS, TDS and TSS of water samples
5	Biosorption of selected dyes using fungal dead biomass
6	Biodegradation of xenobiotics using bacterial isolates
7	Production of biogas using cow dung
8	Isolation of plasmid from <i>E.coli</i> and separation by gel electrophoresis
9	Restriction digestion of plasmid- single, double and triple digestion. Determination of molecularweight.
10	Preparation of competent cells and transformation
11	Recombinant expression of protein in bacteria - IPTG induction and SDS PAGE
12	Callus culture from plant tissues and <i>Agrobacterium</i> transformation studies- Demonstration

Books for study

1. Cappuccino, J.H. and Sherman, N. (2007). Microbiology- A Lab Manual. 7th Edition. The Benjamin Publishing Company, Singapore.
2. Gunasekaran, P. (2008). Laboratory Manual in Microbiology. New Age International (P) Ltd. Publishers, New Delhi.
3. Glick B.R. & Pasternak, J.J., (2006). Molecular Biotechnology- Principles and Applications of Recombinant DNA technology, ASM press, Washington.

Books for Reference

1. Kannan, N. (1996). Laboratory Manual in General Microbiology. 1st Edition, Palani Paramount Publications, Tamil Nadu.
2. Madigan, M.T. and Martinko, J.M. (2014). Brock Biology of Microorganisms. 14th Edition. Prentice Hall International Inc., USA.
3. Dubey RC and Maheswari DK (2004). Practical Microbiology 1st Edition, S.Chand & Company Ltd., New Delhi.
4. Subba Rao, N.S. (1995). Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
5. Ratledge C & Kristiansen B. (2008). Basic Biotechnology 3rd Edition, Cambridge University Press, England.

Web Resources

1. <https://bio-protocol.org/bio101/e52>
2. <https://www.mdpi.com/2673-3994/2/2/9/pdf>
3. <https://international.neb.com/protocols/2012/05/21/transformation-protocol>
4. <https://www.addgene.org/protocols/restriction-digest/>
5. https://www.mpipz.mpg.de/26121/Mathur_Callus_Culture.pdf

Rationale for Nature of the course

Hands on training on environmental microbiology and biotechnology have greater application in industrial sector, research, medicine and in agriculture. Technical skills pertaining to isolation, identification and characterization of microbes will be useful for handling, analyzing and interpreting various biological samples. The goal of this course is to provide students with knowledge and skills on overview of how microbes are manipulated to solve practical problems through biotechnology.

Activities having direct bearing on skill development/ employability/entrepreneurship

Technical skills on isolation and characterization of microbes will be helpful for screening and identifying microbes of economic importance. Employing microorganisms for production of biogas in rural areas. Imparting knowledge on various molecular tools and vectors which could be applied for further studies

Pedagogy

Demonstration and practical session

Course designers:

1. **Dr. N.Panneerselvam**
2. **Dr. P.Kiruthika Lakshmi**

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcomes	KnowledgeLevel
CLO1	Isolate and identify microorganisms found in different habitat	Up to K4
CLO2	Determine the water quality based on its microbiological characteristics	Up to K4
CLO3	Demonstrate biogas production by using methanogenic bacteria	Up to K4
CLO4	Acquaint basic biotechnological tools, vectors and techniques involved in transformation	Up to K3
CLO5	Produce and validate recombinant strains	Up to K3

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of course outcome with Programme outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	3	3	2	3	2
CLO2	2	3	2	3	2
CLO3	3	2	-	-	3
CLO4	2	2	3	3	2
CLO5	2	2	3	3	2

Advance application – 3,

Intermediate level – 2,

Basic level – 1.

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	3	3	3	3	2
CLO2	2	2	3	3	2
CLO3	3	3	-	3	3
CLO4	3	3	2	2	2
CLO5	3	3	2	1	1

Advance application – 3,

Intermediate level – 2,

Basic level – 1.

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major Core Practical -8	21P4RMP8	Lab in Genomics & Proteomics and Entrepreneurial skill in Microbiology	2	4	40	60	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives:

1. To familiarize with Genomics and Proteomics techniques
2. To gain knowledge on separation of DNA and Protein using electrophoresis
3. To analyze protein and DNA sequences using in-silico tools
4. To predict and verify 3D structure of protein
5. To develop knowledge on entrepreneurial skill in Microbiology

S.No.	Experiments
1.	Extraction and purification of genomic DNA from fungal and animal tissues.
2.	DNA quantification by UV Spectrophotometer and Colorimetric estimation
3.	Analysis of proteins by SDS page and Western blotting
4.	Southern blotting and hybridization
5.	Pair wise and Multiple sequence alignment
6.	Prediction of Phylogenetic tree
7.	Molecular visualization of protein using RASMOL
8.	Homology modeling and structure verification by Ramachandran Plot
9.	Docking of ligand and receptor molecule using Hex software
10.	Cultivation and harvesting of mushroom
11.	Visit to clinical laboratory
12.	Visit to biofertilizer plant

Books for Study

1. Gunasekaran P (1995) Laboratory Manual in Microbiology New Age International Pvt. Ltd, Madras.
2. Cappucino R. (2001) Microbiology – A Laboratory Manual 6th edn. Benjamin/Cummings PubCo. California.
3. Ausubel, F.M., Roger, B., Robert E. Kingston, David A. Moore, Seidman J.G., John A. Smith. and Kelvin, S. (1997). Third Edition, Short Protocols in Molecular Biology, John Wiley & Sons Inc., New York.

Books for Reference

1. Maloy, S.R. (1990). Experimental Techniques in Bacterial Genetics, Jones and Bartlett Publishers, Boston

Web Resources

1. <https://www.biocourseware.com>
2. <https://www.microbiologyonline.com>
3. <https://www.ncbi.nlm.nih.gov/>
4. <https://www.introductiontomicrobiologyculture.m.youtube.com>
5. <https://www.practicalmicrobiology.m.youtube.com>

Rationale for Nature of the course

The course familiarizes different concepts in Genomics and Proteomics and to develop a sufficient background to students about the biological macromolecules. The molecular weight and different nature of protein found by various separation techniques.

Activities having direct bearing on skill development/employability/entrepreneurship

Students will be able to observe and identify DNA and RNA from bacterial and fungal samples. Handle various tools, instruments for the separation techniques. Estimate the biological macromolecules from samples.

Pedagogy

Demonstration and practical session.

Course designers:

Dr.K. Kannan

Course Learning Outcomes(CLO)

On successful completion of the programme, the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Extract and Quantify genomic DNA from Eukaryotes	UptoK3
CLO2	Separate DNA and protein molecules using electrophoresis	UptoK2
CLO3	Predict the domains and Phylogenetic relationships among the organisms	UptoK3
CLO4	Build 3D structure of proteins using bioinformatics tools	UptoK3
CLO5	Bloom as an entrepreneur in the field of Microbiology	UptoK4

K1–Remembering and recalling facts with specific answers

K2– Basic understanding of facts and stating main ideas with general answers
K3–Application oriented–Solving Problems

K4–Examining, analyzing, presentation and make interferences with evidence

Mapping of course outcome with Programme outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	3	2	-
CLO2	2	-	2	2	2
CLO3	1	2	3	-	3
CLO4	2	-	2	2	2
CLO5	2	2	2	3	-

Advance application–3, Intermediate level–2, Basic level–1

Mapping of course outcome with Programme specific outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	1	2	2	3	-
CLO2	2	3	-	2	2
CLO3	2	2	2	-	3
CLO4	3	3	-	3	2
CLO5	2	-	2	2	2

Advance application–3, Intermediate level–2, Basic level–1.

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Major Elective - 1	21P1RME1	Food and Dairy Microbiology	4	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

- To understand the role of intrinsic and extrinsic factors on growth and survival of microorganisms in foods
- To know the principles of food preservation
- To learn microbial contamination of milk.
- To identify the role of microorganisms in the causation of the diseases and how to protect against food-borne pathogens
- To acquire knowledge on nutritional value of fermented foods

Unit	Description	Hours	K-level	CLO
I	Unit – I :Microbial contamination in food Food as a substrate for microorganism: Microorganisms important in food Microbiology - bacteria, yeast, moulds, Factors influencing microbial growth in food, Contamination of foods, General principles underlying spoilage – chemical changes caused by microorganisms. Microorganisms associated with food, Factors affecting the microbial growth in food – intrinsic, extrinsic, implicit and processing factors. Hurdle effect, Food contamination and spoilage. Microbial spoilage of cereals, poultry, fish, meat, egg, stored grains fruits and vegetables. Spoilage of canned foods. Microbiological examination of food.	15Hrs	Up to K2	1

II	Unit – II : Food Preservation Food preservation, physical and chemical methods. Natural food preservatives. Principles and methods of food preservation Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO₂, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins. Biopreservation of foods : protective cultures and other antimicrobials (herbs, spices and other natural antimicrobial compounds).	15Hrs	Up to K3	2
III	Unit – III : Microbiology of milk Composition of milk, Pasteurization, Preservation of milk. Microbial examination of milk, Role of microbes and microbial enzymes in the manufacture of dairy products, Organisms used as starter culture in the manufacture of fermented dairy products, Yogurt Manufacture, Nutritional Benefits of Yogurt, sour cream, kefir, traditional and modern manufacturing of kefir, manufacture of cultured buttermilk, Cheese, General steps in cheese making, Cheese types, Microbial contamination of milk.	15Hrs	Up to K3	3
IV	Unit –IV : Food borne diseases Food borne infections and intoxications, bacterial and non-bacterial, pathogenesis, clinical features, isolation, identification and association with food, Mycotoxins and mycotic poisoning, Prevention measures, Food control agencies and their regulations. Laboratory testing of foodborne outbreaks, Indicator organisms. Microbiological Criteria of foods and their significance, Role of microbes in fermented foods – beverages, Curd, Butter milk, Toddy foods and Traditional foods.	15Hrs	Up to K4	4
V	Unit – V : Fermented food products Developments in the history of fermented foods, Nutritional value of fermented foods. Food fermentations: bread, cheese, vinegar, fermented vegetables, fermented dairy products. Experimental and industrial production methods of fermented food products. Spoilage and defects of fermented dairy products. Oriental Fermented foods, their quality standards and control. Food Produced by Microbes: Fermented foods, microbial cells as food (single cell proteins) .Bioconversions: Production of alcohol, Fermented beverages (beer and wine). Steroid conversions. Industrial Enzymes productions. Genetically modified foods.	15Hrs	Up to K4	5

Total

75 Hours

Books for study:

1. Adams, M.R. and Moss, M.O. (2008) Food Microbiology .New Age International Publishers, UK
2. Frazier WC and Wasthoff DC (2008) FOD MICROBIOLOGY, 4th Edition. McGraw Hill Publishing Co, New Delhi.
3. Banwart, G.J. (1989) Basic Food Microbiology 2nd edition. Van Nostrand Reinhold Publishers, New York.

Books for reference:

1. Jay, J.M., Loessner, M.J., Golden, D.A. (2005) Modern Food Microbiology 7th edition. Springer Publishers, Netherland
2. Hobbs, B.C. and Roberts, D. (1991) Food poisoning and food hygiene 6th edition. Sevenoaks: Edward Arnold Publishers, London
3. Robinson, R.K. (2002) Dairy Microbiology Handbook: The Microbiology of Milk and Milk Products 3rd edition. Wiley-Interscience Publishers, UK

Web resources:

1. <https://www.intechopen.com/books/food-industry/microbiological-contamination-of-homemade-food>
2. https://nchfp.uga.edu/publications/nchfp/factsheets/food_pres_hist.html
3. <https://www.frontiersin.org/articles/10.3389/fmicb.2015.01177/full>
4. <https://vikaspedia.in/health/nutrition/food-borne-diseases-or-food-poisoning>
5. https://www.med.umich.edu/pfans/_pdf/hetm-2017/0717-fermentedfoods.pdf

Rationale for nature of the course

The course includes various factors involved in microbial contamination in food. Moreover, incidence of microorganisms in food represents a major challenge for public health due to their ability to cause food poisoning. Food preservation aims at inactivating and controlling the growth of spoilage and pathogenic microorganisms, insuring shelf-stable and healthy foods.

Activities having direct bearing on skill development/ employability/ entrepreneurship

Microbiological analysis of food, Determination food quality, Production of various fermented food products

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course designer

Mrs.N.Sumathy

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcomes	KnowledgeLevel
CLO1	Outline the role of microorganisms in the production of food and factors influencing their growth and survival.	Up to K2
CLO2	Discuss about various principles involved in food preservation techniques	Up to K3
CLO3	Explain the microbial contamination of milk	Up to K3
CLO4	Describe the characteristics of important pathogens and spoilage microorganisms in foods.	Up to K4
CLO5	Summarize the production and recovery processes of various fermented foods.	Up to K4

Mapping of Course Outcome with Programme Outcomes

	PO 1	PO2	PO3	PO4	PO5
CLO1	2	3	2	1	3
CLO2	3	-	2	2	3
CLO3	3	2	-	3	3
CLO4	3	2	3	3	-
CLO5	1	2	3	2	3

Advance application–3

Intermediate level–2

Basic level –1

Mapping of Course Learning Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	2	1	1	2
CLO2	3	3	2	-	2
CLO3	3	3	-	3	2
CLO4	2	3	3	-	2
CLO5	3	2	2	3	3

Advance application – 3

Intermediate level–2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	Section D (Open Choic e)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35 %
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
TotalMarks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers

K2–Basic understanding of facts and stating main ideas with general answersK3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Learning Outcome Based Education & Assessment(LOBE) Blue Print Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	SectionD (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of questions	K- Level		
1.	CLO 1	Up to K2	2	K2 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K3	2	K3 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K3	2	K3 & K3	1	K2	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K4	2	K1& K1	1	K3	2 (K4&K4)	1(K4)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be Answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2–Basic understanding of facts and stating main ideas with general answersK3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Microbial contamination in food	a) Food as a substrate for microorganism : Microorganisms important in food Microbiology - bacteria, yeast, moulds.		3	Talk and Talk, Quiz
	b) Factors influencing microbial growth in food, Contamination of foods, General principles underlying spoilage – chemical changes caused by microorganisms.		3	
	c) Microorganisms associated with food, Factors affecting the microbial growth in food – intrinsic, extrinsic, implicit and processing factors.		4	
	d) Hurdle effect, Food contamination and spoilage. Microbial spoilage of cereals, poultry, fish, meat, egg, stored grains fruits and vegetables.		3	
	e) Spoilage of canned foods. Microbiological examination of food.		2	
II Food Preservation	a) Food preservation, physical and chemical methods. Natural food preservatives.		4	Chalk and Talk, Quiz
	b) Principles and methods of food preservation Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging.		5	
	c) chemical methods of food preservation: salt, sugar, organic acids, SO ₂ , nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins.		3	
	d) Biopreservation of foods : protective cultures and other antimicrobials (herbs, spices and other natural antimicrobial compounds).		3	
III Microbiology of milk	a) Composition of milk, Pasteurization, Preservation of milk.		3	Chalk and Talk, Quiz
	b) Microbial examination of milk, Role of microbes and microbial enzymes in the manufacture of dairy products, Organisms used as starter culture in the manufacture of fermented dairy products		3	
	c) Yogurt Manufacture, Nutritional Benefits of Yogurt, sour cream, kefir, traditional and modern manufacturing of kefir,		4	
	d) manufacture of cultured buttermilk, Cheese, General steps in cheese making, Cheese types		3	
	e) Microbial contamination of milk.		2	

IV Food borne diseases	a) Food borne infections and intoxications, bacterial and non-bacterial, pathogenesis, clinical features, isolation, identification and association with food,		3	Chalk & Talk, PPT, Quiz
	b) Mycotoxins and mycotic poisoning, Prevention measures, Food control agencies and their regulations.		3	
	c) Laboratory testing of foodborne outbreaks, Indicator organisms.		3	
	d) Microbiological Criteria of foods and their significance, Role of microbes in fermented foods – beverages, Curd, Butter milk		3	
	e) Microbiological Criteria of foods and their significance, Role of microbes in Toddy foods and Traditional foods.		3	
V Fermented food products	a) Developments in the history of fermented foods, Nutritional value of fermented foods		3	Chalk & Talk, PPT, Assignment
	b) Food fermentations: bread, cheese, vinegar, fermented vegetables, fermented dairy products.		3	
	c) Experimental and industrial production methods of fermented food products. Spoilage and defects of fermented dairy products.		3	
	d) Oriental Fermented foods, their quality standards and control. Food Produced by Microbes: Fermented foods, microbial cells as food (single cell proteins).		3	
	e) Bioconversions: Production of alcohol, Fermented beverages (beer and wine). Steroid conversions. Industrial Enzymes productions. Genetically modified foods		3	
Total :			75	Hours

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Major Elective-2	21P2RME2	Computational Biology	4	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To introduce the basic aspects of computational biology and biological databases
- To provide an overview and significance of pairwise and multiple sequence alignment
- To impart knowledge on computational analysis of nucleic acid sequences
- To explore and analyze the protein sequence and structure using in silico tools
- To emphasize the significance of molecular modeling and drug designing

Unit	Description	Hours	K-level	CLO
I	Unit - I: Introduction to computational biology and bioinformatics resources Definition, history and scope of computational biology. An overview of major biological Databases, Primary, secondary, functional, composite, structural classification database- Concepts and bioinformatics tools available at these databases. Nucleic acid sequence databases- GenBank, EMBL, DDBJ, Protein sequence databases-SWISS-PROT, TrEMBL, PIR, PDB, SCOP, CATH, Genome Databases at NCBI, EBI, TIGR, SANGER, UCSC genome browser, Microbial genomic database (MBGD). Applications of bioinformatics.	15 Hrs	Up to K2	1
II	Unit- II: Sequence homology and alignment Sequence formats: genbank, fasta, gcg, msf, nbrf, pir etc., Basic concepts of sequence similarity, identity and homology, Definitions of homologues, orthologues, paralogues, xenologues. Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM, Gaps and penalties. Pairwise alignment: Dot plots, Dynamic programming- global (Needleman- Wunsch) and local (Smith-Waterman) alignments, Heuristic approach, Multiple Sequence Alignment: Dynamic Programming, Progressive methods, Iterative methods, Motif finding. Sequence-based database searches, BLAST and FASTA algorithms, various versions of basic BLAST and FASTA.	15 Hrs	Up to K3	2

III	Unit- III: Computational analysis of nucleic acid Prediction of open reading frame using ORF finder, identification of functional genes using fgenesB, genscan. Computational prediction of transcription factor binding sites (TFBS) using PROMO. Primer- definition and properties. Primer designing using Primer-3. Screening of single nucleotide polymorphisms (SNP) using SIFT, significance of SNPs in medical genetics and basic research. Restriction digestion using <i>insilico</i> tools and construction of restriction map using NEB CUTTER. Molecular phylogeny, types of phylogenetic trees and applications. Distance based method (UPGMA, neighbor joining), Character Based Method (Maximum Parsimony and Maximum Likelihood method) for phylogenetic tree construction, bootstrapping.	15 Hrs	Up to K3	3
IV	Unit- IV: Computational analysis of protein Structural classification of proteins, primary structure analysis of protein using protparam, concepts of classes, folds, motif, domain. Principles of protein folding and methods to study protein folding. Secondary structure prediction and evaluation using Jpred. Molecular models for visualization of protein, retrieval of coordinate file from PDB database and visualization of 3-D structure of protein using RasMol and SPDBV. Prediction of hydrophobicity profiles using Kyte and Doolittle. Active site prediction using CastP server and its significance.	15 Hrs	Up to K4	4
V	Unit- V: Molecular modeling and drug designing Protein modeling –Principle of homology, comparative modeling (threading) and abinitio methods. Homology modeling of protein tertiary structure using SWISSMODEL. Structure validation using Ramachandran plot. Analysis of ligand-protein interactions by molecular docking, docking- principles and applications, molecular dynamics simulations, computer aided drug design (CADD), screening of ligands, Quantitative structure activity relationship (QSAR). Role of molecular modeling and simulation in drug designing.	15 Hrs	Up to K4	5

Total 75 Hours

Books for Study

1. Ghosh, Z. and Mallick, V. (2008). Bioinformatics-principles and applications. Oxford university press, New Delhi
2. Rastogi, S.C., Mendiratta, N. and Rastogi, P. (2003). Bioinformatics – Concepts, Skills & Applications, CBS Publishers & Distributors, Chennai
3. Lesk, M.A. (2008). Introduction to Bioinformatics. Oxford Univ. Publishers Ltd., New Delhi

Books for Reference

1. Ignacimuthu, S.J. (2001). Basic bioinformatics, Phoenix Publishing House Pvt., Ltd., New Delhi.
2. Attwood, T.K. and Parry-Smith, D.J (2004). Introduction to Bioinformatics, Pearson Education Ltd., New Delhi.
3. Higgins, D. and Taylor, W. (2000). Bioinformatics- Sequence, structure and databanks, Oxford University Press, New Delhi .

Web Resources

1. <https://www.youtube.com/watch?v=3uY5N3rgoLE>
2. <https://www.omicsonline.org/open-access/molecular-docking-approaches-types-applications-and-basic-challenges-2155-9872-1000356.php?aid=88070>
3. <https://www.easybiologyclass.com/structure-of-proteins-biochemistry-lecture-notes/>

Rationale for Nature of the course

The goal of this course is to provide students with high-capacity analysis of genes and proteins by integrating informatics to solve biological problems. It has become an important focus for industry, particularly in this post-genomic era. This course also highlights the computational techniques for a variety of applications, including determining gene and protein functions, establishing evolutionary relationships, and predicting the three-dimensional shapes of proteins.

Activities having direct bearing on skill development/ employability/entrepreneurship

Applying the techniques pertaining to sequence and structure analysis will be helpful for the understanding of biological processes. Imparting skills on various computational tools could be applied for academic research or work within the bioinformatics industry. Critical reasoning and analysis of genomics data can be used as the blueprint for drug designing

Pedagogy

Chalk and talk, PPT, group discussion, seminar, educational videos, assignment and quiz

Course designers

Dr.P.Kiruthika Lakshmi

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcome	KnowledgeLevel
CLO1	Elaborate various tools available in the biological databases	Up to K2
CLO2	Perform pairwise and multiple sequence alignment using various algorithm	Up to K3
CLO3	Analyze nucleic acid sequences and evaluate its evolutionary significance	Up to K3
CLO4	Compare various forms of protein and visualize its tertiary structure	Up to K4
CLO5	Model the structure of protein and apprise the role of molecular modeling in drug designing	Up to K4

K1 –Remembering and recalling facts with specific answers
 K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems
 K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	-	1	2	2
CLO2	3	3	3	-	-
CLO3	3	3	3	3	2
CLO4	3	3	3	3	2
CLO5	3	2	2	3	1

Advance application–3 Intermediate level –2 Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	-	1	1	3
CLO2	3	3	3	2	-
CLO3	3	3	3	3	3
CLO4	3	3	3	3	3
CLO5	3	2	2	3	2

Advance application–3 Intermediate level –2 Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	SectionA (No Choice)	Section B(No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35 %
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total Marks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers
 K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems
 K4 – Examining, analyzing, presentation and make interferences with evidences

Learning Outcome Based Education & Assessment (LOBE) Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either /or Choice)	SectionD (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K2	2	K2 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K3	2	K3 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K3	2	K3 & K3	1	K2	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K4	2	K1& K1	1	K3	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction to computational biology and bioinformatics resources	Definition, history and scope of computational biology. An overview of major biological Databases, Primary, secondary, functional, composite, structural classification database		4	Chalk and Talk, PPT, Quiz, Group discussion
	Concepts and bioinformatics tools available at these databases. Nucleic acid sequencedatabases-GenBank, EMBL, DDBJ		3	
	Protein sequence databases-SWISS-PROT, TrEMBL, PIR, PDB, SCOP, CATH		3	
	Genome Databases at NCBI, EBI, TIGR, SANGER, UCSC genome browser		3	
	e) Microbial genomic database (MBGD). Applications of bioinformatics.		2	

II Sequence homology and alignment	Sequence formats: genbank, fasta, gcg, msf, nbf-pir etc., Basic concepts of sequence similarity, identity and homology, Definitions of homologues, orthologues, paralogues, xenologues.		4	Chalk and Talk, PPT, Quiz
	Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM, Gaps and penalties. Pairwise alignment: Dot plots, Dynamic programming- global (Needleman-Wunsch) and local (Smith-Waterman) alignments, Heuristic approach,		4	
	Multiple Sequence Alignment: Dynamic Programming, Progressive methods, Iterative methods		3	
	Motif finding. Sequence-based databasesearches		2	
	BLAST and FASTA algorithms, various versions of basic BLAST and FASTA		2	
III Computational analysis of nucleic acid	Prediction of open reading frame using ORF finder, identification of functional genes using fgenesB, genscan. Computational prediction of transcription factor binding sites (TFBS) using PROMO.		5	PPT, Seminar, Screening of educational videos, quiz
	Primer- definition and properties. Primer designing using Primer-3. Screening of single nucleotide polymorphisms (SNP) using SIFT, significance of SNPs in medical genetics and basic research.		3	
	Restriction digestion using <i>insilico</i> tools and construction of restriction map using NEB CUTTER. Molecular phylogeny, types of phylogenetic trees and applications.		4	
	Distance based method (UPGMA, neighbor joining), Character Based Method (Maximum Parsimony and Maximum Likelihood method) for phylogenetic tree construction, bootstrapping.		3	

IV Computational analysis of protein	Structural classification of proteins, primary structure analysis of protein using protparam, concepts of classes, folds, motif, domain.		3	PPT, Seminar, Screening of educational videos, quiz
	Principles of protein folding and methods to study protein folding. Secondary structure prediction and evaluation using Jpred.		4	
	Molecular models for visualization of protein, retrieval of coordinate file from PDB database and visualization of 3-D structure of protein using RasMol and SPDBV.		4	
	Prediction of hydrophobicity profiles using Kyte and Doolittle. Active site prediction using CastP server and its significance.		4	
V Molecular modeling and drug designing	Protein modeling –Principle of homology, comparative modeling (threading) and abinitio methods.		5	PPT, Seminar, Screening of educational videos, Assignment
	b) Homology modeling of protein tertiary structure using SWISSMODEL. Structure validation using Ramachandran plot.		3	
	Analysis of ligand-protein interactions by molecular docking, docking- principles and applications, molecular dynamics simulations		4	
	Computer aided drug design (CADD), screening of ligands, Quantitative structureactivity relationship (QSAR). Role of molecular modeling and simulation in drugdesigning		3	
Total			75 Hours	

DEPARTMENT OF MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Add-on	21P3RAD1	Values and Ethics in Research	2	2	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives:

- To understand the philosophy of science, ethics and research integrity
- To analyze publication ethics, research misconduct and predatory publications
- To learn the biosafety measures in handling hazardous microbes and genetically modified organisms
- To explore the ethical issues related to animals
- To appreciate the various forms of intellectual property rights (IPR) and its importance to safe guard the ethnic knowledge

Unit	Description	Hours	K-level	CLO
I	Unit-I: Introduction to Ethics Definition, nature, scope, concept and branches of ethics. Ethics with respect to science and research. Intellectual honesty and research integrity. Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP). Redundant publications: duplicate and overlapping publications, salami, slicing. Selective reporting and misrepresentation of data.	6hrs	Up to K2	1
II	Unit-II: Publication Ethics Definition, introduction and importance. Best practices/standards setting initiatives and guidelines: COPE, WAME etc. Conflicts of interest. Publication misconduct: Definition, concept, problems that lead to unethical behaviour and vice versa. Violation of publication ethics, authorship and contributor ship. Predatory publishers and journals.	6 hrs	Up to K3	2

III	Unit-III: Biosafety Introduction; Historical background; Biosafety in the laboratory; Laboratory associated infections and other hazards; Biosafety management for environmentally safe use of biotechnology; Biosafety guidelines- SOP; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Definition of GMOs and LMOs; Good manufacturing practices (GMP) and Good lab practices (GLP); Overview of National Regulations and relevant International Agreements including Cartagena Protocol; Roles of Institutional Biosafety Committee (IBSC), RCGM and GEAC. Guidelines for research in transgenic sciences and release of GMOs to environment; Bioterrorism and convention on biological weapons.	6 hrs	Up to K4	3
IV	Unit-IV: Animal Ethics Issues related to the use of animal as models for microbial diseases- Animal ethics norms in India - Licensing of animal house - Ethical clearance norms for conducting studies on human subjects. Ethical issues related to research in embryonic stem cell cloning. Ethical principles for the protection of human subjects research.	6 hrs	Up to K4	4
V	Unit-V: Intellectual Property Right Introduction and the need for intellectual property right (IPR). IPR in India – Genesis and Development. Types of IP – Patents, Trademarks, Copyright and Related Rights. Industrial Design, Traditional Knowledge and Geographical Indications. Importance of IPR – patentable and non-patentable; patenting life. Legal protection of Biotechnological inventions protected by a patent. Indian Patent Act 1970 and Recent amendments. Biopiracy and Bioprospecting. Commercializing Biotechnology inventions. Case studies on basmati rice, turmeric, and neem patents.	6hrs	Up to K3	5

Total – 30 hours

Books for study

1. Satheesh M. K. (2020). Bioethics and Biosafety, First Edition , Dreamtech Press, India.

Books for reference:

1. Alfonso Gómez-Lobo. (2015). Bioethics and the Human Goods: An Introduction to Natural Law Bioethics, Georgetown University press, US.
2. Tom L. Beauchamp , James F. Childress. (2013). Principles of Biomedical Ethics(Beauchamp), 7th Edition, OUP, USA.
3. Lewis Vaughn (2019). Bioethics: Principles, Issues, and Cases. IV Edition. Oxford university press.USA
4. Antonio Sandu, Ana Frunza and Elena Unguru (2016).I edition. Ethics in Research Practiceand Innovation. Springer publications USA
5. Kambadur Muralidhar, Ethics in Science Education, (2019). Research and Governance.Indian National Science Academy, India
6. Yatendra Kumar Singh, Bipin Dubey (2021). Introduction of Research Methods and Publication Ethics, Friends publications, India.

Web Resources

1. <https://medcraveonline.com/SIJ/values-and-science-an-analysis-the-ethics-in-the-science.html>
2. <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>
3. https://www.rand.org/pubs/research_reports/RR2912.html
4. <https://onlineethics.org/cases/ethics-science-classroom/chapter-1-how-ethics-and-values- intersect-science>
5. <https://www.bu.edu/researchsupport/files/2016/09/RCR-The-Ethics-of-Scientific-Research- A-Guidebook-for-Course-Development.pdf>

Rationale for nature of the course

Values and ethics in research will help students to appreciate the philosophy of science and ethics, research integrity, publication ethics and the biosafety measures to safeguard the environment from harmful microbes and the ethical issues related to animals. This course will give an insight on the various forms of intellectual property rights (IPR) and its importance to safe guard the ethnic knowledge.

Activities having direct bearing on skill development/ employability/entrepreneurship

This course will help the students to do research and help in publishing the papers

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Assignment, Screening of educational videos and quiz

Course designers

Dr.Asha Kannan A.P

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Demonstrate research and publication ethics	Up to K2
CLO2	Recognize research misconduct and predatory publications.	Up to K3
CLO3	Predict the biosafety measure to be taken while handling hazardous microbes and genetically modified organisms	Up to K4
CLO4	Discuss the ethical issues related to animals	Up to K4
CLO5	Debate on various forms of (IPR) and its importance to safe guard the ethnic knowledge.	Up to K3

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	2	1	-	2
CLO2	1	-	2	1	1
CLO3	1	-	1	1	2
CLO4	1	2	2	-	2
CLO5	2	-	2	2	2

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	-	3	2	3
CLO2	1	2	1	2	3
CLO3	2	2	-	1	3
CLO4	2	2	2	-	2
CLO5	2	-	2	3	2

Advance application–3

Intermediate level –2

Basic level –1

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	3	6	10	-	19	15.83	37.5%
K2	2	4	10	10	26	21.67	
K3	2	-	20	20	42	35.0	35%
K4	3	-	10	20	33	27.5	27.5%
Total Marks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Learning Outcome Based Education & Assessment (LOBE)Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	SectionD (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K3	2	K2 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K4	2	K3 & K4	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K3	2	K1& K1	1	K1	2 (K1&K1)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
 K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidence

Lesson Plan

Units	Description	Staff	Hours	Mode
I Introduction to Ethics	Definition, nature and scope, concept, branches ethics.		1	Chalk and Talk PPT Quiz
	Ethics with respect to science and research Intellectual honesty and research integrity Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)		2	
	Redundant publications: duplicate and overlapping publications, salami slicing		2	
	Selective reporting and misrepresentation of data		1	

II Publication ethics	Definition, introduction and importance		1	Chalk and TalkPPT Quiz
	Best practices/standards setting initiatives and guidelines: COPE, WAME etc. Conflicts of interest .		2	
	Publication misconduct: Definition, concept, problems that lead to unethical behaviour and vice versa.		1	
	Violation of publication ethics, authorship and contributor ship.		1	
	Identification of publication misconduct, complaints and appeals. Predatory publishers and journals		1	
III Biosafety	Introduction; Historica background; Biosafety the laboratory; ILaboratory inassociated other hazards; infections and		2	Chalk and Talk & PPTQuiz
	Biosafety management for environmentally safe use ofbiotechnology;Biosafetyguidelines;RecommendedBiosafet yLevelsforInfectiousAgents and Infected Animals; Definition of GMOs & LMOs; Good manufacturing practices (GMP) and Good lab practices(GLP)		2	
	Overview of National Regulations and relevant International AgreementsincludingCartagenaProtocol;RolesofInstitutional BiosafetyCommittee(IBSC), RCGM and GEAC Guidelines for research in transgenic sciences and release of GMOs to environment; Bioterrorism and convention on biological weapons		2	
IV Animal ethics	Ethical issues related to the use of animal as models for microbial diseases- Animal ethics norms in India .		2	PPT & Chalk and Talk Quiz
	Licensing of animal house - Ethical clearance norms for conducting studies on human subjects. Ethical issues related to research in embryonic stem cell cloning		1	
	Ethical principles for the protection of human subjects research.		2	

V Intellectual property right	Introduction and the need for intellectual property right (IPR) IPR in India – Genesis and Development. Types of IP – Patents, Trademarks, Copyright & Related Rights. Industrial Design, Traditional Knowledge and Geographical Indications.		2	PPT &Chalk and Talk Assignment
	Importance of IPR – patentable and non-patentable; patenting life. Legal protection of Biotechnological inventions protected by a patent. Indian Patent Act 1970 and Recent amendments. Case studies on Basmati rice, Turmeric, and Neem patents		2	
	Filing of a patent application. Ownership of patent, Transfer of patent Rights- Limitations of patent Rights. The different layers of thenational patent system. Biopiracy and Bioprospecting. Commercializing Biotechnology inventions.		2	
Total				30 Hrs

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Major Practical -1	21P1RMP1	Lab in Microbial Taxonomy and Biochemistry	2	4	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives

- To recall the basic techniques in microbiology.
- To explore methods of cultivation of microbes
- To partially characterize the microorganisms.
- To understand various microbial staining techniques.
- To quantify various biomolecules

S.No.	Experiments
1.	Pure culture technique: Streak plate, pour plate, spread plate, decimal dilution.
2.	Motility demonstration: Hanging drop preparation, wet mount, semi-solid agar.
3.	Staining techniques : Smear preparation, Simple staining, Gram's staining, Acid fast staining
4.	Spore staining, Capsule Staining (positive and negative)
5.	Physiological characteristics - IMVIC test, H ₂ S production, Oxidase, Catalase, Urease test, Gelatin liquefaction. Carbohydrate fermentation.
6.	Qualitative analysis of Carbohydrates
7.	Estimation of Glucose by Anthrone method
8.	Estimation of Proteins by Lowri's method
9.	Estimation of DNA by diphenylamine method
10.	Separation of amino acids by paper chromatography
11.	Separation of amino acids by thin layer chromatography
12.	Separation of pigments by column chromatography

Books for study:

1. Cappuccino, J.H. and Sherman, N. (2007). Microbiology- A Lab Manual. 7th Edition. The Benjamin Publishing Company, Singapore.
2. Gunasekaran, P. (2008). Laboratory Manual in Microbiology. New Age International (P) Ltd. Publishers, New Delhi.
3. Jayaraman, J. (2011). Laboratory Manual in Biochemistry. 2nd Edition. New Age International (P) Ltd. Publishers, New Delhi.

Books for Reference

1. Aneja, K.R. (2003). Experiments in Microbiology: Plant Pathology and Tissue Culture. Wishwa Prakashan, New Delhi.
2. Plummer, D.T. (1987). An introduction to Practical Biochemistry. 3rd Edition. Tata McGrawHill, New Delhi.
3. Work, T.S. and Work, E. (1978). Laboratory Techniques in Biochemistry and Molecular Biology. North-Holland Publishing Company, Holland.
4. Khan, N.A. (2014). Laboratory Manual of Biochemistry. Daya Publishing House, Daryaganj.

Web Resources

1. <https://microbiologyinfo.com/category/basic-microbiology/>
2. <https://microbiologyinfo.com/category/staining-techniques/>
3. <https://microbiologyinfo.com/category/culture-media/>
4. <https://microbiologyinfo.com/category/biochemistry/>

Rationale for nature of the course

Student become competent in the application of techniques associated with molecular biology. Identifying various physiological processes and molecular characterization of microorganisms. The taxonomical position of microbes can be determined based on the morphological and biochemical characteristics. The goal of this course is to understand the basic building blocks of living organisms, introduce the structure and properties of various biomolecules and to emphasize on the association between structure and function of various biomolecules.

Activities having direct bearing on skill development/ employability/entrepreneurship

Able to isolate and analyse the genomic DNA from prokaryotes and eukaryotes. Knowledge gained could be applied for further studies. Classify microorganisms based on its morphology and cultural characteristics. Providing knowledge on biomolecules, and their significance in the metabolism Exploring the structure of biomolecules found in cells, to determine their structures.

Pedagogy

Demonstration and practical session.

Course designers

1. Dr. K. Rajeswari
2. Mrs. N. Sumathy

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Recall the fundamental techniques in the field of microbiology.	Up to K2
CLO2	Analyze the morphology of microorganisms under microscope.	Up to K4
CLO3	Determine physiological characteristics of microorganisms.	Up to K4
CLO4	Estimate the quantity of carbohydrates, DNA and proteins.	Up to K2
CLO5	Separation of amino acids by chromatography technique	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	3	2	-	3
CLO2	2	3	3	2	3
CLO3	2	3	3	-	3
CLO4	2	3	3	2	3
CLO5	2	3	3	2	3

Advance application–3

Intermediate level –2

Basic level –1

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	2	2	3
CLO2	2	2	-	2	3
CLO3	2	3	3	2	3
CLO4	-	2	2	2	3
CLO5	2	2	2	2	3

Advance application–3

Intermediate level –2

Basic level –1

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Major Practical - 2	21P1RMP2	Lab in Microbial Physiology and Bioinstrumentation	2	4	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives

- To provide a basic knowledge on the core principles of microbial Physiology.
- To understand the microbial growth kinetics and understanding different physiological phenomenon.
- To apply and handle the various instruments for their routine laboratory work.
- To demonstrate the methods of algal measurements
- To verify the Beer's Law using colorimeter

S.No.	Experiments
1.	Measurement of microbial growth- turbidity method
2.	Isolation of Photosynthetic bacteria
3.	Glucose uptake by <i>E. coli</i> / <i>Saccharomyces cerevisiae</i> [Active and Passive diffusion]
4.	Demonstration of utilization of sugars by oxidation and fermentation techniques.
5.	Extraction and estimation of photosynthetic pigments (bacterial and blue green algae)
6.	Separation of molecules using density gradient centrifugation technique
7.	Measurement of pH of various biological samples using pH meter
8.	Counting of microbial colonies with Quebec colony counter
9.	Measurement of algal cell using micrometry technique
10.	Verification of Beer's Law using colorimeter
11.	Agarose Gel Electrophoresis (DNA)
12.	SDS-PAGE (Protein)

Books for study

1. Kannan, N. (1996). Laboratory Manual in General Microbiology. 1st Edition. Palani Paramount Publications, Tamil Nadu.
2. Benson, H.J. (1998). Microbiological Applications- Laboratory Manual in General Microbiology. 7th International Edition, McGraw-Hill, Boston.
3. Jayaraman, J. (2011). Laboratory Manual in Biochemistry. 2nd Edition. New Age International (P)Ltd. Publishers, New Delhi.

Books for Reference

1. Reddy, S.R. and Reddy, S.M. (2005). Microbial Physiology. Scientific Publishers, India.
2. Willey, J.M., Sherwood, L.M. and Woolverton, C.J. (2013). Prescott's Microbiology. 9th Edition. McGraw-Hill, Boston.
3. Plummer, D.T. (1987). An Introduction to Practical Biochemistry. 3rd Edition. Tata McGraw Hill, New Delhi.
4. Switzer, R.L. and Garritty, L.F. (1999). Experimental Biochemistry. 3rd Edition. WH Freeman and Co., New York.

Web Resources

1. <http://science.umd.edu/classroom/bsci424/BSCI223WebSiteFiles/LectureList.htm>
2. <https://microbiologysociety.org/why-microbiology-matters.html>
3. <https://open.umn.edu/opentextbooks/textbooks/404>
4. <https://microbiologyinfo.com/top-and-best-microbiology-books/>

Rationale for nature of the course

Hands on training on microbial physiology have greater application in industry, developing medicine and even in agriculture. Technical skills related to bioinstrumentation are essential for its application in the laboratory. It is useful for handling, analyzing and interpreting various biological samples. Hands-on experience pertaining to biological equipments is mandatory in the field of quality control, testing, diagnosis and research.

Activities having direct bearing on skill development/employability/entrepreneurship:

Experiments related to Microbial physiology have traditionally played a very important role in both fundamental research and in industrial applications of microorganisms. It is Possible to optimize industrial fermentations through introduction of directed genetic modification -an approach referred to as metabolic engineering. Applying the techniques related to quality control in various industrial sectors and research units. Fabricating minor equipments, marketing and servicing of laboratory equipments.

Pedagogy

Demonstration and practical session.

Course designers:

1. Dr. P.N.Rajarajan
2. Dr. P.Kiruthika Lakshmi

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcomes	Knowledge Level
CLO1	Illustrate bacterial growth by turbidity method	Up to K2
CLO2	Calculate glucose uptake by microbes	Up to K3
CLO3	Apply oxidation and fermentation techniques	Up to K3
CLO4	Demonstrate photosynthetic pigments and their estimation	Up to K4
CLO5	Standardize Beer-Lambert's law	Up to K4

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	2	2	1	2
CLO2	3	2	2	-	1
CLO3	1	-	2	2	-
CLO4	1	2	1	1	1
CLO5	2	3	2	1	2

Advance application – 3, Intermediate level – 2, Basic level – 1.

Mapping of course outcome with Programme outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	1	1	2
CLO2	3	2	-	2	2
CLO3	1	-	2	1	1
CLO4	2	1	1	2	2
CLO5	3	2	3	2	-

Advance application – 3, Intermediate level – 2, Basic level – 1.

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Major Practical -3	21P2RMP3	Lab in Cell and Molecular Biology and Microbial Genetics	2	4	40	60	100

Nature of Course				
Knowledge and skill			Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives

- To employ methods of DNA isolation and demonstration
- To illustrate different methods for mutant isolation
- To demonstrate bacterial conjugation process
- To evaluate the life cycle of phage
- To estimate the phage particles

S.No.	Experiments
1.	Isolation of Chromosomal DNA from <i>E. coli</i>
2.	Isolation of plasmid DNA from bacteria
3.	Isolation of spontaneous mutants Drug resistant mutants by replica plate technique
4.	Isolation of spontaneous mutants Drug resistant mutants by gradient plate technique.
5.	Enrichment of auxotrophic mutant by Ampicillin treatment.
6.	Isolation of mutants using UV and NTG mutagenesis.
7.	Isolation of Petite mutants of Yeast.
8.	T7 phage lysate preparation and titration.
9.	Transformation of <i>E.coli</i> with plasmids (pUC 18/pBR322).
10.	Bacterial conjugation (Hfr X F-).
11.	P1 lysate preparation and P1 transduction.
12.	DNA Barcoding

Books for study:

1. Chaitanya, K.V. (2013). Cell and Molecular Biology: A Lab Manual. PHI Learning, New Delhi.
2. Ausubel, F.M., Roger, B., Kingston, R.E., Moore, D.A., Seidman, J.G., Smith, J.A. and Kelvin, S. (1992). Short Protocols in Molecular Biology. 3rd Edition. John Wiley & Sons Inc., New York.
3. Berger, S.L. and Kimmel, R. (1987). Guide to Molecular Cloning Techniques. Academic Press, Inc., New York.

Books for Reference:

1. Brown, T.A. (1998). Molecular Biology Lab; Gene Analysis. Academic Press, London.
2. Malov, S.R. (1990). Experimental Techniques in Bacterial Genetics. Jones and Bartlett Publishers, Boston.
3. Miller, J.H. (1992). A Short Course in Bacterial Genetics: A Lab Manual & Hand Book for *E. coli* and related Bacteria. Cold spring Harbor Lab press, New York.
4. Rajamanickam, C. (2001). Experimental protocols in basic molecular biology, Osho Scientific Publications, Madurai.

Web Resources

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2581910/>
2. <https://microbiologybook.org/mayer/ab-ag-rx.htm>
3. https://www.ebi.ac.uk/interpro/potm/2005_2/Page2.htm

Rationale for nature of the course

This course introduces the methods of DNA isolation and demonstration. It also introduces methods of mutant isolation. The life cycle of phage and estimation of phage particles can be explored to understand phage genetics. It demonstrates gene transfer through conjugation process.

Activities having direct bearing on skill development/ employability/entrepreneurship

Employ methods of DNA isolation and demonstration. Illustrate different methods for mutant isolation Demonstrate bacterial conjugation process. Evaluate the life cycle of phage Estimate the phage particles.

Pedagogy

Demonstration and practical session.

Course designers:

1. Dr. A. P. Asha Kannan
2. Mr. P. Sasikumar

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcomes	Knowledge Level
CLO1	Describe the key concepts in DNA isolation and demonstration	Up to K1
CLO2	Illustrate the significance of bacterial mutants	Up to K2
CLO3	Apply scientific principles in the interpretation of yeast mutants	Up to K3
CLO4	Demonstrate life cycle of phage	Up to K4
CLO5	Demonstrate titration of phage particles	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	2	2	1	2
CLO2	3	2	2	1	1
CLO3	1	1	2	2	1
CLO4	1	2	1	1	1
CLO5	2	3	2	1	2

Advance application – 3, Intermediate level – 2, Basic level – 1.

Mapping of course outcome with Programme outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	1	1	2
CLO2	3	2	1	2	2
CLO3	1	1	2	1	1
CLO4	2	1	1	2	2
CLO5	3	2	3	2	1

Advance application – 3, Intermediate level – 2, Basic level – 1.

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Major Practical -4	21P2RMP4	Lab in Immunology and Research Methodology	2	4	40	60	100

Nature of Course			
Knowledge and skill			Employability oriented
Skill oriented	✓		Entrepreneurship oriented

Course Objectives

- Immunological techniques help to understand and acquire a wide knowledge on immunity and immune system.
- Brief about different immunological techniques.
- Employ laboratory techniques that basically develop the preanalytical, analytical and post analytical skills for the performance of the tests.
- Analyze the suitable statistical program for research experiments
- Evaluate the significance of difference using statistical tools

S.No.	Experiments
1.	Identification of blood cells and Differential Count
2.	Total RBC Count
3.	Total WBC Count
4.	Separation of plasma and serum from the blood sample (demonstration).
5.	Identification of human blood groups. (ABO and Rh)
6.	Widal test for typhoid fever
7.	Immunodiffusion by Ouchterlony
8.	Radial immunodiffusion method
9.	Immunoelectrophoresis.
10.	Student' t' test using suitable statistical method
11.	Identification of significance of difference and analysis of data using ANOVA
12.	Plagiarism checker (demonstration).

Books for study

1. Carpenter, D.L. (1975). Immunology and Serology. 3rd Edition. W.B. Saunders Company, London.
2. Garvey, J.S., Cremer, N.E. and Sussdorf, D.H. (1977). Methods in Immunology. A Laboratory Text for Instruction and Research. 3rd Edition. The Benjamin Cummings Publishing Company Advanced Book Program, London.
3. Banerjee, P.K. (2007). Introduction to Biostatistics. S.Chand and Company Publications, New Delhi.

Books for Reference

1. Hudson, L. and Hay, F.C. (1989). Practical Immunology. 3rd Edition, Blackwell scientific Publications, Oxford.
2. Myers, R.L. (1989). Immunology: A Laboratory Manual. Wm. C.Brown Publishers. Dubuque, Iowa.
3. Rastogi, S.C. (1996). Immunodiagnostics Principles and Practice. New Age International (P) Ltd., New Delhi.
4. Talwar, G.P. and Gupta, S.K. (1992). A Hand Book of Practical and Clinical Immunology. Vol.1 -2. CBS Publishers & Distributors, Delhi.
5. Pillai, R.S.N. and Bagavathi, V. (2010). Statistics theory and practice. S. Chand and Company Publications, New Delhi.

Web Resources

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2581910/>
2. https://www.ebi.ac.uk/interpro/potm/2005_2/Page2.html/
3. <https://www.nejm.org/medical-research/autoimmune-disease%20Course%20Learning%20Outcomes/>
4. <https://onlinelibrary.wiley.com/journal/13652567>

Rationale for Nature of the course

The effective treatment of any ailments depends on degree of accuracy in the disease diagnosis. Immunological techniques play a critical role in the field of medical diagnosis and immunotherapy. A clear insight on the understanding the immunological background is mandatory for analysis and interpretation of serological assay. Statistical evaluation of post analytical data helps to authenticate the reliability of the results.

Activities having direct impact on Skill development/Employability / Entrepreneurship

Hands on experience in various serological test.. Performing haemogram test and blood group identification. Testing the significance of experimental results using statistical analysis.

Pedagogy

Demonstration and practical session.

Course designers:

1. Dr. S.Sree Gayathri
2. Dr. K. Kannan

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

	Course Learning Outcomes	KnowledgeLevel
CLO1	Describe an understanding of the key concepts in immunology	Up to K2
CLO2	Illustrate the salient features of antigen antibody reaction and its uses in diagnostics and various other studies	Up to K2
CLO3	Apply scientific principles in the interpretation of immunological responses and data	Up to K3
CLO4	Demonstrate suitable statistical program for research experiments	Up to K4
CLO5	Explain the significance of difference using statistical tools	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	2	2	-	2
CLO2	3	2	2	1	1
CLO3	1	-	2	2	1
CLO4	1	2	1	1	-
CLO5	2	3	2	1	2

Advance application – 3, Intermediate level – 2, Basic level – 1.

Mapping of course outcome with Programme outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	1	1	2
CLO2	3	2	1	2	2
CLO3	-	-	2	-	1
CLO4	2	1	1	2	2
CLO5	3	2	3	2	1

Advance application – 3, Intermediate level – 2, Basic level – 1.

The Madura College, Madurai
Department of Microbiology

PG Microbiology Program Structure

Semester	Subject Code	Title of the paper	Paper	Hours	Credits	Nature of Course(Employability/ Entrepreneurship/ Skill Development)			Scope of focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision (%) /New
						Empl	Ent	Skill	Local	National	Global	
I	21P1RMC1	Microbial Taxonomy	Core -1	5	4			✓	✓			17
	21P1RMC2	Biochemistry	Core -2	5	4			✓	✓			55
	21P1RMC3	Microbial Physiology	Core -3	5	4			✓	✓			50
	21P1RME1	Bioinstrumentation	Major Elective- 1	5	4			✓	✓			New
	21P1RME1	Food & Dairy Microbiology	Major Elective- 1	5	4			✓	✓			New
	21P1RMP1	Lab in Microbial Taxonomy and Biochemistry	Practical- 1	4	2			✓	✓			10
	21P1RMP2	Lab in Microbial Physiology and Bioinstrumentation	Practical- 2	4	2			✓	✓			50
	21P1RNM1	Microbial World	NME -1	2	2			✓	✓			Nil
II	21P2RMC4	Cell and Molecular Biology	Core -4	5	4			✓	✓			30
	21P2RMC5	Microbial Genetics	Core -5	5	4			✓	✓			17
	21P2RMC6	Immunology	Core -6	5	4			✓	✓			New
	21P2RME2	Research Methodology	Major Elective- 2	5	4			✓	✓			New
	21P2RME2	Computational Biology	Major Elective- 2	5	4			✓	✓			New
	21P2RMP3	Lab in Cell and Molecular Biology and Microbial Genetics	Practical- 3	4	2			✓	✓			0
	21P2RMP4	Lab in Immunology and Research Methodology	Practical- 4	4	2			✓	✓			100

	21P2RNM2	Food and Dairy Microbiology	NME -2	2	2			✓	✓			New
III	21P3RMC7	Clinical Microbiology	Core -7	5	4	✓			✓			New
	21P3RMC8	Agricultural Microbiology	Core -8	5	4			✓	✓			New
	21P3RMC9	Industrial Microbiology	Core -9	5	4			✓	✓			New
	21P3RMD C	Forensic Science	Major Multidisciplinary	6	4			✓	✓			New
	21P3RMP5	Lab in Clinical Microbiology and Agricultural Microbiology	Practical- 5	4	2			✓	✓			100
	21P3RMP6	Lab in Industrial Microbiology and Nanotechnology	Practical- 6	4	2			✓	✓			100
IV	21P4RMC10	Environmental Microbiology	Core -10	5	4			✓	✓			New
	21P4RMC11	Microbial Biotechnology	Core -11	5	4			✓	✓			3
	21P4RMC12	Genomics and Proteomics	Core -12	5	4			✓	✓			10
	21P4RME3	Entrepreneurial skill in Microbiology		5	4		✓		✓			New
	21P4RME3	Medical Laboratory Technology	Major Elective- 3	5	4			✓	✓			New
	21P4RMP7	Lab in Environmental Microbiology and Microbial Biotechnology	Practical- 7	4	2			✓	✓			50
	21P4RMP8	Lab in Genomics and Proteomics & Entrepreneurial skill in Microbiology	Practical- 8	4	2			✓	✓			60
	21P4RPR1	Project	Project	-	6			✓	✓			Nil

THE MADURA COLLEGE

An Autonomous Institution affiliated to Madurai Kamaraj University

Re-accredited (3rd cycle) with 'A' grade by NAAC

Vidya Nagar, T.P.K. Road, Madurai – 625 011

SELF FINANCED STREAM

DEPARTMENT OF MICROBIOLOGY

Programme : B.Sc (Microbiology)

Metric and weight calculation

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U1TLA1/20U1HLA1/20U1SLA1	CLO1	0.000	0.047	0.047	0.094	0.094	1.503
	CLO2	0.000	0.094	0.094	0.141	0.094	
	CLO3	0.000	0.141	0.047	0.000	0.094	
	CLO4	0.141	0.000	0.047	0.000	0.094	
	CLO5	0.000	0.000	0.141	0.000	0.094	
	Total	0.141	0.282	0.376	0.235	0.470	
20U1NEN1	CLO1	0.000	0.094	0.141	0.094	0.000	1.644
	CLO2	0.000	0.094	0.141	0.141	0.000	
	CLO3	0.000	0.094	0.094	0.094	0.000	
	CLO4	0.000	0.094	0.094	0.094	0.000	
	CLO5	0.000	0.094	0.141	0.141	0.000	
	Total	0.000	0.470	0.611	0.564	0.000	
20U1VEN1	CLO1	0.141	0.141	0.141	0.141	0.141	2.818
	CLO2	0.141	0.000	0.094	0.141	0.141	
	CLO3	0.141	0.000	0.094	0.141	0.141	
	CLO4	0.094	0.000	0.094	0.141	0.141	
	CLO5	0.141	0.094	0.094	0.141	0.141	
	Total	0.658	0.235	0.517	0.705	0.705	
20U1LAC1	CLO1	0.141	0.094	0.094	0.141	0.094	2.818
	CLO2	0.141	0.094	0.094	0.094	0.094	
	CLO3	0.141	0.094	0.141	0.094	0.094	
	CLO4	0.141	0.094	0.141	0.094	0.094	
	CLO5	0.141	0.141	0.141	0.094	0.094	
	Total	0.705	0.517	0.611	0.517	0.470	
20U1LAP1	CLO1	0.141	0.094	0.141	0.094	0.094	2.818
	CLO2	0.141	0.094	0.094	0.094	0.094	
	CLO3	0.141	0.094	0.141	0.094	0.094	
	CLO4	0.141	0.094	0.141	0.094	0.094	
	CLO5	0.141	0.141	0.141	0.094	0.094	
	Total	0.705	0.517	0.658	0.470	0.470	
20U1RMC1	CLO1	0.047	0.047	0.047	0.047	0.047	1.785
	CLO2	0.094	0.047	0.047	0.047	0.047	
	CLO3	0.094	0.094	0.047	0.047	0.047	
	CLO4	0.094	0.094	0.047	0.094	0.094	
	CLO5	0.141	0.094	0.094	0.094	0.094	
	Total	0.470	0.376	0.282	0.329	0.329	

20U1RMC2	CLO1	0.094	0.047	0.047	0.094	0.047	1.879
	CLO2	0.047	0.094	0.047	0.047	0.094	
	CLO3	0.094	0.094	0.047	0.047	0.047	
	CLO4	0.141	0.094	0.094	0.047	0.047	
	CLO5	0.141	0.094	0.094	0.094	0.047	
	Total	0.517	0.423	0.329	0.329	0.282	
20U1RMP1	CLO1	0.094	0.094	0.141	0.047	0.094	2.067
	CLO2	0.047	0.141	0.047	0.047	0.094	
	CLO3	0.047	0.094	0.141	0.094	0.094	
	CLO4	0.094	0.141	0.047	0.047	0.094	
	CLO5	0.047	0.094	0.047	0.047	0.094	
	Total	0.329	0.564	0.423	0.282	0.470	
20U2TLA2/20U2HLA2/20U2SLA2	CLO1	0.047	0.000	0.141	0.000	0.094	1.550
	CLO2	0.000	0.000	0.094	0.000	0.141	
	CLO3	0.047	0.000	0.141	0.047	0.094	
	CLO4	0.094	0.047	0.141	0.047	0.141	
	CLO5	0.000	0.000	0.141	0.047	0.047	
	Total	0.188	0.047	0.658	0.141	0.517	
20U2NENF2	CLO1	0.000	0.094	0.141	0.094	0.000	1.644
	CLO2	0.000	0.094	0.141	0.141	0.000	
	CLO3	0.000	0.094	0.094	0.094	0.000	
	CLO4	0.000	0.094	0.094	0.094	0.000	
	CLO5	0.000	0.094	0.141	0.141	0.000	
	Total	0.000	0.470	0.611	0.564	0.000	
20U2EVS1	CLO1	0.094	0.000	0.000	0.047	0.141	1.973
	CLO2	0.094	0.000	0.094	0.047	0.141	
	CLO3	0.094	0.141	0.000	0.047	0.141	
	CLO4	0.094	0.000	0.000	0.141	0.141	
	CLO5	0.094	0.141	0.000	0.141	0.141	
	Total	0.470	0.282	0.094	0.423	0.705	
20U2LAC2	CLO1	0.141	0.094	0.094	0.094	0.094	2.584
	CLO2	0.141	0.047	0.094	0.094	0.094	
	CLO3	0.141	0.094	0.094	0.094	0.094	
	CLO4	0.141	0.094	0.094	0.094	0.094	
	CLO5	0.141	0.094	0.141	0.094	0.094	
	Total	0.705	0.423	0.517	0.470	0.470	
20U2LAP2	CLO1	0.141	0.094	0.141	0.094	0.094	2.818
	CLO2	0.141	0.094	0.094	0.094	0.094	
	CLO3	0.141	0.094	0.141	0.094	0.094	
	CLO4	0.141	0.094	0.141	0.094	0.094	
	CLO5	0.141	0.141	0.141	0.094	0.094	
	Total	0.705	0.517	0.658	0.470	0.470	

20U2RMC3	CLO1	0.047	0.094	0.094	0.047	0.141	2.255
	CLO2	0.047	0.094	0.047	0.094	0.094	
	CLO3	0.094	0.047	0.141	0.047	0.141	
	CLO4	0.094	0.047	0.141	0.047	0.141	
	CLO5	0.047	0.047	0.141	0.141	0.141	
	Total	0.329	0.329	0.564	0.376	0.658	
20U2RMC4	CLO1	0.094	0.094	0.141	0.047	0.094	2.255
	CLO2	0.047	0.141	0.047	0.047	0.094	
	CLO3	0.047	0.094	0.141	0.094	0.094	
	CLO4	0.094	0.141	0.047	0.047	0.094	
	CLO5	0.047	0.094	0.141	0.141	0.094	
	Total	0.329	0.564	0.517	0.376	0.470	
20U2RMP2	CLO1	0.094	0.094	0.141	0.094	0.094	2.724
	CLO2	0.094	0.141	0.094	0.094	0.141	
	CLO3	0.141	0.094	0.141	0.141	0.094	
	CLO4	0.094	0.141	0.094	0.094	0.141	
	CLO5	0.094	0.094	0.094	0.094	0.094	
	Total	0.517	0.564	0.564	0.517	0.564	
20U3TLA3/17U3HLA3/20U3SLA3	CLO1	0.000	0.047	0.047	0.094	0.094	1.503
	CLO2	0.000	0.094	0.094	0.141	0.094	
	CLO3	0.000	0.141	0.047	0.000	0.094	
	CLO4	0.141	0.000	0.047	0.000	0.094	
	CLO5	0.000	0.000	0.141	0.000	0.094	
	Total	0.141	0.282	0.376	0.235	0.470	
20U3NENF3	CLO1	0.000	0.094	0.141	0.094	0.000	1.644
	CLO2	0.000	0.094	0.141	0.141	0.000	
	CLO3	0.000	0.094	0.094	0.094	0.000	
	CLO4	0.000	0.094	0.094	0.094	0.000	
	CLO5	0.000	0.094	0.141	0.141	0.000	
	Total	0.000	0.470	0.611	0.564	0.000	
20U3RSM1	CLO1	0.094	0.094	0.141	0.094	0.094	2.584
	CLO2	0.094	0.094	0.141	0.094	0.094	
	CLO3	0.094	0.141	0.094	0.094	0.141	
	CLO4	0.094	0.094	0.094	0.094	0.094	
	CLO5	0.141	0.094	0.094	0.094	0.094	
	Total	0.517	0.517	0.564	0.470	0.517	
20U3CAC1	CLO1	0.141	0.094	0.094	0.047	0.047	1.973
	CLO2	0.141	0.094	0.094	0.000	0.047	
	CLO3	0.141	0.094	0.047	0.047	0.000	
	CLO4	0.141	0.094	0.047	0.094	0.047	
	CLO5	0.141	0.094	0.047	0.047	0.094	
	Total	0.705	0.470	0.329	0.235	0.235	

20U3CAP1	CLO1	0.141	0.094	0.000	0.000	0.000	1.362
	CLO2	0.141	0.094	0.000	0.000	0.000	
	CLO3	0.141	0.094	0.000	0.000	0.000	
	CLO4	0.141	0.094	0.000	0.000	0.000	
	CLO5	0.141	0.094	0.094	0.094	0.000	
	Total	0.705	0.470	0.094	0.094	0.000	
20U3RMC5	CLO1	0.094	0.094	0.094	0.094	0.141	2.584
	CLO2	0.094	0.094	0.094	0.094	0.141	
	CLO3	0.141	0.094	0.094	0.094	0.094	
	CLO4	0.094	0.094	0.141	0.094	0.094	
	CLO5	0.141	0.094	0.094	0.094	0.094	
	Total	0.564	0.470	0.517	0.470	0.564	
20U3RMP3	CLO1	0.094	0.094	0.141	0.094	0.094	2.677
	CLO2	0.094	0.141	0.094	0.094	0.094	
	CLO3	0.094	0.094	0.141	0.141	0.094	
	CLO4	0.141	0.141	0.094	0.094	0.141	
	CLO5	0.094	0.094	0.094	0.094	0.094	
	Total	0.517	0.564	0.564	0.517	0.517	
20U4TLA4/17U4HLA4/20U4SLA4	CLO1	0.000	0.047	0.047	0.094	0.094	1.503
	CLO2	0.000	0.094	0.094	0.141	0.094	
	CLO3	0.000	0.141	0.047	0.000	0.094	
	CLO4	0.141	0.000	0.047	0.000	0.094	
	CLO5	0.000	0.000	0.141	0.000	0.094	
	Total	0.141	0.282	0.376	0.235	0.470	
20U4NEN4	CLO1	0.000	0.094	0.141	0.094	0.000	1.644
	CLO2	0.000	0.094	0.141	0.141	0.000	
	CLO3	0.000	0.094	0.094	0.094	0.000	
	CLO4	0.000	0.094	0.094	0.094	0.000	
	CLO5	0.000	0.094	0.141	0.141	0.000	
	Total	0.000	0.470	0.611	0.564	0.000	
20U4RSM2	CLO1	0.094	0.047	0.047	0.094	0.047	1.879
	CLO2	0.047	0.094	0.047	0.047	0.094	
	CLO3	0.094	0.094	0.047	0.047	0.047	
	CLO4	0.141	0.094	0.094	0.047	0.047	
	CLO5	0.141	0.094	0.094	0.094	0.047	
	Total	0.517	0.423	0.329	0.329	0.282	
20U4CAC2	CLO1	0.141	0.094	0.047	0.000	0.000	1.409
	CLO2	0.141	0.094	0.047	0.000	0.000	
	CLO3	0.141	0.094	0.047	0.000	0.000	
	CLO4	0.141	0.094	0.047	0.000	0.000	
	CLO5	0.141	0.094	0.047	0.000	0.000	
	Total	0.705	0.470	0.235	0.000	0.000	

20U4CAP2	CLO1	0.141	0.094	0.000	0.000	0.000	1.362
	CLO2	0.141	0.094	0.000	0.000	0.000	
	CLO3	0.141	0.094	0.000	0.000	0.000	
	CLO4	0.141	0.094	0.000	0.000	0.000	
	CLO5	0.141	0.094	0.094	0.047	0.047	
	Total	0.705	0.470	0.094	0.047	0.047	
20U4RMC6	CLO1	0.047	0.094	0.141	0.094	0.141	2.677
	CLO2	0.094	0.141	0.094	0.094	0.094	
	CLO3	0.094	0.094	0.141	0.141	0.141	
	CLO4	0.094	0.094	0.094	0.094	0.094	
	CLO5	0.094	0.141	0.094	0.141	0.094	
	Total	0.423	0.564	0.564	0.564	0.564	
20U4RMP4	CLO1	0.094	0.094	0.141	0.094	0.094	2.677
	CLO2	0.094	0.141	0.094	0.094	0.094	
	CLO3	0.094	0.094	0.141	0.141	0.094	
	CLO4	0.141	0.141	0.094	0.094	0.141	
	CLO5	0.094	0.094	0.094	0.094	0.094	
	Total	0.517	0.564	0.564	0.517	0.517	
20U5RSM3	CLO1	0.047	0.047	0.047	0.047	0.000	1.503
	CLO2	0.094	0.047	0.047	0.000	0.047	
	CLO3	0.094	0.094	0.000	0.047	0.047	
	CLO4	0.094	0.094	0.000	0.094	0.094	
	CLO5	0.141	0.000	0.094	0.094	0.094	
	Total	0.470	0.282	0.188	0.282	0.282	
20U5RMC7	CLO1	0.047	0.047	0.047	0.047	0.047	1.691
	CLO2	0.094	0.047	0.047	0.047	0.000	
	CLO3	0.094	0.094	0.000	0.047	0.047	
	CLO4	0.094	0.094	0.047	0.094	0.094	
	CLO5	0.141	0.094	0.094	0.094	0.094	
	Total	0.470	0.376	0.235	0.329	0.282	
20U5RMC8	CLO1	0.000	0.047	0.047	0.000	0.047	1.362
	CLO2	0.094	0.047	0.047	0.047	0.047	
	CLO3	0.094	0.000	0.000	0.047	0.047	
	CLO4	0.000	0.094	0.047	0.094	0.094	
	CLO5	0.141	0.094	0.094	0.094	0.000	
	Total	0.329	0.282	0.235	0.282	0.235	
20U5RMC9	CLO1	0.094	0.094	0.141	0.094	0.094	2.396
	CLO2	0.000	0.094	0.141	0.094	0.094	
	CLO3	0.094	0.141	0.000	0.094	0.141	
	CLO4	0.094	0.094	0.094	0.094	0.094	
	CLO5	0.141	0.094	0.141	0.141	0.000	
	Total	0.423	0.517	0.517	0.517	0.423	

20U5RMP5	CLO1	0.000	0.141	0.141	0.094	0.094	2.208
	CLO2	0.094	0.000	0.141	0.000	0.141	
	CLO3	0.094	0.094	0.000	0.094	0.141	
	CLO4	0.094	0.094	0.141	0.094	0.094	
	CLO5	0.141	0.094	0.000	0.094	0.094	
	Total	0.423	0.423	0.423	0.376	0.564	
20U5RMP6	CLO1	0.141	0.094	0.141	0.141	0.000	2.584
	CLO2	0.000	0.141	0.094	0.141	0.094	
	CLO3	0.141	0.047	0.000	0.094	0.094	
	CLO4	0.141	0.141	0.141	0.141	0.141	
	CLO5	0.141	0.141	0.141	0.000	0.094	
	Total	0.564	0.564	0.517	0.517	0.423	
20U5RIDC	CLO1	0.094	0.094	0.141	0.000	0.141	2.631
	CLO2	0.094	0.094	0.141	0.094	0.094	
	CLO3	0.000	0.141	0.141	0.094	0.141	
	CLO4	0.094	0.094	0.094	0.141	0.141	
	CLO5	0.141	0.141	0.141	0.141	0.000	
	Total	0.423	0.564	0.658	0.470	0.517	
20U5RME1	CLO1	0.000	0.047	0.094	0.047	0.047	2.020
	CLO2	0.141	0.047	0.047	0.047	0.141	
	CLO3	0.141	0.141	0.000	0.141	0.141	
	CLO4	0.141	0.094	0.141	0.094	0.000	
	CLO5	0.000	0.094	0.094	0.094	0.047	
	Total	0.423	0.423	0.376	0.423	0.376	
20U6RSM4	CLO1	0.047	0.000	0.047	0.047	0.047	1.268
	CLO2	0.047	0.047	0.047	0.047	0.000	
	CLO3	0.000	0.047	0.047	0.047	0.047	
	CLO4	0.047	0.094	0.094	0.000	0.094	
	CLO5	0.094	0.094	0.000	0.094	0.094	
	Total	0.235	0.282	0.235	0.235	0.282	
20U6RMC10	CLO1	0.141	0.000	0.141	0.047	0.094	2.631
	CLO2	0.141	0.094	0.094	0.094	0.141	
	CLO3	0.141	0.141	0.094	0.047	0.141	
	CLO4	0.094	0.094	0.000	0.094	0.141	
	CLO5	0.141	0.141	0.141	0.094	0.141	
	Total	0.658	0.470	0.470	0.376	0.658	
20U6RMC11	CLO1	0.094	0.094	0.141	0.094	0.094	2.396
	CLO2	0.094	0.000	0.141	0.094	0.094	
	CLO3	0.094	0.141	0.000	0.094	0.141	
	CLO4	0.094	0.094	0.094	0.094	0.094	
	CLO5	0.141	0.094	0.094	0.094	0.094	
	Total	0.517	0.423	0.470	0.470	0.517	

20U6RMC12	CLO1	0.047	0.047	0.047	0.047	0.047	1.362
	CLO2	0.047	0.047	0.047	0.047	0.047	
	CLO3	0.000	0.047	0.047	0.047	0.047	
	CLO4	0.047	0.094	0.094	0.000	0.094	
	CLO5	0.094	0.094	0.000	0.094	0.094	
	Total	0.235	0.329	0.235	0.235	0.329	
20U6RMP7	CLO1	0.141	0.094	0.141	0.141	0.141	2.771
	CLO2	0.141	0.141	0.094	0.094	0.000	
	CLO3	0.141	0.000	0.047	0.094	0.094	
	CLO4	0.141	0.141	0.141	0.141	0.141	
	CLO5	0.141	0.141	0.141	0.094	0.047	
	Total	0.705	0.517	0.564	0.564	0.423	
20U6RMP8	CLO1	0.094	0.094	0.094	0.094	0.141	2.537
	CLO2	0.094	0.094	0.094	0.094	0.141	
	CLO3	0.094	0.000	0.141	0.094	0.141	
	CLO4	0.094	0.094	0.094	0.094	0.141	
	CLO5	0.141	0.094	0.141	0.000	0.141	
	Total	0.517	0.376	0.564	0.376	0.705	
20U6RME2	CLO1	0.094	0.094	0.141	0.000	0.141	2.631
	CLO2	0.094	0.094	0.141	0.094	0.094	
	CLO3	0.000	0.141	0.141	0.094	0.141	
	CLO4	0.094	0.094	0.094	0.141	0.141	
	CLO5	0.141	0.141	0.141	0.141	0.000	
	Total	0.423	0.564	0.658	0.470	0.517	
20U6RME3	CLO1	0.141	0.047	0.094	0.047	0.047	2.396
	CLO2	0.141	0.000	0.047	0.047	0.141	
	CLO3	0.141	0.141	0.141	0.141	0.141	
	CLO4	0.141	0.094	0.141	0.094	0.141	
	CLO5	0.047	0.094	0.094	0.094	0.000	
	Total	0.611	0.376	0.517	0.423	0.470	
	Total	20.339	19.823	20.668	17.944	18.226	97

NME COURSES

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U3RNM1	CLO1	0.026	0.026	0.026	0.026	0.026	
	CLO2	0.053	0.026	0.026	0.026	0.026	
	CLO3	0.053	0.053	0.026	0.026	0.026	
	CLO4	0.053	0.053	0.026	0.053	0.053	
	CLO5	0.079	0.053	0.053	0.053	0.053	
	Total	0.263	0.211	0.158	0.184	0.184	1
20U4RNM2	CLO1	0.035	0.035	0.035	0.035	0.035	
	CLO2	0.035	0.053	0.053	0.035	0.053	
	CLO3	0.053	0.035	0.035	0.053	0.053	
	CLO4	0.035	0.053	0.035	0.035	0.035	
	CLO5	0.035	0.035	0.035	0.035	0.035	
	Total	0.193	0.211	0.193	0.193	0.211	1

All the course outcomes are adequately mapped against the programme outcomes and all the programme outcomes carry adequate weight against the cumulative outcome of the programme.

THE MADURA COLLEGE
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 Re-accredited (3rd cycle) with 'A' grade by NAAC
 Vidya Nagar, T.P.K. Road, Madurai – 625 011
SELF FINANCED STREAM
DEPARTMENT OF MICROBIOLOGY
Programme : M.Sc (Microbiology)
Metric and weight calculation

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
21P1RMC1	CLO1	0.161	0.242	0.081	0.161	0.242	5.082
	CLO2	0.242	0.242	0.161	0.161	0.242	
	CLO3	0.242	0.161	0.242	0.161	0.242	
	CLO4	0.242	0.161	0.242	0.242	0.242	
	CLO5	0.161	0.161	0.242	0.161	0.242	
	Total	1.049	0.968	0.968	0.887	1.210	
21P1RMC2	CLO1	0.161	0.161	0.242	0.242	0.161	4.276
	CLO2	0.161	0.161	0.161	0.161	0.161	
	CLO3	0.242	0.242	0.161	0.161	0.161	
	CLO4	0.161	0.161	0.161	0.081	0.161	
	CLO5	0.161	0.081	0.161	0.242	0.161	
	Total	0.887	0.807	0.887	0.887	0.807	
21P1RMC3	CLO1	0.081	0.081	0.081	0.081	0.081	2.743
	CLO2	0.081	0.081	0.081	0.081	0.081	
	CLO3	0.081	0.081	0.081	0.081	0.081	
	CLO4	0.081	0.161	0.161	0.161	0.161	
	CLO5	0.161	0.161	0.161	0.161	0.161	
	Total	0.484	0.565	0.565	0.565	0.565	
21P1RME1	CLO1	0.242	0.081	0.161	0.081	0.242	4.598
	CLO2	0.242	0.081	0.081	0.081	0.242	
	CLO3	0.242	0.242	0.242	0.242	0.242	
	CLO4	0.242	0.242	0.242	0.242	0.242	
	CLO5	0.081	0.161	0.161	0.161	0.081	
	Total	1.049	0.807	0.887	0.807	1.049	
21P1RMP1	CLO1	0.161	0.161	0.161	0.161	0.242	4.598
	CLO2	0.161	0.161	0.161	0.161	0.242	
	CLO3	0.161	0.242	0.242	0.161	0.242	
	CLO4	0.161	0.161	0.161	0.161	0.242	
	CLO5	0.161	0.161	0.161	0.161	0.242	
	Total	0.807	0.887	0.887	0.807	1.210	
21P1RMP2	CLO1	0.161	0.161	0.081	0.081	0.161	3.469
	CLO2	0.242	0.161	0.081	0.161	0.161	
	CLO3	0.081	0.081	0.161	0.081	0.081	
	CLO4	0.161	0.081	0.081	0.161	0.161	
	CLO5	0.242	0.161	0.242	0.161	0.081	
	Total	0.887	0.645	0.645	0.645	0.645	

21P2RMC4	CLO1	0.081	0.081	0.081	0.081	0.081	2.743
	CLO2	0.081	0.081	0.081	0.081	0.081	
	CLO3	0.081	0.081	0.081	0.081	0.081	
	CLO4	0.081	0.161	0.161	0.161	0.161	
	CLO5	0.161	0.161	0.161	0.161	0.161	
	Total	0.484	0.565	0.565	0.565	0.565	
21P2RMC5	CLO1	0.161	0.081	0.161	0.161	0.081	3.872
	CLO2	0.161	0.161	0.161	0.161	0.242	
	CLO3	0.161	0.161	0.081	0.081	0.161	
	CLO4	0.161	0.161	0.161	0.161	0.161	
	CLO5	0.242	0.161	0.161	0.161	0.161	
	Total	0.887	0.726	0.726	0.726	0.807	
21P2RMC6	CLO1	0.081	0.161	0.161	0.081	0.161	3.066
	CLO2	0.161	0.081	0.081	0.161	0.161	
	CLO3	0.081	0.161	0.161	0.081	0.081	
	CLO4	0.081	0.161	0.081	0.161	0.081	
	CLO5	0.161	0.161	0.081	0.161	0.081	
	Total	0.565	0.726	0.565	0.645	0.565	
21P2RME2	CLO1	0.081	0.081	0.081	0.081	0.081	3.469
	CLO2	0.081	0.081	0.081	0.081	0.081	
	CLO3	0.161	0.161	0.161	0.161	0.081	
	CLO4	0.161	0.161	0.161	0.242	0.161	
	CLO5	0.242	0.161	0.242	0.242	0.161	
	Total	0.726	0.645	0.726	0.807	0.565	
21P2RMP3	CLO1	0.161	0.161	0.081	0.081	0.161	3.469
	CLO2	0.242	0.161	0.081	0.161	0.161	
	CLO3	0.081	0.081	0.161	0.081	0.081	
	CLO4	0.161	0.081	0.081	0.161	0.161	
	CLO5	0.242	0.161	0.242	0.161	0.081	
	Total	0.887	0.645	0.645	0.645	0.645	
21P2RMP4	CLO1	0.161	0.161	0.081	0.081	0.161	3.469
	CLO2	0.242	0.161	0.081	0.161	0.161	
	CLO3	0.081	0.081	0.161	0.081	0.081	
	CLO4	0.161	0.081	0.081	0.161	0.161	
	CLO5	0.242	0.161	0.242	0.161	0.081	
	Total	0.887	0.645	0.645	0.645	0.645	
21P3RMC7	CLO1	0.081	0.161	0.242	0.161	0.161	3.711
	CLO2	0.161	0.000	0.242	0.161	0.242	
	CLO3	0.161	0.161	0.000	0.242	0.000	
	CLO4	0.161	0.161	0.161	0.161	0.161	
	CLO5	0.242	0.161	0.161	0.161	0.000	
	Total	0.807	0.645	0.807	0.887	0.565	

21P3RMC8	CLO1	0.161	0.242	0.081	0.161	0.242	4.598
	CLO2	0.242	0.242	0.161	0.161	0.242	
	CLO3	0.242	0.161	0.000	0.161	0.242	
	CLO4	0.242	0.161	0.242	0.000	0.242	
	CLO5	0.161	0.161	0.242	0.161	0.242	
	Total	1.049	0.968	0.726	0.645	1.210	
21P3RMC9	CLO1	0.000	0.161	0.242	0.161	0.161	4.114
	CLO2	0.161	0.081	0.242	0.161	0.242	
	CLO3	0.161	0.161	0.000	0.242	0.242	
	CLO4	0.161	0.161	0.161	0.161	0.000	
	CLO5	0.242	0.161	0.242	0.242	0.161	
	Total	0.726	0.726	0.887	0.968	0.807	
21P3RMDC	CLO1	0.081	0.081	0.081	0.081	0.081	2.743
	CLO2	0.081	0.081	0.081	0.081	0.081	
	CLO3	0.081	0.081	0.081	0.081	0.081	
	CLO4	0.081	0.161	0.161	0.161	0.161	
	CLO5	0.161	0.161	0.161	0.161	0.161	
	Total	0.484	0.565	0.565	0.565	0.565	
21P3RMP5	CLO1	0.242	0.242	0.161	0.242	0.161	4.034
	CLO2	0.000	0.242	0.161	0.242	0.161	
	CLO3	0.242	0.161	0.081	0.081	0.242	
	CLO4	0.161	0.161	0.000	0.242	0.000	
	CLO5	0.161	0.000	0.242	0.242	0.161	
	Total	0.807	0.807	0.645	1.049	0.726	
21P3RMP6	CLO1	0.161	0.161	0.242	0.161	0.161	4.598
	CLO2	0.161	0.242	0.161	0.161	0.161	
	CLO3	0.081	0.161	0.242	0.242	0.242	
	CLO4	0.161	0.242	0.161	0.161	0.161	
	CLO5	0.161	0.161	0.161	0.242	0.242	
	Total	0.726	0.968	0.968	0.968	0.968	
21P4RMC10	CLO1	0.081	0.000	0.081	0.081	0.081	3.630
	CLO2	0.161	0.161	0.242	0.161	0.161	
	CLO3	0.161	0.161	0.081	0.161	0.000	
	CLO4	0.161	0.161	0.161	0.161	0.161	
	CLO5	0.242	0.161	0.242	0.242	0.161	
	Total	0.807	0.645	0.807	0.807	0.565	
21P4RMC11	CLO1	0.242	0.081	0.161	0.242	0.242	4.840
	CLO2	0.242	0.242	0.242	0.242	0.242	
	CLO3	0.242	0.161	0.000	0.242	0.242	
	CLO4	0.242	0.242	0.242	0.242	0.242	
	CLO5	0.161	0.161	0.161	0.081	0.000	
	Total	1.129	0.887	0.807	1.049	0.968	

21P4RMC12	CLO1	0.081	0.081	0.081	0.081	0.081	2.339
	CLO2	0.081	0.081	0.081	0.081	0.081	
	CLO3	0.000	0.081	0.081	0.081	0.081	
	CLO4	0.081	0.161	0.161	0.000	0.161	
	CLO5	0.161	0.161	0.000	0.161	0.161	
	Total	0.403	0.565	0.403	0.403	0.565	
21P4RME3	CLO1	0.081	0.000	0.081	0.081	0.081	2.420
	CLO2	0.081	0.081	0.081	0.081	0.081	
	CLO3	0.081	0.081	0.081	0.000	0.081	
	CLO4	0.081	0.000	0.161	0.161	0.161	
	CLO5	0.161	0.161	0.161	0.161	0.161	
	Total	0.484	0.323	0.565	0.484	0.565	
21P4RMP7	CLO1	0.242	0.242	0.161	0.242	0.161	4.598
	CLO2	0.161	0.242	0.161	0.242	0.161	
	CLO3	0.242	0.161	0.000	0.000	0.242	
	CLO4	0.161	0.161	0.242	0.242	0.161	
	CLO5	0.161	0.161	0.242	0.242	0.161	
	Total	0.968	0.968	0.807	0.968	0.887	
21P4RMP8	CLO1	0.161	0.161	0.242	0.161	0.000	3.469
	CLO2	0.161	0.000	0.161	0.161	0.161	
	CLO3	0.081	0.161	0.242	0.000	0.242	
	CLO4	0.161	0.000	0.161	0.161	0.161	
	CLO5	0.161	0.161	0.161	0.242	0.000	
	Total	0.726	0.484	0.968	0.726	0.565	
21P4RPR	CLO1	0.242	0.242	0.242	0.242	0.242	6.050
	CLO2	0.242	0.242	0.242	0.242	0.242	
	CLO3	0.242	0.242	0.242	0.242	0.242	
	CLO4	0.242	0.242	0.242	0.242	0.242	
	CLO5	0.242	0.242	0.242	0.242	0.242	
	Total	1.210	1.210	1.210	1.210	1.210	
	Total	19.926	18.393	18.877	19.361	19.442	96

NME COURSES

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
21P1RNM1	CLO1	0.051	0.103	0.051	0.103	0.051	
	CLO2	0.103	0.103	0.154	0.154	0.103	
	CLO3	0.051	0.103	0.051	0.103	0.051	
	CLO4	0.103	0.051	0.103	0.051	0.051	
	CLO5	0.051	0.051	0.051	0.103	0.051	
	Total	0.359	0.410	0.410	0.513	0.308	2
21P2RNM2	CLO1	0.051	0.103	0.051	0.103	0.051	
	CLO2	0.103	0.103	0.154	0.154	0.103	
	CLO3	0.051	0.103	0.051	0.103	0.051	
	CLO4	0.103	0.051	0.103	0.051	0.051	
	CLO5	0.051	0.051	0.051	0.103	0.051	
	Total	0.359	0.410	0.410	0.513	0.308	2

All the course outcomes are adequately mapped against the programme outcomes and all the programme outcomes carry adequate weight against the cumulative outcome of the programme.



DEPARTMENT OF BIOTECHNOLOGY

Revised Curriculum
(Choice Based Credit system with Outcome Based Education)
Academic Year 2020-2021 onwards

V and VI semesters (B.Sc. Biotechnology)
Allied Courses (B.Sc. Microbiology)

Department of Biotechnology

Vision

To produce disciplined and competent students of high calibre, to become socially committed and ethically strong to meet the challenges.

Mission

- To foster excellence in the field of biotechnology.
- To adopt proper pedagogical methods to ensure quality education and academic excellence.
- To provide conducive environment for learning following ethical, moral and spiritual values.

Programme Educational Objectives (PEOs)

The objectives of this programme

PEO-1	Exhibit practical and theoretical knowledge essential for pursuing higher studies
PEO-2	Elaborate basic and advanced laboratory skills necessary for Biotechnology.
PEO-3	Pursue careers in Pharmaceutical and Food Industry etc, and skills required to employ in a biotechnology laboratory or manufacturing facility
PEO-4	Aware of lifelong learning following ethics for professional practice.
PEO-5	Acquire theoretical and practical skills to develop biotech process to meet the demand.

Programme Specific Outcomes (PSOs)

On the successful completion of B.Sc., Biotechnology the students will be able to

	PSOs	Graduate Attributes
PSO-1	Infer knowledge in core concepts, recent developments and laboratory skills in various domains of biotechnology.	• Knowledge on core competency • Modern Tool Usage
PSO-2	Identify the various biological processes in prokaryotic and eukaryotic organisms and make use of skills in biological and computational tools and techniques.	• Life-long learning • Design • Problem analysis
PSO-3	Correlate and apply physio-chemical, biological, computational, biological and chemical principles and techniques in various areas of Biotechnology.	• Problem analysis • Conduct investigations of complex problems • Design & Development of solutions for complex problems • Modern Tool Usage
PSO-4	Exhibit in depth knowledge in various thrust areas of Biotechnology so as to meet the demands in industry and academia.	• Individual and team work • Communication • Life-long learning
PSO-5	Explain the importance of ethics and socioeconomic development through Biotechnology.	• Ethics • Environment and sustainability

Department of Biotechnology
The Madura College, Madurai
OBE Programme structure for B.Sc., Biotechnology (2020 onwards)

Semester	Subject Code	Course	Title of the Course	H	C
I	20U1TLA1	Language-I	Tamil-I/Hindi-I	6	3
	20U1NEN1	English-I	English-I	6	3
	20U1VEN1	VE & PE	Value Education and Professional Ethics	3	3
		Ancillary-I Theory 1		4	4
		Ancillary-I Practicals		2	1
	20U1LMC1	Major Core-1	Genetics	3	3
	20U1LMC2	Major Core-2	Basics of Biotechnology	3	3
	20U1LMP1	Major Practicals	Major Practicals-I	3	2
				30	22
II	20U2TLA2	Language-II	Tamil-II/Hindi-II	6	3
	20U2NEN2	English-II	English-II	6	3
	20U2EVS1	E & GS	Environmental and Gender Studies	3	3
		Ancillary-I Theory 2		4	4
		Ancillary-I Practicals		2	1
	20U2LMC3	Major Core-3	General Physiology	3	3
	20U2LMC4	Major Core-4	Bioinstrumentation	3	3
	20U2LMP2	Major Practicals	Major Practicals-II	3	2
		Extension			1
				30	23
III	20U3TLA3	Language-III	Tamil-III/Hindi-III	6	3
	20U3NEN3	English-III	English-III	6	3
	20U3LNM1	NME-I	Introduction to Biotechnology	2	2
	20U3LSM1	SBE-I	Biophysics and Bioenergetics	2	2
		Ancillary-II Theory 1		4	4
		Ancillary-II Practicals		2	1
	20U3LMC5	Major Core-5	Biochemistry	5	5
	20U3LMP3	Major Practicals	Major Practicals-III	3	2
				30	22
IV	20U4TLA4	Language-IV	Tamil-IV/Hindi-IV	6	3
	20U4NEN4	English-IV	English-IV	6	3
	20U4LNM2	NME-II	Applied Biotechnology	2	2
	20U4LSM2	SBE-II	Food Processing and Preservation	2	2
		Ancillary-II Theory 2		4	4
		Ancillary-II Practicals		2	1
	20U4LMC6	Major Core-6	Cell and Molecular Biology	5	5
	20U4LMP4	Major Practicals	Major Practicals-IV	3	2
				30	22

Semester	Subject Code	Paper	Title of the paper	H	C
V	20U5LSM3	SBE-III	Bioethics, Biosafety and IPR	2	2
	20U5LMC7	Major Core-7	Immunology	5	5
	20U5LMC8	Major Core-8	Industrial Biotechnology	5	5
	20U5LMC9	Major Core-9	Plant Biotechnology	5	5
	20U5LME1	Major Elective-I [#]	Biostatistics	4	3
	20U5LIDC1	Interdisciplinary*	Computer Aided Drug Design*	3	2
	20U5LMP5	Major Practicals	Major Practicals-V	3	2
	20U5LMP6	Major Practicals	Major Practicals-VI	3	2
				30	26
VI	20U6LSM4	SBE-IV	Genomics & Proteomics	2	2
	20U6LMC10	Major Core-10	Environmental Biotechnology	5	5
	20U6LMC11	Major Core-11	Recombinant DNA Technology	5	5
	20U6LMC12	Major Core-12	Medical Biotechnology	5	5
	20U6LME3	Major Elective-III [#]	Bioinformatics	4	3
	20U6LME4	Major Elective-IV [#]	Animal Biotechnology	3	2
	20U6LMP7	Major Practicals	Major Practicals-VII	3	2
	20U6LMP8	Major Practicals	Major Practicals-VIII	3	2
				30	26

*Inter-disciplinary course – Biotechnology & Computer Science

[#]Elective Papers for B.Sc., Biotechnology

Semester	Paper	Title of the paper
V	Major Electives I & II	Biostatistics
		Forensic Biotechnology
		Pharmaceutical Biotechnology
VI	Major Electives III & IV	Animal Biotechnology
		Bioinformatics
		Microbial Biotechnology
		Nanobiotechnology

Ancillary Biotechnology Papers for B.Sc., Microbiology

Semester	Subject Code	Paper	Title of the paper	H	C
I	20U1LAC1	Ancillary-I Theory	Concepts in Biotechnology	4	4
	20U1LAP1	Ancillary-I Practicals	Lab in Biotechnology - I	2	1
II	20U2LAC2	Ancillary-II Theory	Biotechnology in Human Welfare	4	4
	20U2LAP2	Ancillary-II Practicals	Lab in Biotechnology-II	2	1

Extra Credit Courses

Certificate Course

Semester	Title of the paper	H	C
Even	Clinical Laboratory Technology	30	
Odd	Sericulture Technology	30	
	Spirulina Cultivation	30	

Add-on courses for B.Sc. Biotechnology

Semester	Subject Code	Title of the paper	H	C
III	21U3LAD1	Reproductive Biology	2	2
IV	21U3LAD2	Enzyme Technology	2	2

Self-study courses for B.Sc. Biotechnology

Semester	Subject Code	Title of the paper	H	C
IV	21U4LSS1	Medical Biochemistry		2
IV	21U4LSS2	Evolutionary Biology		2

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	SBE-III	20U5LSM3	Bioethics, Biosafety and IPR	2	2	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To focus on the various forms of IPR and patenting procedure. - To emphasize on the various levels of biosafety and risk assessment in Biotechnology. - To provide the students with an understanding about the ethics associated with Biotechnology.				
Unit	Description	Hours	K-level	CLO
I	Intellectual property rights - Introduction Intellectual property rights –definition, concepts, forms of IPR – patents, design, trade mark, trade secret, geographical indicators, copy rights. Patents – prerequisite, nature and scope of patents, claim, grant, types of patent- utility patent, design patent, plant patent advantages, disadvantages, validity.	6	Up to K3	1
II	Biosafety Biosafety –risk group, biosafety levels, risk assessment, Cartagena protocol, organization and database information on biosafety, Indian biosafety framework. Genetically modified organisms (GMO) – concerns and challenges in plant and animal biotechnology. Allergenicity and GMOs - Assessment and screening.	6	Up to K4	2
III	Regulatory mechanism of genetically modified organisms Regulatory bodies: International -WTO, OECD, FAO, GEAC National bodies – IBSC, RCGM, DLC, procedure for approval of environmental release of transgenic crops, biosafety guidelines in India-DBT, rules for the manufacture and storage of hazardous microbes and genetically modified organisms.	6	Up to K3	3
IV	Bioethics Scope, origin, different approaches to ethics, issues and conflicts	6	Up to K4	4

	in the development of GMOs, gene therapy, cloning , transgenic animals, socio-economic, socio-legal, environmental, health and safety issues, Bioethics Advisory Committee-IBC, IAB.			
V	Case studies in IPR and biosafety Diamond vs Chakraborty, Neem patent, turmeric patent, tulsi patent, Bt cotton, Bt brinjal, Golden rice, Myriad's Gene patent, CRISPR-CAS 9	6	Up to K2	5

Books for Study

1. Deepa Goel and Shomini Paraskar. 2013. IPR, Biosafety and Bioethics, Pearson Education, India.
2. Sreekrishna V. 2017. Bioethics and Biosafety in Biotechnology. New Age International.

Books for Reference

1. Satheesh MK. 2013. Bioethics and Biosafety, I K International Publishing House Pvt Ltd.
2. Ben Mephram. 2008. Bioethics: An Introduction for the biosciences. Second edition. Oxford University Press

Web resources

1. https://www.youtube.com/watch?v=hzzQk1PuMVM&feature=emb_imp_woyt
2. <https://www.youtube.com/watch?v=TaDfxrTo0HE>

Rationale for nature of the course

The skilled based paper on Bioethics, Biosafety and IPR aimed to provide understanding about intellectual property rights and significance of ethics in the field of Biotechnology. This course highlights the biosafety aspects and risk assessment in the development of Genetically Modified Organisms [GMOs]. The course on Bioethics, Biosafety and IPR provides an adequate knowledge to the students on intellectual property rights and make use of those in future as a researcher and entrepreneur.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Student seminar on important aspects of patenting process
- Scientific discussion among students about various case studies of ethics and patenting

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Ms. R.Suguna

Dr. S. Baskaran

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Relate various forms of IPR used in Biotechnology.	Up to K3
CLO-2	Compare various biosafety levels used in biological research.	Up to K4
CLO-3	Discuss about national and international regulatory bodies for ethics, biosafety and IPR.	Up to K3
CLO-4	Point out the issues and conflicts related to Genetically Modified Organisms [GMOs]	Up to K4
CLO-5	Discuss about the case studies in IPR and biosafety issues	Up to K2

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	1	3	2	1
CLO-2	3	1	3	2	1
CLO-3	3	1	2	1	2
CLO-4	3	1	2	2	1
CLO-5	3	1	2	1	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	1	2	3	3
CLO-2	3	1	2	3	3
CLO-3	1	1	1	3	3
CLO-4	3	1	2	3	3
CLO-5	1	1	1	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Intellectual property rights –definition, concepts, forms of IPR – patents, design, trade mark, trade secret, geographical indicators, copy rights.	3	Chalk, Quiz and talk Assignments
	Patents – prerequisite, nature and scope of patents, claim, grant, types of patent- utility patent, design patent, plant patent advantages, disadvantages, validity.	3	
II	Biosafety –risk group, biosafety levels, risk assessment, Cartagena protocol, organization and database information on biosafety, Indian biosafety framework.	3	Chalk, Quiz and talk Assignments
	Genetically modified organisms (GMO) – concerns and challenges in plant and animal biotechnology. Allergenicity and GMOs - Assessment and screening.	3	
III	Regulatory bodies: International -WTO, OECD, FAO, GEAC National bodies – IBSC, RCGM, DLC, procedure for approval of environmental release of transgenic crops,	3	Chalk, Quiz and talk Assignments
	Biosafety guidelines in India-DBT, rules for the manufacture and storage of hazardous microbes and genetically modified organisms.	3	
IV	Scope, origin, different approaches to ethics, issues and conflicts in the development of GMOs, gene therapy, cloning , transgenic animals	3	Chalk, Quiz and talk Assignments
	Socio-economic, socio-legal, environmental, health and safety issues, Bioethics Advisory Committee-IBC, IAB.	3	
V	Diamond vs Chakraborty, Neem patent, turmeric patent, tulsi patent, Bt cotton, Bt brinjal, Golden rice, Myriad's Gene patent, CRISPR-CAS 9	6	Chalk, group discussion, Quiz and talk Assignments

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Bioethics, Biosafety and IPR Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
2.	CLO 2	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
2.	CLO 4	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K4)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Bioethics, Biosafety and IPR Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
2	CLO 2	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
3	CLO 3	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
4	CLO 4	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
5	CLO 5	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K2 Level)	1 Question from Unit-I (K3 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K4 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K3 Level)
		2 Questions from Unit-IV (K4 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K1 Level)	1 Question from Unit-V (K2 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Core-7	20U5LMC7	Immunology	5	5	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To provide students with an understanding about the components of immune system. - To focus on the unique properties, biological roles and functions of immune components. - Emphasize on the association between diseases progression and response of immune system.				
Unit	Description	Hours	K-level	CLO
I	Introduction to Immunology History of Immunology, types of immunity –innate, specific, acquired, active and passive, organs of the immune system - primary and secondary lymphoid organs. Haematopoiesis, cells of immune system -neutrophils, macrophages, natural killer cells, null cells, basophils, mast cells, B cells & T cells – structure and functions	15	Up to K-2	1
II	Components of Immune System Characteristic features of immunogens, antigens, haptens, epitopes and adjuvants. Immunoglobulin - classes, structure and functions, Cytokines – types and functions. B cells - maturation, activation, proliferation, germinal center, plasma cells, memory cells, class switching, T-cells - receptor, activation, maturation, differentiation.	15	Up to K-3	2
III	Immune response mechanism MHC- types, structure, self MHC restriction, Antigen processing and presentation, Antigen dependent cell cytotoxicity, T-Cell mediated cytotoxicity, Complement – activation, complement pathways - Classical, Alternate, biological activities. Hypersensitivity - Type I, II, III, IV reactions	15	Up to K-4	3

IV	Unit -IV Clinical Immunology Autoimmune diseases: Organ-Specific-Hashimoto's thyroiditis, Grave's disease, Myasthenia gravis, Systemic- Systemic lupus erythematosus, Rheumatoid arthritis. Transplantation - types of graft, graft rejection mechanism, Graft Versus Host diseases, mixed leukocyte reaction – one way and two way, tissue typing, immunosuppressive agents. Cancer immunology – tumour antigens, effector mechanisms	15	Up to K-3	4
V	Unit V Immunotechniques and Vaccine Antigen-antibody interactions - Agglutination-hemagglutination, bacterial agglutination, passive agglutination, agglutination inhibition, precipitation techniques- RID, ODD, Radio Immuno Assay, Immunoelectrophoresis, ELISA- indirect, sandwich, competitive, ELISPOT Immunofluorescence assays - Fluorescence activated cell sorter (FACS) technique. Vaccine- Active and passive immunization, attenuated, heat-killed, subunit vaccines, route of administration.	15	Up to K-4	5

Books for study

1. Owen JA, Punt J, Stranford. 2013. Kuby Immunology. W. H. Freeman & Company.
2. Fahim Halim Khan. 2004. Elements of Immunology. Pearson Education.

Books for reference

1. Coico R and Sunshine G. 2015. Immunology: a short course. 7th Edition. Wiley-Blackwell
2. Abbas AK, Andrew H. Lichtman H, Shiv Pillai. 2015. Basic Immunology: Functions and disorders of the Immune System. Elsevier.

Rationale for nature of the course

This major core paper focuses on students' ability to understand the components of the immune system and their mechanisms against various antigens. Understanding the immune system against different kinds of foreign particles including pathogens is essential for the various fields such as medical diagnosis and treatment, vaccine development, transplantation procedure etc.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Creating mind map enables the student's understanding on core concepts
- Learning the immune response using flowchart method
- Case study analysis helps to understand the association between the pathogens and immune responses

Web resources

1. <https://www.roitt.com/>
2. <https://nptel.ac.in/courses/102/105/102105083/>

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designer

Dr. P.Vimal

Ms. R. Suguna

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Explain the historical perspectives and components of the immune system	Up to K-2
CLO-2	Illustrate the structure, properties and functions of immunoglobulin and development of B and T Cells	Up to K-3
CLO-3	Analyse the importance of MHC, complement system and hypersensitivity reactions	Up to K-4
CLO-4	Relate various immune disorders with autoantibodies and graft rejection	Up to K-3
CLO-5	Use the immunological concepts to understand the diagnostic techniques	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	2	3	2	2
CLO-2	2	2	3	2	2
CLO-3	2	2	3	2	2
CLO-4	3	2	3	2	2
CLO-5	2	3	3	2	3

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	2	2	2
CLO-2	3	2	2	2	2
CLO-3	3	2	2	2	3
CLO-4	3	2	2	3	2
CLO-5	3	3	3	3	2

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	History of Immunology, types of immunity –innate, specific, acquired, active and passive	5	Chalk and talk, Quiz Assignments
	Organs of the immune system - primary and secondary lymphoid organs. Haematopoiesis	5	
	cells of immune system -neutrophils, macrophages, natural killer cells, null cells, basophils, mast cells, B cells & T cells – structure and functions	5	
II	Characteristic features of immunogens, antigens, haptens, epitopes and adjuvants	2	Chalk and talk, PPT, Quiz Assignments
	Immunoglobulin - classes, structure and functions, Cytokines – types and functions.	3	
	B cells - maturation, activation, proliferation, germinal center, plasma cells, memory cells, class switching	5	
	T-cells - receptor, activation, maturation, differentiation.	5	
III	MHC- types, structure, self MHC restriction, Antigen processing and presentation	5	Chalk and talk Quiz Assignments
	Antigen dependent cell cytotoxicity, T-Cell mediated cytotoxicity, Complement – activation, complement pathways - Classical, Alternate, biological activities.	5	
	Hypersensitivity - Type I, II, III, IV reactions	5	
IV	Autoimmune diseases: Organ-Specific-Hashimoto's thyroiditis, Grave's disease, Myasthenia gravis, Systemic-Systemic lupus erythematosus, Rheumatoid arthritis.	5	Chalk and talk PPT Quiz, assignments
	Transplantation - types of graft, graft rejection mechanism, Graft Versus Host diseases, mixed leukocyte reaction – one way and two way,	5	
	Tissue typing, immunosuppressive agents. Cancer immunology – tumour antigens, effector mechanisms	5	
V	Antigen-antibody interactions - Agglutination-hemagglutination, bacterial agglutination, passive agglutination, agglutination inhibition	5	Chalk and talk Quiz, assignments
	Precipitation techniques- RID, ODD, Radio Immuno Assay, Immunoelectrophoresis, ELISA- indirect, sandwich, competitive, ELISPOT Immunofluorescence assays - Fluorescence activated cell sorter (FACS) technique.	5	
	Vaccine-Active and passive immunization, attenuated, heat-killed, subunit vaccines, route of administration.	5	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Immunology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
3.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
4.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Immunology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Core 8	20U5LMC8	Industrial Biotechnology	5	5	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To provide an in depth knowledge on fermentation process - To gain knowledge on various upstream and downstream processes - To understand the production of bio-products by fermentation technology				
Unit	Description	Hours	K-level	CLO
I	Introduction to industrial biotechnology Fermentation - biochemistry of fermentation. Bioreactors – types - continuous stirred tank, bubble column, airlift, fluidized and packed bed. Features and operation of bioreactors – sterilization, inoculation, aeration, control system. Solid state fermentation, Media for industrial fermentation - substrates used as carbon, nitrogen, growth factor sources. Isolation of microbes - enrichment methods, preservation. Genetic improvement of strains-selection of mutants, genetic recombination. Culture methods - batch culture, fed - batch, semi-continuous, continuous.	15	Up to K-2	1
II	Downstream processing Principles and processing: cell disruption- mechanical, enzymatic and chemical methods. Pre-treatment and stabilisation of bio-products. Physical methods of separation-filtration and centrifugation, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation. Purification - chromatography – adsorption, reverse phase, ion exchange, size exclusion. Concentration - crystallization, drying and lyophilisation.	15	Up to K-3	2
III	Production of primary metabolites & secondary metabolites Primary metabolites: production of organic acids – citric acid and acetic acid, amino acids - L- glutamic acid, alcohols - ethanol and	15	Up to K-4	3

	butanol. Secondary metabolites: antibiotics - penicillin and streptomycin, vitamins- riboflavin and b12, beverages - beer and wine, enzymes-amylases and pectinase.			
IV	Enzyme Technology in industries Need of enzymes in industries, commercial production of enzymes - selection of organisms, formulation of medium, production process, recovery and purification. Regulation of microbial enzyme production - induction, feedback repression, nutrient repression. Genetic engineering for microbial enzyme production. Immobilization-methods, choice of immobilization techniques, applications –Production of D & L-amino acids, production of high fructose syrup	15	Up to K-4	4
V	Production of Bio products Production of bio-pesticides - NPV and <i>Baeveria bassiana</i> ; Biofertilizers - Rhizobium, Azotobacter and azospirillum. Biopolymers- Xanthan, pullulan, PHA and PHB; Biodiesel, Cheese and SCP. Production of recombinant proteins, vaccines - Sabin -polio vaccines and <i>Haemophilus influenza</i> type b.	15	Up to K-3	5

Books for Study

1. Satyanarayana U. 2005. Biotechnology Books & Allied (P) Ltd.
2. Reddy SM. 2012. Basics of Industrial Biotechnology, First edition. New age International publishers.

Books for Reference

1. Prescott SC and Dunn CG. 2005. Industrial Microbiology, Agrobios (India).
2. Cruger, Wulf and Anneliese Crueger. 2000. Biotechnology: A Textbook of Industrial Microbiology, II Edition, Panima Publishing.
3. Stanbury PF Whitaker A and Hall SJ. 1995. Principles of Fermentation Technology, II Edition, Butterworth – Heinemann.

Web resources

1. <https://www.youtube.com/channel/UCSVZShFk767sMFosu06rSHg>
2. https://onlinecourses.nptel.ac.in/noc19_bt20/preview

Rationale for nature of the course

The core paper on Industrial biotechnology focuses on cognizance on the exploitation of microbes for the production of bio-products, its strategies and methods to scale up and improvement of industrially important strains. Knowledge on these aspects allows the students to gain in-depth understanding about the biotechnological processes in industry level.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar on theoretical concepts of fermenter
- Explaining various industrial process using poster
- Scientific discussion about recent advance in biotechnology at industry level

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr. N. Krithiga

Dr. S. Baskaran

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Explain the features of bioreactors and their development	Upto K2
CLO-2	Prepare the flow charts for various downstream processes	Upto K3
CLO-3	Correlate the organisms and their products through fermentation	Upto K4
CLO-4	Illustrate the role genetic engineering in microbial enzyme production	Upto K4
CLO-5	Relate the microbes with their applications in various fields.	Upto K3

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	2
CLO-2	3	2	3	2	2
CLO-3	3	3	3	2	2
CLO-4	3	3	3	2	2
CLO-5	2	3	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	2	3	2
CLO-2	2	3	3	3	2
CLO-3	3	3	3	2	2
CLO-4	3	2	3	2	3
CLO-5	3	3	2	3	2

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Fermentation - biochemistry of fermentation. Bioreactors – types - continuous stirred tank, bubble column, airlift, fluidized and packed bed.	5	Chalk and talk Problem solving Quiz & assignments
	Features and operation of bioreactors – sterilization, inoculation, aeration, control system. Solid state fermentation, Media for industrial fermentation - substrates used as carbon, nitrogen, growth factor sources.	5	
	Isolation of microbes - enrichment methods, preservation. Genetic improvement of strains-selection of mutants, genetic recombination. Culture methods - batch culture, fed - batch, semi-continuous, continuous.	5	
II	Principles and processing: cell disruption- mechanical, enzymatic and chemical methods. Pre-treatment and stabilisation of bio-products.	5	Chalk and talk PPT, Quiz & assignments
	Physical methods of separation-filtration and centrifugation, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation.	5	
	Purification - chromatography – adsorption, reverse phase, ion exchange, size exclusion. Concentration - crystallization, drying and lyophilisation.	5	
III	Primary metabolites: production of organic acids – citric acid and acetic acid, amino acids - L- glutamic acid, alcohols - ethanol and butanol.	10	Chalk and talk, Quiz & assignments
	Secondary metabolites: antibiotics - penicillin and streptomycin, vitamins- riboflavin and b12, beverages - beer and wine, enzymes-amylases and pectinase.	5	
IV	Need of enzymes in industries, commercial production of enzymes - selection of organisms, formulation of medium, production process, recovery and purification.	5	Chalk and talk PPT, Quiz & assignments
	Regulation of microbial enzyme production - induction, feedback repression, nutrient repression. Genetic engineering for microbial enzyme production.	5	
	Immobilization-methods, choice of immobilization techniques, applications –Production of D & L-amino acids, production of high fructose syrup	5	
V	Production of bio-pesticides - NPV and <i>Baeveria bassiana</i> ; Biofertilizers - Rhizobium, Azotobacter and azospirillum.	10	Chalk and talk, Quiz & assignments
	Biopolymers- Xanthan, pullulan, PHA and PHB; Biodiesel, Cheese and SCP. Production of recombinant proteins, vaccines - Sabin -polio vaccines and <i>Haemophilus influenza</i> type b.	5	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Industrial Biotechnology Course Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
2.	CLO 4	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K4)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Industrial Biotechnology Course Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
4	CLO 4	Up to K-4	2	K1 & K2	1	K1	2 (K3&K3)	1(K4)
5	CLO 5	Up to K-3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K4 Level)	1 Question from Unit-III (K3 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K4 Level)
		2 Questions from Unit-V (K3 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Core-9	20U5LMC9	Plant Biotechnology	5	5	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To make students to understand about the plant tissue culture - To provide students with the basic understanding of micro-propagation and conservation - To understand the various methods of gene transfer for crop improvement				
Unit	Description	Hours	K-level	CLO
I	Introduction to plant tissue culture and culture methods Plant tissue culture – definition, history, culture media-composition –inorganic, organic supplements, growth regulators, culture methods- callus culture - explants, factors affecting callus culture, applications of callus culture, cell culture - Isolation of single cells, suspension culture - types and synchronization, protoplast-isolation, culture, regeneration, fusion-methods	15	Up to K-2	1
II	Plant production techniques Production of haploid plants- androgenesis- anther and pollen culture-development of androgenesis haploid, factor affecting androgenesis, applications of haploids. Somaclonal variations-isolation of somaclonal variants- with and without <i>in vitro</i> selection, factors affecting somaclonal variants, applications of somaclonal variants.	15	Up to K-3	2
III	Micropropagation, germplasm conservation and cryopreservation Micropropagation - definition, techniques, factors affecting, in vitro clonal propagation - meristem and shoot tip culture, bud culture - single node, axillary, organogenesis, somatic	15	Up to K-4	3

	embryogenesis-direct and indirect, synthetic seed production, applications of micropropagation. Germplasm conservation - types - <i>in-situ</i> and <i>ex-situ</i> , cryopreservation			
IV	Gene transfer methods Stable expression - Agrobacterium mediated- Agrobacterium-plant interaction; Ti plasmids- virulence mechanism, derived vector systems: co-integrate vectors and binary vectors; Agrobacterium-mediated gene delivery in plants, particle bombardment, silicon carbide fibre mediated, PEG mediated. Transient expression virus mediated - caulimoviruses and gemini viruses.	15	Up to K-3	4
V	Genetic marker and transgenic plants Marker genes - selectable: Antibiotics resistance - <i>npt-II</i> , <i>hpt</i> , <i>aadA</i> , Antimetabolite marker - <i>dhfr</i> , Herbicide resistance genes - <i>bar</i> , <i>aroA</i> and <i>bxn</i> , reporter gene - <i>gfp</i> , <i>yfp</i> , <i>rfp</i> , firefly and renilla luciferase. GMOs - Bt toxin, golden rice, cloning of edible vaccines, pest resistant – maize, virus resistant- coat protein-mediated, drought resistant- stomatal-mediated, terminator seed technology.	15	Up to K-4	5

Books for Study

1. Satyanarayana U. 2017. Biotechnology. Books and Allied Pvt Ltd.
2. Chawla HS. 2017. An Introduction to Plant Biotechnology. CBS Publishers

Books for Reference

1. Razdan MK. 2005. Introduction to Plant Tissue Culture. Oxford & IBH.
2. Slater A. 2006. Plant Biotechnology – The Genetic Manipulation of Plants. Oxford press.

Web resources

1. <https://nptel.ac.in/courses/102/103/102103016/#>
2. <https://www.youtube.com/watch?v=ZqTGvSFbnxk>

Rationale for nature of the course

The core paper on Plant Biotechnology emphasizes on the various methods of plant transgenesis, production of haploid plants and conservation of germplasm. Knowledge and skills gained from this paper allows the students to get jobs in various plant based agro-industries.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Explaining the plant tissue culture using flowcharts
- Student presentation on transgenic plant development
- Scientific discussion on theoretical concepts of plant genetic engineering

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr. N. Kamaladhasan

Dr. P. Vimal

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Explain about the various methods of plant tissue culture practices	Up to K2
CLO-2	Illustrate about the production of haploid plants and their significance	Up to K3
CLO-3	Analyze about various methods of germplasm conservation	Up to K4
CLO-4	Illustrate the methods gene transfer techniques for production GM plants	Up to K3
CLO-5	Categorize various plant based DNA marker for screening process	Up to K4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	2	2	2	1
CLO-2	3	3	2	2	2
CLO-3	2	1	3	2	3
CLO-4	2	3	3	3	2
CLO-5	3	3	2	2	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	3	3	2
CLO-2	3	3	3	3	3
CLO-3	2	2	2	3	2
CLO-4	3	3	2	3	3
CLO-5	3	2	2	2	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Plant tissue culture – definition, history, culture media-composition –inorganic, organic supplements, growth regulators	5	Chalk and talk Problem solving, Quiz & assignment
	Culture methods- callus culture - explants, factors affecting callus culture, applications of callus culture,	5	
	Cell culture - Isolation of single cells, suspension culture - types and synchronization, protoplast-isolation, culture, regeneration, fusion-methods	5	
II	Production of haploid plants- androgenesis- anther and pollen culture-development of androgenesis haploid, factor affecting androgenesis, applications of haploids.	10	Chalk and talk, Quiz & assignment
	Somaclonal variations- isolation of somaclonal variants- with and without <i>in vitro</i> selection, factors affecting somaclonal variants, applications of somaclonal variants.	5	
III	Micropropagation - definition, techniques, factors affecting, <i>in vitro</i> clonal propagation - meristem and shoot tip culture	5	Chalk and talk, Quiz & assignment
	Bud culture - single node, axillary, organogenesis, somatic embryogenesis-direct and indirect, synthetic seed production, applications of micropropagation.	5	
	Germplasm conservation - types - <i>in-situ</i> and <i>ex-situ</i> , cryopreservation	5	
IV	Stable expression - Agrobacterium mediated- Agrobacterium-plant interaction; Ti plasmids-virulence mechanism, derived vector systems: co-integrate vectors and binary vectors	5	Chalk and talk PPT, Quiz & assignment
	Agrobacterium-mediated gene delivery in plants, particle bombardment, silicon carbide fibre mediated, PEG mediated	5	
	Transient expression virus mediated - caulimoviruses and gemini viruses.	5	
V	Marker genes - selectable: Antibiotics resistance - <i>npt-II</i> , <i>hpt</i> , <i>aadA</i> , Antimetabolite marker - <i>dhfr</i> , Herbicide resistance genes - <i>bar</i> , <i>aroA</i> and <i>bxn</i>	5	Chalk and talk Problem solving, Quiz & assignment
	Reporter gene - <i>gfp</i> , <i>yfp</i> , <i>rfp</i> , firefly and renilla luciferase. GMOs - Bt toxin, golden rice, cloning of edible vaccines,	5	
	Pest resistant – maize, virus resistant- coat protein-mediated, drought resistant- stomatal-mediated, terminator seed technology.	5	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Plant Biotechnology Course Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Plant Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Elective-I	20U5LME1	Biostatistics	3	4	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To provide students with an understanding about the importance of data collection and representation of data - To make students to understand the various measures of statistical analysis - To make the students understand about the test of significance				
Unit	Description	Hours	K-level	CLO
I	Introduction to Biostatistics ,Diagrammatic and graphical representation of Data Definition, Types – Descriptive & Inferential statistics, Terms – Population, sample, Unit, Variables, Data, Inference, accuracy and precision. Collection of data- primary, secondary, qualitative and quantitative data. Classification and tabulation of data & Frequency distribution. Significance of Diagrams & Graphs: Diagrams – line, bar, pie, pictogram, cartogram, Significance and limitations of Diagrammatic representation. Graphic Representation - Types - Histogram, frequency polygon, frequency curve and cumulative frequency curve, Significance and limitations of graphical representations.	12	Up to K-2	1
II	Measures of central tendency and dispersion Central tendency - definition and characteristics-. Mean, median and mode. Dispersion - definition, methods of measuring dispersion - range, means deviation, standard deviation, variance, standard error, Measures of Skewness and kurtosis. (with equal importance to problems and theory)	12	Up to K-3	2

III	Correlation and regression Correlation - Definition & significance. Types - Positive and negative, simple and multiple, linear and non-linear, Methods of correlation analysis - Scatter diagram, graphical diagram and co-efficient of correlation. Regression – Definition, Types of regression analysis, Regression lines and equations, Regression co-efficient.(with equal importance to problems and theory)	12	Up to K-4	3
IV	Probability Definition of probability; Laws of probability additive and multiplicative laws of probability .Theoretical distribution – Binomial, Poisson and Normal distribution, fit the binomial distribution.	12	Up to K-3	4
V	Test of Hypothesis and Significance Null and alternative hypothesis. Chi- square test Chi-square test for Goodness of fit, test for homogeneity, t-test, Z-test, ANOVA - One-way. (with equal importance to problems and theory)	12	Up to K-4	5

Books for Study

1. Ramakrishnan P. 2010. Introduction to Biostatistics. Saras Publication
2. Khan and Khanum. 2004. Fundamentals of Biostatistics, Ukaaz Publications, Hyderabad

Books for Reference

1. Gurumani N. 2010. An Introduction to Biostatistics. MJP Publications, Chennai
2. Veer Bala Rastogi. 2006. Fundamentals of Biostatistics. Ane Books India.

Web resources

1. https://www.youtube.com/channel/UCi8fhTsXjHh-ip5_BBtfX_Q
2. <https://www.youtube.com/channel/UCQcSuqVcBUFG70U8wvfPcg>

Rationale for nature of the course

The Biostatistics course exemplifies the introduction of statistics in the field of Biological Sciences. It offers a method to review data and its types. It makes the students to understand the statistical and scientific theories behind decision-making. It is a fundamental data science that underpins most key life science research disciplines. Biostatistics makes the students competent to apply their transferable skills in analysis, problem solving and critical thinking.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Poster preparation on core statistical concepts.
- Solving the biological data sets using appropriate statistical tools.
- Analysis of biological data sets using appropriate statistical software.

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Ms. R.Suguna

Dr. N. Krithiga

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Explain the various methods of collection and representation of data.	Up to K-2
CLO-2	Illustrate the various measures of central tendency and deviation.	Up to K-3
CLO-3	Relate the variables for correlation and regression analysis.	Up to K-4
CLO-4	Illustrate the problems related to probability and theoretical distribution.	Up to K-3
CLO-5	Solve problems in test of significances.	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	2	2	2	2
CLO-2	1	1	2	2	2
CLO-3	2	2	3	1	2
CLO-4	3	2	3	2	1
CLO-5	2	2	2	2	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	3	3
CLO-2	2	2	3	2	2
CLO-3	3	3	2	2	2
CLO-4	3	2	2	2	3
CLO-5	2	3	2	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Definition, Types – Descriptive & Inferential statistics, Terms – Population, sample, Unit, Variables, Data, Inference, accuracy and precision. Collection of data-primary, secondary, qualitative and quantitative data.	5	Chalk and talk Problem solving, Quiz & assignments
	Classification and tabulation of data & Frequency distribution. Significance of Diagrams & Graphs: Diagrams – line, bar, pie, pictogram, cartogram, Significance and limitations of Diagrammatic representation.	5	
	Graphic Representation - Types - Histogram, frequency polygon, frequency curve and cumulative frequency curve, Significance and limitations of graphical representations.	5	
II	Central tendency - definition and characteristics-Mean, median and mode.	5	Chalk and talk Problem solving, Quiz & assignments
	Dispersion - definition, methods of measuring dispersion - range, means deviation, standard deviation, variance, standard error,	5	
	Measures of Skewness and kurtosis (with equal importance to problems and theory)	5	
III	Correlation - Definition & significance. Types - Positive and negative, simple and multiple, linear and non-linear,	5	Chalk and talk Problem solving, Quiz & assignments
	Methods of correlation analysis - Scatter diagram, graphical diagram and co-efficient of correlation.	5	
	Regression – Definition, Types of regression analysis, Regression lines and equations, Regression co-efficient.(with equal importance to problems and theory)	5	
IV	Definition of probability; Laws of probability additive and multiplicative laws of probability	5	Chalk and talk Problem solving, Quiz & assignments
	Theoretical distribution – Binomial, Poisson and Normal distribution	5	
	Fit the binomial distribution.	5	
V	Null and alternative hypothesis	5	Chalk and talk Problem solving, Quiz & assignments
	Chi- square test Chi-square test for Goodness of fit , test for homogeneity	5	
	t-test, Z-test, ANOVA - One-way. (with equal importance to problems and theory)	5	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Biostatistics Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Biostatistics Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Interdisciplinary Course	20U5LIDC1	Computer-Aided Drug Design	3	4	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship	

Course Objectives

- To provide students with an understanding of the process of drug discovery and development
- To understand how to relate chemical structure to biological activity.
- To learn about novel chemical entities with the potential to be developed into novel therapeutic agents.
- To impart knowledge in basic Linux commands.
- To understand and implement Linux commands in Cygwin and remote login using Putty.

Unit	Description	Hours	K-level	CLO
I	Introduction to Drug Discovery and Development Stages of drug discovery and development Lead discovery and Analog Based Drug Design. Rational approaches to lead discovery -based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.	12	Up to K-2	1
II	Virtual screening techniques Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore-based Screening, Molecular docking; Rigid docking, flexible docking, manual docking, Docking based screening. De novo drug design. ADME databases, chemical, biochemical and pharmaceutical databases. Conformational Analysis, CADD –an introduction	12	Up to K-2	2
III	Molecular Modelling Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Molecular dynamics simulation of biomolecules, Protein structure modeling - Homology modeling - steps in homology modeling - loop	12	Up to K-2	3

	modeling- side-chain modeling- threading - folding- Ab initio modeling.			
IV	Shell and Basic Linux Commands Shell – Changing the Running Shell – Shell Prompt – Creating User Account – Basic syntax for Command – Creating alias for long command – Input/Output Redirection – Listing Files and Directories – cat command – wc command – Manipulating Files and Directories – Compressing Files – Archiving Files – Managing Disk Space – Changing your Password – File Access Permissions – Granting Access to Files – Creating Group Account – Sudo Command – Change File Owner and Group – Communication Commands	12	Up to K-2	4
V	Cygwin and PuTTY Cygwin Utilities – PuTTY Client Basics and Simple Login – Copying Data – Public Key Authentication. Cygwin X-Windows Server to run graphical applications over the PuTTY connection. Introduction to Cygwin operating environment: What's Cygwin – Unix family – Impacts – Getting started – Installation - Basic Commands – Comparing Cygwin with DOS commands – Understanding files and directories – Directory mapping between Cygwin and Windows – Vi commands – compilation – example.	12	Up to K-2	5

Books for Study

1. Andrew R. Leach. 2001. Molecular modelling, Principles and applications, Prentice-Hall.
2. Vinter JG and Mark Gardener.1994. Molecular modelling and drug design, MacMillan.
3. Gary Walsh. 2003. Biopharmaceuticals: Biochemistry and Biotechnology. Wiley – Blackwell.

Books for Reference

1. Leach AR. 2001.Molecular Modelling - Principles and Applications, 2nd Edition, Prentice-Hall.
2. Ramachandran KI, Deepa G, Namboori K. 2008. Computational Chemistry and Molecular Modeling: Principles and Applications, Springer.

Web resources

- <https://www.cygwin.com/cygwin-ug-net/cygwin-ug-net.pdf><https://www.cygwin.com/cygwin-ug-net/cygwin-ug-net.pdf>
- https://www.lrz.de/services/compute/courses/x_lecturenotes/191007_PuTTY_Tutorial_2019.pdf

- <https://www.cs.dartmouth.edu/~campbell/cs50/putty-cygwin-tutorial.pdf>
- http://ftp.it.murdoch.edu.au/pub/units/ICT106/Practicals/ict106_pract_week1.pdf

Rationale for nature of the course

The course focuses on the basics of drug discovery, development and design of drugs using computer programmes. The course has been designed to enrich the students' knowledge to meet the demands in competitive biotechnology and pharmacology. Linux is an open-source platform to develop user friendly, High Security, High Stability applications and supports various forums.

Activities having a direct bearing on Skill development / Employability /Entrepreneurship

- Seminar on recent trends in drug design and development
- Poster preparation on core concepts of computer-aided drug design
- Scientific discussion on various computer programmes and packages used in drug design.
- Implement Linux commands in Cygwin and file transfers using Putty.

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem-solving

Course content designers

Dr. N. Krithiga

Dr. S. Baskaran

Mrs. S. Rajalakshmi

Mr. N. Radhakrishnan

Course Learning Outcomes

On completion of this course, the students will be able to

#	CLOs	K – Level
CLO-1	Explain about various stages of drug discovery	Up to K-2
CLO-2	Elaborate on the virtual screening and molecular docking of drugs	Up to K-2
CLO-3	Outline the steps in molecular modelling	Up to K-2
CLO-4	Describe various Linux Commands	Up to K-2
CLO-5	Illustrate Linux commands in Cygwin tool.	Up to K-2

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	2
CLO-2	3	2	3	2	2
CLO-3	3	2	3	2	2
CLO-4	3	3	3	2	2
CLO-5	3	3	3	2	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	2	1
CLO-2	3	3	3	2	1
CLO-3	3	3	3	2	1
CLO-4	3	3	3	3	1
CLO-5	3	3	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Stages of drug discovery and development Lead discovery and Analog Based Drug Design. Rational approaches to lead discovery -based on traditional medicine, Random screening, Non-random screening,		Chalk and talk Quiz & assignments
	Serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.		
II	Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore-based Screening		Chalk and talk PPT Quiz & assignments
	Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. De novo drug design. ADME databases, chemical, biochemical and pharmaceutical databases.		
	Conformational Analysis, CADD –an introduction		
III	Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Molecular dynamics simulation of biomolecules		Chalk and talk Quiz & assignments
	Protein structure modeling - Homology modeling - steps in homology modeling - loop modeling- side-chain modeling- threading - folding- Ab initio modeling.		
IV	Shell and Basic Linux Commands: Shell – Changing the Running Shell – Shell Prompt – Creating User Account – Basic syntax for Command – Creating alias for long command		Chalk and talk PPT Quiz & assignments
	Input/Output Redirection – Listing Files and Directories – cat command – wc command – Manipulating Files and Directories – Compressing Files – Archiving Files – Managing Disk Space – Changing your Password		
	File Access Permissions – Granting Access to Files – Creating Group Account – Sudo Command – Change File Owner and Group – Communication Commands		

V	Cygwin Utilities – PuTTY Client Basics and Simple Login – Copying Data – Public Key Authentication. Cygwin X-Windows Server to run graphical applications over the PuTTY connection. Introduction to Cygwin operating environment: What's Cygwin – Unix family – Impacts – Getting started		Chalk and talk Quiz & assignments
	Installation - Basic Commands – Comparing Cygwin with DOS commands – Understanding files and directories – Directory mapping between Cygwin and Windows – Vi commands – compilation – example.		

Learning Outcome Based Education & Assessment (LOBE)

BluePrint – Computer-Aided Drug Design (CIA-I & II)

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
CLO x	Up to K2	1	K1	1	K2/K2	1	K2
CLO y	Up to K2	2	K1	1	K2/K2	2	K2
No. of Questions to be asked		3		2		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		6		14		20	

Distribution of Section-wise Marks with K Levels (CIA I & II)

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	6	-		6	9.37	100
K2	-	28	30	58	90.62	
K3	-	-	-	-	-	-
K4	-	-	-	-	-	-
Total Marks	6	14	30	64	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)
BluePrint – Computer-Aided Drug Design Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K-Level	Section – A		Section – B		Section – C	
			Short Answers		(Either/or Choice)		(Open Choice)	
			No. of Questions	K-Level	No. of Questions	K-Level	No. of Questions	K-Level
1	CLO 1	Up to K2	1	K1	1	K2/K2	1	K2
2	CLO 2	Up to K2	1	K1	1	K2/K2	1	K2
3	CLO 3	Up to K2	1	K1	1	K2/K2	1	K2
4	CLO 4	Up to K2	1	K1	1	K2/K2	1	K2
5	CLO 5	Up to K2	1	K1	1	K2/K2	1	K2
No. of Questions to be asked			5		5		5	
No. of Questions to be answered			5		5		3	
Marks for each question			2		7		10	
Total Marks for each section			10		35		30	

Distribution of Section-Wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	10	-		10	7.69	100
K2	-	70	50	120	92.30	
K3	-	-	-	-	-	-
K4	-	-	-	-	-	-
Total Marks	10	35	30	130	100.00	100

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Elective-I	20U5LME3	Pharmaceutical Biotechnology	3	4	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To provide students with an understanding about the drug design - To focus on the drug action, metabolism and toxicity - To gain knowledge on various bio therapeutics agents				
Unit	Description	Hours	K-level	CLO
I	Pharmaceutical, Biologics and biopharmaceutical Introduction- Pharmaceutical and biopharmaceutical biotechnology, history, age of biopharmaceuticals, current status and future prospects of and biopharmaceuticals, classification of drugs-based on chemical structure, therapeutic action, nomenclature of drugs.	12	Up to K-2	1
II	Development of drugs Introduction, overview of drug discovery, impart of genomics and proteomics on drug development, pharmacogenomics , approaches to drug discovery , Leads , HITS drug designing – rational , combinatorial and High Throughput screening.	12	Up to K-3	2
III	Drug action and metabolism Drug action-pharmacodynamics and pharmokinetics, drug receptors-types and nature, transport systems, mechanism of drug action – as enzymes, gene inhibitors, membrane inhibitors. Non-specific action of drugs-drug binding, pro-drug, biotransformation drugs, routes of drug administration. Drug metabolism-absorption, distribution, elimination, sites of drug metabolism, factors affecting metabolism.	12	Up to K-4	3

IV	Drug abuse and toxicity Definition –drug abuse, general principle of treatment of drug abuse – reference with paracetamol, barbiturates, opioids, organophosphorous, atropine poisoning, heavy metals and antagonists.	12	Up to K-3	4
V	Biotherapeutic agents Principles of antimicrobial therapy, selection-bacteriostatic and bactericidal drugs, drug resistance, cell wall inhibitors – penicillin, cephalosporin, protein synthesis inhibitors – tetracycline, chloramphenicol, antifungal-amphotericin, antiviral-acyclovir, protease inhibitor-methotrexate, 5'FU, toxol.	12	Up to K-4	5

Books for study

1. Howland RD, Mycek MJ, Harvey RA, Champe PC. 2006. Lippincott's illustrated reviews: Pharmacology. Philadelphia: Lippincott Williams & Wilkins.
2. Walsh G. 2013. Pharmaceutical biotechnology: concepts and applications. John Wiley
- 3.

Books for reference

1. Neal MJ. 2020. Medical pharmacology at a glance. John Wiley & Sons.
2. Patrick GL. 2013. An introduction to medicinal chemistry. Oxford university press.

Web resources

1. <https://www.youtube.com/watch?v=sjaEgXmUtH4>
2. <https://www.youtube.com/watch?v=FioRil-0bZE>

Rationale for nature of the course

This elective paper emphasizes on the various stages of drug design and development. Students gain knowledge on the mode of action, metabolism and toxicity of drugs. Students will gain knowledge in pharmaceutical science. They would be competent to get a placement in pharma based companies

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Scientific interaction and seminar on pharma based biotechnological products.
- Poster preparation on core concepts used in biotechnology.

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Ms. R. Suguna

Dr. N. Krithiga

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe the historical perspectives and future prospects of bio pharmaceuticals	Up to K-2
CLO-2	Prepare a flowchart to explain the dates of drug design and development	Up to K-3
CLO-3	Categorize drug with its mode of action	Up to K-4
CLO-4	Illustrate about the drug abuse and toxicity	Up to K-3
CLO-5	Outline the drug with its principle of therapy	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	2	2	2
CLO-2	3	3	2	2	2
CLO-3	2	2	2	2	2
CLO-4	3	2	2	2	2
CLO-5	3	3	2	2	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	2	2	2
CLO-2	3	3	3	3	3
CLO-3	3	3	3	2	2
CLO-4	3	3	2	2	2
CLO-5	3	3	2	3	2

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Introduction- Pharmaceutical and biopharmaceutical biotechnology, history, age of biopharmaceuticals, current status and future prospects of and biopharmaceuticals	6	Chalk and talk Quiz & Assignments
	Classification of drugs-based on chemical structure, therapeutic action, nomenclature of drugs.	6	
II	Introduction, overview of drug discovery, impart of genomics and proteomics on drug development, pharmacogenomics	6	Chalk and talk Quiz & Assignments
	Approaches to drug discovery, Leads, HITS drug designing – rational, combinatorial and High Throughput screening.	6	
III	Drug action-pharmacodynamics and pharmacokinetics, drug receptors-types and nature, transport systems, mechanism of drug action – as enzymes, gene inhibitors, membrane inhibitors.	6	Chalk and talk Quiz & Assignments
	Non-specific action of drugs-drug binding, pro-drug, biotransformation drugs, routes of drug administration. Drug metabolism-absorption, distribution, elimination, sites of drug metabolism, factors affecting metabolism.	6	
IV	Definition –drug abuse, general principle of treatment of drug abuse – reference with paracetamol, barbiturates, opioids	6	Chalk and talk Quiz & Assignments
	Organophosphorous, atropine poisoning, heavy metals and antagonists.	6	
V	Principles of antimicrobial therapy, selection-bacteriostatic and bactericidal drugs, drug resistance, cell wall inhibitors – penicillin, cephalosporin	6	Chalk and talk Quiz & Assignments
	Protein synthesis inhibitors – tetracycline, chloramphenicol, antifungal-amphotericin, antiviral-acyclovir, protease inhibitor-methotrexate, 5'FU, toxol.	6	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Pharmaceutical Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
3.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
4.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Pharmaceutical Biotechnology Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Elective-II	20U5LME4	Forensic Biotechnology	2	3	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To provide students with an opportunity to gain knowledge in forensic science - To gain the knowledge on various biological samples for the analysis in forensics - To focus on the genomics and proteomics in forensics				
Unit	Description	Hours	K-level	CLO
I	Introduction to forensic science Definition, development of forensic sciences, multidisciplinary nature, Forensic evidences: biological – body fluids, DNA, proteins, microbes, chemicals – poisons, drugs, alcohol, explosives	9	Up to K-2	1
II	Forensic samples and identification Identification of blood - Luminol, Kastle Meyer test, Titanium dioxide. Identification of seminal stains- Acid Phosphatase Test, Barberios Test. Identification of saliva: Starch iodine test, Radial gel diffusion and examination of buccal epithelial cells. Diatoms and pollen grains- morphology.	9	Up to K-3	2
III	Forensic genomics and DNA profiling Polymorphisms in DNA, Markers – nomenclature, types-STRs, SNPs, RFLP, Y-chromosome, mtDNA, COI and COII for insect identification. DNA Extraction Methods – organic, chelex, FTA paper, differential. Quantification – UV and Slot bot method. PCR amplification – PCR process, types of PCR – multiplex and real-time, PCR inhibitors.	9	Up to K-4	3
IV	Forensic proteomics Human blood group systems. History, biochemistry and	9	Up to K-3	4

	genetics of ABO. Red cell enzymes: genetics, Polymorphism and typing of PGM, GLO-I, ESD, EAP, AK, ADA. Serum proteins: Genetics, polymorphism and typing of – Hb, HP, Tf, Bf, C3.			
V	Forensic chemistry and toxicology Poisons – types, extraction - Liquid-liquid extraction, Solid phase extraction, Solid phase microextraction (SPME), distillation. Analysis – GC-MS, FTIR and SEM. Alcoholic beverages, classification of liquors based on origin, detection-Kozelka-Hine method, breath alcohol devices.	9	Up to K-4	5

Books for study

1. Butler JM. 2009. Fundamentals of Forensic DNA Typing. Academic Press.
2. Gunn A. 2009. Essential Forensic Biology. Wiley Inc.

Books for reference

1. Johll M. 2008. Investigating Chemistry-A Forensic Science Perspective, Second Edition. W. H. Freeman.
2. James SH, Nordby JJ and Bell S. 2014. Forensic Science: An Introduction to Scientific and Investigative Techniques. Fourth Edition. CRC Press.

Web resources

1. <https://www.youtube.com/watch?v=YY5tpD3HNII>
2. <https://nptel.ac.in/courses/102/104/102104052/>

Rationale for nature of the course

The elective course on Forensic biotechnology focuses on the various biological samples and its analysis in forensic science. The students would gain the knowledge in forensics and this course would be an avenue for the placement opportunity.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Poster preparation on techniques used in forensic biology.
- Interaction session to discuss the various case studies

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr.P.Vimal
Ms. R. Suguna

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Discuss about the various biological samples in forensics	Up to K-2
CLO-2	Illustrate the methods of identification of biological samples	Up to K-3
CLO-3	Outline the various molecular markers used in forensics	Up to K-4
CLO-4	Categories various proteomic analysis tools used in forensic science	Up to K-3
CLO-5	Illustrate the toxic compound identification by various analytical techniques	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	2	2	2
CLO-2	3	2	2	2	2
CLO-3	3	3	2	2	2
CLO-4	3	3	3	2	2
CLO-5	2	2	2	2	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	2	3
CLO-2	3	2	2	3	2
CLO-3	3	2	2	2	2
CLO-4	3	2	2	2	2
CLO-5	3	2	2	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Definition, development of forensic sciences, multidisciplinary nature	3	Chalk and talk Quiz & assignments
	Forensic evidences: biological – body fluids, DNA, proteins, microbes,	3	
	Chemicals – poisons, drugs, alcohol, explosives	3	
II	Identification of blood - Luminol, Kastle Meyer test, Titanium dioxide.	3	Chalk and talk Quiz & assignments
	Identification of seminal stains- Acid Phosphatase Test, Barberios Test.	3	
	Identification of saliva: Starch iodine test, Radial gel diffusion and examination of buccal epithelial cells. Diatoms and pollen grains- morphology.	3	
III	Polymorphisms in DNA, Markers – nomenclature, types-STRs, SNPs, RFLP, Y-chromosome, mtDNA, COI and COII for insect identification. DNA Extraction Methods – organic, chelex, FTA paper, differential. Quantification – UV and Slot bot method.	6	Chalk and talk Quiz & assignments
	PCR amplification – PCR process, types of PCR – multiplex and real-time, PCR inhibitors.	3	
IV	Human blood group systems. History, biochemistry and genetics of ABO. Red cell enzymes: genetics, Polymorphism and typing of PGM, GLO-I, ESD, EAP, AK, ADA.	6	Chalk and talk Quiz & assignments
	Serum proteins: Genetics, polymorphism and typing of – Hb, HP, Tf, Bf, C3.	3	
V	Poisons – types, extraction - Liquid-liquid extraction, Solid phase extraction, Solid phase microextraction (SPME), distillation.	3	Chalk and talk Quiz & assignments
	Analysis – GC-MS, FTIR and SEM. Alcoholic beverages, classification of liquors based on origin, detection-Kozelka-Hine method, breath alcohol devices.	6	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Forensic Biotechnology Course Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
5.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
6.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
5.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
6.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Forensic Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Practicals	20U5LMP5	Major Practicals-V	2	3	40	60	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	✓
			Entrepreneurship oriented	

Course Objectives	
- To provide students with an understanding of the basic immunology techniques - To focus on the statistical methods to analyse the biological data - To understand the concepts of IPR and biosafety	
Experiments	
1	Preparation of Antigens
2	Hemagglutination
3	Radial Immunodiffusion
4	Ouchterlony double diffusion
5	Collection and Tabulation of Data
6	Measures of central tendency
7	Measures of dispersion –range, mean deviation, standard Deviation, co-efficient of variance
8	Correlation and Regression analysis
9	Chi-Square analysis
10	Test of significance - t-test analysis and one way ANOVA
	Spotters Neutrophils, macrophages, lymph nodes, spleen, western blot, WIPO, symbols – IPR, symbols - biohazards

Books for study

1. Abhijit Dutta. 2011. Experimental Biology: A laboratory Manual. Narosa publications.
2. Rajan & Selvi Christy. 2010. Experimental Procedures in Lifesciences. Anjanaa Book House
3. Veer BalaRastogi. 2006. Fundamentals of Biostatistics. Ane Books India

Course content designers

Ms. R. Suguna
Dr. N. Krithiga

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K –Level
CLO-1	Explain the types of antigen and its complex formation	Up to K-2
CLO-2	infer the results of various immunotechniques	Up to K-4
CLO-3	solve the problems of biological data	Up to K-3
CLO-4	calculate the measures of central dispersion , correlation and regression	Up to K-3
CLO-5	interpret the biological data by the test of hypothesis	Up to K-2

Rationale for nature of the course

The laboratory course based on the core paper Immunology, Biostatistics and IPR aims to discern the basic understanding on the methods and techniques used in immunology and statistics. They would be trained to make use of mathematical principles for statistical analysis of biological data.

Activities having direct bearing on Skill development /Employability /Entrepreneurship

- Individual experimental activity to the students.
- Hands on training various instruments.
- Analysis and interpretation of results.

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	2
CLO-2	3	2	3	2	2
CLO-3	3	2	2	3	2
CLO-4	3	2	3	1	1
CLO-5	3	2	3	2	2

Mapping of Course outcomes with Program specific Outcomes

CO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	3	2
CLO-2	3	3	2	2	2
CLO-3	3	3	2	3	2
CLO-4	3	3	2	2	2
CLO-5	3	3	2	3	3

Advance application-3; Intermediate level-2 & Basic level-1

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Practicals	20U5LMP6	Major Practicals-VI	3	3	40	60	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	✓
			Entrepreneurship oriented	

Course Objectives	
- To provide an opportunity to understand the fermentation process - To focus on the plant tissue culture practise - To understand about animal cells and tissue culture methods	
Experiments	
1	Isolation and Immobilization of yeast cells
2	Alcohol fermentation by yeast
3	Isolation and characterization of amylase producing microorganisms(from soil samples)
4	Determination of Microbial growth curve - effect of pH on bacterial growth curve
5	Preparation of Plant Tissue culture media and callus induction - <i>Daucus carota</i>
6	Micro propagation – apical meristem culture- <i>Daucus carota</i>
7	Anther and pollen culture – <i>Hibiscus</i> species
8	Genomic DNA isolation from plants
9	Enzymatic separation of animal tissues
10	Cell viability test using trypan Blue staining
	Spotters Callus, <i>Agrobacterium tumefaciens</i> , CO ₂ incubator, Bioreactor, feeder layer culture, eagle MEM, protoplast fusion, Caulimo Virus, <i>Aspergillus</i> , Alcohol production unit

Books for study

1. Aneja KR. 2010. Experiments in microbiology, plant pathology and biotechnology. New Age International Publishers.
2. Abhijit Dutta. 2011. Experimental Biology: A laboratory Manual. Narosa publications.
3. Rajan & Selvi Christy. 2010. Experimental Procedures in Lifesciences. Anjanaa Book House

Course content designers

R. Suguna

Dr. N. Krithiga

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K –Level
CLO-1	Convert waste into value products through fermentation	Up to K-2
CLO-2	Analyse the microbial growth pattern	Up to K-4
CLO-3	Experiment with different culture methods of plant tissues	Up to K-3
CLO-4	Demonstrate the anther and pollen culture	Up to K-3
CLO-5	Identify viability of animal cells using staining	Up to K-2

Rationale for nature of the course

The laboratory course based on the core paper Industrial, Plant and animal Biotechnology aims to discern the basic understanding on the various analytical and culture methods in biotechnology. Students would be trained to make use of techniques and can meet the demands of industries and academia.

Activities having direct bearing on Skill development /Employability /Entrepreneurship

- Individual experimental activity to the students.
- Hands on training various instruments.
- Analysis and interpretation of results.

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	2
CLO-2	3	2	3	2	2
CLO-3	3	2	2	3	2
CLO-4	3	2	3	1	1
CLO-5	3	2	3	2	2

Mapping of Course outcomes with Program specific Outcomes

CO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	3	2
CLO-2	3	3	2	2	2
CLO-3	3	3	2	3	2
CLO-4	3	3	2	2	2
CLO-5	3	3	2	3	3

Advance application-3; Intermediate level-2 & Basic level-1

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective-IV	20U6LME4	Genomics and Proteomics	2	3	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To gain knowledge on various genome mapping and sequencing techniques. - To understand about the tools used in proteomics. - To discuss the concepts of comparative genomics.				
Unit	Description	Hours	K-level	CLO
I	Introduction to genomics and proteomics Genomics - definition, genome organization in prokaryotes and eukaryotes - nucleosome assembly, histone deacetylase, histone acetylase transferase, methylase, demethylase, genome imprinting. Proteomics – definition, proteome – link between transcriptome and the proteome, types of proteomics – expression, structural and functional.	9	Up to K-2	1
II	Mapping genome Genome- human, <i>Arabidopsis thaliana</i> , HGP, Genetic mapping - DNA marker for genetic mapping - RFLP, DNA microarray; Physical mapping - restriction mapping, fluorescent in situ hybridization, sequence tagged mapping.	9	Up to K-3	2
III	Genome sequencing DNA sequencing – Sanger's, Maxam and Gilbert method, sequence assembly by shot gun, clone contigs, expressed sequence tags, genome assembly: trimming and quality determination – Phred score, validation. NGS –Illumina, nanopore, Roche 450, PacBio. mRNA sequencing an introduction.	9	Up to K-4	3
IV	Tools of proteomics SDS-PAGE, 2D PAGE, Western blotting, protein sequencing –	9	Up to K-4	4

	Edman, Mass spectroscopy MALDI-TOF, protein microarray, reverse phase HPLC, peptide mass fingerprinting, mapping protein modification.			
V	Comparative Genomics Purpose and methods of comparison - at nucleotide level, gene cluster level, phylogenetic comparison. Tools -subtractive hybridization. Comparison of the genomes of the pathogenic and non-pathogenic organisms. Applications of comparative genomics, predicting regulatory elements, Identifying targets, protein motif and domain analysis for conserved strings. Functional Genomics- application of microarray, expression and regulation of entire set of genes and differential expression of genes, disease vs normal condition – breast cancer.	9	Up to K-3	5

Books for Study

1. Brown TA. 2007. Genomes 3. Garland Science, NY.
2. Liebler DC. 2002. Introduction to Proteomics. Humana Press.

Books for Reference

1. Gibson G and Muse SV. 2009. A primer of genome science. Third Edition. Sinauer associates.
2. Campbell AM and Heyer LJ. 2007. Discovering Genomics, Proteomics and Bioinformatics. Second Edition. Pearson.

Web resources

1. <https://nptel.ac.in/content/storage2/courses/102103017/pdf/lecture%201.pdf>
2. <https://www.youtube.com/watch?v=OGNIR389mhY>

Rationale for nature of the course

The course content of Genomics and Proteomics includes the current trends in genome and proteome analysis. It focuses on the use of various analytical tools to determine and compare the changes at both structural and expression level.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Poster preparation for theoretical concepts
- Writing assignment on core concepts.
- Scientific discussion and analysis on theoretical concepts using various online tools

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Ms. R. Suguna

Dr. N. Kamaladhasan

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Discuss the genome organization and proteome of cells	Up to K2
CLO-2	Illustrate the various genetic mapping techniques	Up to K3
CLO-3	Analyse the genome sequencing strategies	Up to K4
CLO-4	Categories various proteomic tools used in biological research	Up to K4
CLO-5	Interpret the gene expression pattern in normal and diseased conditions	Up to K3

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	3	2	3
CLO-2	3	2	3	2	1
CLO-3	2	3	2	2	2
CLO-4	3	2	3	2	3
CLO-5	3	3	3	2	3

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	2	2	2
CLO-2	3	2	3	3	3
CLO-3	3	2	2	3	2
CLO-4	3	3	3	2	3
CLO-5	3	3	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Genomics - definition, genome organization in prokaryotes and eukaryotes - nucleosome assembly, histone deacetylase, histone acetylase transferase, methylase, demethylase, genome imprinting.	6	Chalk and talk PPT Quiz & assignment
	Proteomics – definition, proteome – link between transcriptome and the proteome, types of proteomics – expression, structural and functional.	3	
II	Genome- human, <i>Arabidopsis thaliana</i> , HGP, Genetic mapping - DNA marker for genetic mapping - RFLP, DNA microarray	6	Chalk and talk PPT Quiz & assignment
	Physical mapping - restriction mapping, fluorescent in situ hybridization, sequence tagged mapping.	3	
III	DNA sequencing – Sanger’s, Maxam and Gilbert method, sequence assembly by shot gun, clone contigs, expressed sequence tags	3	Chalk and talk PPT Quiz & assignment
	Genome assembly: trimming and quality determination – Phred score, validation.	3	
	NGS –Illumina, nanopore, Roche 450, PacBio. mRNA sequencing an introduction.	3	
IV	SDS-PAGE, 2D PAGE, Western blotting, protein sequencing – Edman	3	Chalk and talk PPT Quiz & assignment
	Mass spectroscopy MALDI-TOF, protein microarray, reverse phase HPLC	3	
	Peptide mass fingerprinting, mapping protein modification.	3	
V	Purpose and methods of comparison - at nucleotide level, gene cluster level, phylogenetic comparison. Tools -subtractive hybridization.	3	Chalk and talk PPT Quiz & assignment
	Comparison of the genomes of the pathogenic and non-pathogenic organisms. Applications of comparative genomics, predicting regulatory elements, Identifying targets, protein motif and domain analysis for conserved strings.	3	
	Functional Genomics- application of microarray, expression and regulation of entire set of genes and differential expression of genes, disease vs normal condition – breast cancer.	3	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Genomics and Proteomics Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Genomics and Proteomics Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-4	2	K1 & K2	1	K1	2 (K4&K4)	1(K3)
5	CLO 5	Up to K-3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K4 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K3 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Core-10	20U6LMC10	Environmental Biotechnology	5	5	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To provide students with an understanding on various environmental pollution and their management - To understand the various bioremediation process - To gain knowledge on generating wealth from environmental waste				
Unit	Description	Hours	K-level	CLO
I	Sludge and Hazardous Waste and their Management Environmental Biotechnology -Introduction, definition, pollution, pollutant. Sources and characteristics of sludge, Sludge thickening, stabilization, Composting – mechanism, methods: vermi-composting - conditioning, disinfection of sludge, Heat drying, disposal of sludge - land filling, lagooning, sewage disposal, solid waste disposal. Hazardous waste: Characteristics and risk assessment, hazardous waste rule, basel convention, MARPOL convention - Treatment and disposal of hazardous waste.	15	Up to K-2	1
II	Water and Air Pollutions and their Treatments Sewage: composition, characterization – COD, BOD, Coliform bacteria composition. Treatment - Primary, Secondary-Aerobic suspended, Aerobic attached, Anaerobic suspended, Anaerobic attached, Pond treatment, Tertiary- removal of Solids, nitrogen and phosphorous. Air pollution – causes and treatment - biofilters and bioscrubbers; biological removal of sulphur and nitrogen compounds – methods of detecting air pollution – GC-MS.	15	Up to K-3	2
III	Bioremediation and biodegradation Process Bioremediation – Definition, Types: In-situ &Ex-situ, Factors affecting microbial bioremediation, advantage and disadvantages. Biostimulation, Bioaugmentation, Biofiltration, biomagnification, Bioreactor-based treatments, composting and land filling.	15	Up to K-4	3

	Genetically engineered bacteria for bioremediation - <i>Pseudomonas</i> as a universal agent: Metal microbe interaction, Mechanisms – metabolism dependent, metabolism independent, Extracellular precipitation and complexation. Phytoremediation – Rhizofiltration, Rhizodegradation. Biodegradation of hydrocarbons, pesticides and herbicide, Aerobic and Anaerobic degradation of Aliphatic and Aromatic Compounds. Microbial interaction with plastics, antibiotics and others emerging pollutants.			
IV	Eco-friendly bio-products for environmental health Biofertilizers – mechanism of <i>Rhizobium</i> , <i>Azotobacter</i> , <i>Azospirillum</i> , Blue green algae, Nostoc, VAM fungi, Azolla – production and application. Biopesticides: mechanisms – NPV, <i>Beauveria bassiana</i> ; biofuels – Microbial Fuel Cell (MFC); Biomass utilization – ethanol, methanogenesis and biogas production. Bioleaching –mechanism of leaching. Enhanced Oil Recovery; Microbial role in Carbon Storage and Capture, Biodegradable plastics - PHA, PHB using <i>Clostridium</i>	15	Up to K-4	4
V	Industrial Problems and their Remedial process Tannery Industry effluent – source, characteristics, environmental impact, treatment - primary, chemical and biological treatments. Dye Industry – source and origin of dyes, characterization of waste effluents, environmental impact of dye and its intermediates, treatment technologies - primary, chemical and biological. Petroleum Industry – sources, characterization and degradation technologies. Aliphatic and cosmetic degradation	15	Up to K-3	5

Books for Study

1. Fulekar MH. 2010. Environmental Biotechnology. CRC Press
2. Srinivas T. 2008. Environmental Biotechnology. New Age publication.

Books for Reference

1. Rittmann BE and McCarty PL. 2001. Environmental Biotechnology: Principles and Applications, First edition. McGraw-Hill Education.
2. B.C. Bhattacharyya BC, Banerjee R. 2007. Environmental Biotechnology. Oxford Higher Education.

Web resources

1. <https://nptel.ac.in/courses/102/105/102105088/>
2. <https://www.youtube.com/watch?v=fpGEUn18H4E>

Rationale for nature of the course

The course on Environmental Biotechnology focuses on the fundamental concepts and applications of biotechnology in all aspects of environment including its protection, restoration and sustainability. It also emphasizes on the recent development of biotechnology for accessing the microbial potential in environmental applications. The present course will enrich understanding on the application of modern biotechnology to achieve better environmental protection and sustainability through the use of various biological components for mitigation of pollution.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Preparation of mind map and poster on various biotechnological processes used for environmental issues
- Scientific discussion and analysis on theoretical concepts

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr.S. Baskaran

Dr. N. krithiga

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Discuss about the various solid and hazardous waste and their management	Up to K-2
CLO-2	Illustrate various methods of analysis and treatments of pollutant	Up to K-3
CLO-3	Apply the various bioremediation process	Up to K-4
CLO-4	Practice various methods to convert the waste to value products	Up to K-4
CLO-5	Use the various treatments strategies for removal of pollution	Up to K-3

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	3	3	2
CLO-2	3	2	2	2	2
CLO-3	3	3	3	3	2
CLO-4	3	3	2	3	2
CLO-5	3	3	3	3	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	3	3	2
CLO-2	3	3	3	2	2
CLO-3	3	3	3	3	3
CLO-4	3	3	2	3	2
CLO-5	3	3	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Sources and characteristics of sludge, Sludge thickening, stabilization, Composting – mechanism, methods: vermi-composting - conditioning, disinfection of sludge,	5	Chalk and talk PPT Quiz & assignment
	Heat drying, disposal of sludge - land filling, lagooning, septage disposal, solid waste disposal.	5	
	Hazardous waste: Characteristics and risk assessment, hazardous waste rule, Basel convention, MARPOL convention - Treatment and disposal of hazardous waste.	5	
II	Sewage: composition, characterization – COD, BOD, Coliform bacteria composition. Treatment - Primary, Secondary-Aerobic suspended, Aerobic attached growth treatment,	5	Chalk and talk PPT Quiz & assignment
	Anaerobic suspended growth treatment, Anaerobic attached growth treatment, Pond Treatment, Tertiary-Solids removal, nitrogen removal and phosphorous removal.	5	
	Air pollution – causes and treatment - biofilters and bioscrubbers; biological removal of sulphur and nitrogen compounds – methods of detecting air pollution – GC-MS.	5	
III	Bioremediation – Definition, Types: Intrinsic, In-situ - Biostimulation, Bioaugmentation, Biofiltration, Ex-situ-Bioreactor-based treatments, composting and land farming.	5	Chalk and talk PPT Quiz & assignment
	Genetically engineered bacteria for bioremediation - Heavy metals: Metal microbe interaction, Mechanisms – metabolism dependent, metabolism independent,	5	

	Extracellular precipitation and complexation.		
	Phytoremediation – Rhizofiltration, Rhizodegradation	5	
IV	Microbial Polymers: Xanthan – chemical structure, physical and thermal properties, conversion of agro-industrial waste into Xanthan	5	Chalk and talk PPT Quiz & assignment
	Dextran – chemical structure and biosynthesis. Microbial plastics: Polyalkanoates (PHA) and poly 3-hydroxy butyrate (PHB) – mechanisms.	5	
	Biofertilizers: Rhizobium, Azotobacter, Azospirillum, Blue green algae, Nostoc, VAM fungi, Azolla – production and application, Phosphate solubilizing bacteria.	5	
V	Tannery Industry effluent – source, characteristics, environmental impact of tannery effluent, treatment: primary, chemical and biological treatments.	5	Chalk and talk PPT Quiz & assignment
	Dye Industry – source and origin of dyes, characterization of waste effluents, environmental impact of dye and its intermediates, treatment technologies of dyes - primary, chemical and biological.	5	
	Petroleum Industry – sources, characterization and degradation technologies. Aliphatic and cosmetic degradation	5	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Environmental Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
3.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
4.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Environmental Biotechnology Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
5	CLO 5	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K4 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K3 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Core-11	20U6LMC11	Recombinant DNA Technology	5	5	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To provide students with an understanding about the tools and techniques for gene manipulation - To make students to understand the fundamentals of Gene cloning strategies and manipulation of gene expression. - To make the students understand about the production of industrial proteins using recombinant DNA technology				
Unit	Description	Hours	K-level	CLO
I	Tools in rDNA technology Enzymes for DNA manipulation and Klenow fragment. DNA polymerases, nucleases, ligases, end modification - exonuclease III enzyme, Terminal deoxyribonucleotidyl transferase, polynucleotide kinase, alkaline phosphatase, linkers, adaptors, homopolymer tailing Cloning vectors- pUC18, cosmids, lambda DNA as a cloning vectors, M13, phagemids, yeast vector, BAC, MAC, Viral vectors- SV40, Adenovirus, Retrovirus. Expression vector –pET, pMAL .	15	Up to K-2	1
II	Gene cloning strategies Introduction, genomic & cDNA library construction. Gene cloning strategies: cDNA preparation - Oligo dT, random and gene specific primers, cloning - Blunt end, Sticky end, directional, T-tail cloning, PCR based, Ligase free - Infusion, TOPO cloning. Selection of recombinants - antibiotic sensitivity, insertional inactivation, alpha –complementation, gene complementation, reporter gene assay, screening of recombinants- DNA	15	Up to K-3	2

	hybridization, Immunological assay, restriction mapping, Southern blot analysis, DNA sequencing.			
III	Manipulation of gene expression Eukaryotic protein in prokaryotic cells: synthesis and cloning of cDNA, gene expression from strong and regulatable promoters, increasing protein production, fusion proteins, increasing protein stability, intrinsic protein stability, facilitating protein folding, use of protease-deficient host strains, integration of genes into host chromosome, removing selectable marker genes, increasing secretion -secretion into the periplasm, secretion into the medium, metabolic load, posttranslational modification of eukaryotic proteins, <i>Saccharomyces cerevisiae</i> expression systems, mammalian expression systems - baculovirus vectors for protein production.	15	Up to K-4	3
IV	Protein and enzyme engineering Site directed mutagenesis -oligonucleotide-directed, PCR-amplified oligonucleotide-directed, random mutagenesis - random insertion/deletion. Protein engineering - disulfide bonds addition, changing asparagine to other amino acids, reducing the number of free sulfhydryl residues, increasing enzymatic activity, decreasing protease sensitivity, modifying protein specificity, increasing enzyme stability and specificity	15	Up to K-3	4
V	Pharmaceutical products of DNA Technology Production of recombinant insulin, recombinant hGH, clotting factor VIII. Therapeutic agents for human diseases - production of tissue plasminogen activator, interferons, interleukin-10, erythropoietin, leptin, DNase, HIV inhibitor, recombinant antibodies	15	Up to K-4	5

Books for Study

1. Dubey RC. 2012. Advanced Biotechnology. S. Chand Publications.
2. Sandhya Mitra. 2015. Genetic Engineering: Principles and practice. Second edition. McGraw Hill education.

Books for Reference

1. Glick BR and Pasternak J. 2002. Molecular Biotechnology: Principles and Applications of Recombinant DNA. Third edition. American Society for Microbiology.
2. Satyanarayana. U. 2009. Biotechnology. Books and Allied Pvt. Ltd.

Web resources

1. <https://nptel.ac.in/courses/102/103/102103013/#>
2. <https://nptel.ac.in/courses/102/103/102103074/>

Rationale for nature of the course

The core paper on Recombinant DNA technology provides a basic understanding on fundamental principle of cloning. Upon completion, student will be able to understand various aspects of rDNA cloning strategies such as molecular tools used in biotechnology, manipulation of DNA and expression of proteins, host cells, product recovery and analysis.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Preparation of flow chart and poster for cloning methods and genomic library preparation
- Scientific discussion and analysis on theoretical concepts
- Visit research labs and interaction with field experts.

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Ms. R. Suguna

Dr. N. Krithiga

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Explain the various tools used in rDNA technology	Up to K-2
CLO-2	Illustrate the gene cloning strategies	Up to K-3
CLO-3	Analyse the manipulation of gene expression in prokaryotes	Up to K-4
CLO-4	Relate site directed mutagenesis with protein engineering	Up to K-3
CLO-5	Explain the various production of recombinant products	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	2	2	3	2
CLO-2	3	2	2	2	3
CLO-3	2	3	2	1	2
CLO-4	2	2	3	2	1
CLO-5	2	2	3	2	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	3	3	2
CLO-2	2	2	3	3	3
CLO-3	3	3	3	2	3
CLO-4	3	3	2	2	3
CLO-5	3	3	3	2	2

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Enzymes for DNA manipulation and Klenow fragment. DNA polymerases, nucleases, ligases, end modification - exonuclease III enzyme, Terminal deoxyribonucleotidyl transferase, polynucleotide kinase, alkaline phosphatase, linkers, adaptors, homopolymer tailing	7	Chalk and talk PPT Quiz & assignment
	Cloning vectors- pUC18, cosmids, lambda DNA as a cloning vector, M13, phagemids, yeast vector, BAC, MAC, Viral vectors- SV40, Adenovirus, Retrovirus. Expression vector -pET, pMAL.	8	
II	Introduction, genomic & cDNA library construction. Gene cloning strategies: cDNA preparation - Oligo dT, random and gene specific primers.	5	Chalk and talk PPT Quiz & assignment
	Cloning - Blunt end, Sticky end, directional, T-tail cloning, PCR based, Ligase free - Infusion, TOPO cloning. Selection of recombinants - antibiotic sensitivity, insertional inactivation, alpha -complementation, gene complementation, reporter gene assay.	5	
	Screening of recombinants- DNA hybridization, Immunological assay, restriction mapping, Southern blot analysis, DNA sequencing.	5	
III	Eukaryotic protein in prokaryotic cells: synthesis and cloning of cDNA, gene expression from strong and regulatable promoters, increasing protein production, fusion proteins, increasing protein stability, intrinsic protein stability, facilitating protein folding,	5	Chalk and talk PPT Quiz & assignment
	use of protease-deficient host strains, integration of genes into host chromosome, removing selectable marker genes, increasing secretion -secretion into the periplasm, secretion into the medium, metabolic load,	5	
	Posttranslational modification of eukaryotic proteins, <i>Saccharomyces cerevisiae</i> expression systems, mammalian expression systems - baculovirus vectors for protein production.	5	
IV	Site directed mutagenesis -oligonucleotide-directed, PCR-amplified oligonucleotide-directed, random mutagenesis - random insertion/deletion.	7	Chalk and talk PPT Quiz & assignment
	Protein engineering - disulfide bonds addition, changing asparagine to other amino acids, reducing the number of free sulfhydryl residues, increasing enzymatic activity, decreasing protease sensitivity, modifying protein specificity, increasing enzyme stability and specificity	8	
V	Production of recombinant insulin, recombinant hGH, clotting factor VIII.	5	Chalk and talk PPT Quiz & assignment
	Therapeutic agents for human diseases - production of tissue plasminogen activator, interferons, interleukin-10, erythropoietin, leptin, DNase, HIV inhibitor, recombinant antibodies	10	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Recombinant DNA Technology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
5.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
6.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
5.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
6.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Recombinant DNA Technology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Core-12	20U6LMC12	Medical Biotechnology	5	5	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To understand the applications of biotechnology in diagnosis of diseases and therapy - To gain knowledge on recombinant therapeutic proteins and vaccines - To create awareness on use of stem cell technology in medical field.				
Unit	Description	Hours	K-level	CLO
I	Molecular diagnosis of Diseases DNA based Diagnosis: PCR-principles, nucleic acid hybridization-DNA probes, mechanism of probes, radioactive and non-radioactive detection system, microarray-technique and applications. Infectious diseases-malaria and AIDS, genetic diseases-cystic fibrosis, sick-cell anemia. DNA fingerprinting, RFLP, VNTR and SNP. Protein based Diagnosis: Sandwich ELISA – Cancer, indirect ELISA.	15	Up to K-3	1
II	Nucleic acid Therapeutics Gene therapy: types-germ cell and somatic cell, approaches – <i>ex-vivo</i> and <i>in-vivo</i> , methods of gene therapy: viral-mediated – retrovirus, adenovirus and adeno-associated, treatment of ADA deficiency, haemophilia and cystic fibrosis, non-viral mediated - DNA constructs, lipoplexes, receptor-mediated, RNA interference-mechanism. Self-study: antisense technology for AIDS and cancer treatment	15	Up to K-3	2
III	Protein Therapeutics Pharmaceuticals-production and applications of interferons, erythropoietin, tumour necrosis factor. Enzymes- α_1 antitrypsin, glucocerebrosidase, tissue plasminogen activator. Hybridoma technology - principle, production and purification. Applications of monoclonal antibodies - Diagnostics and Therapeutics.	15	Up to K-4	3

IV	Recombinant Vaccines Recombinant vaccines – advantages and limitations, types - Subunit vaccine Hepatitis B and Herpes simplex virus, Peptide vaccines against malaria and tumour, DNA Vaccine against tuberculosis - delivery methods, Advantage, Attenuated vaccine for cholera, typhoid, Vector Recombinant - vaccines against Vaccinia virus. mRNA vaccine , Reverse vaccinology. antibody-enhanced dengue virus infection.	15	Up to K-4	4
V	Stem cell therapy Significance and classification of stem cells, Induced pluripotent stem cells - production, identification, differentiation. Applications of stem cells - heart damage, amyotrophic lateral sclerosis, orthopedics. Stem cell banks: umbilical cord tissue - Collection and preservation, therapeutics use.	15	Up to K-2	5

Books for study

1. Glick BR, Delovitch TL, Patten CL. 2014. Medical Biotechnology. ASM Press, Washington.
2. Firdos Alam Khan. 2014. Biotechnology in Medical Sciences. Taylor and Francis, CRC Press

Books for reference

1. Singh BD. 2021. Biotechnology Expanding Horizons. Kayani Publications.
2. Jogdand SN. 2008. Medical Biotechnology. Himalaya Publishing House.
3. Pongracz J, Keen M. 2008. Medical Biotechnology. Elsevier Health Sciences

Rationale for nature of the course

The core paper on Medical Biotechnology focuses on students' ability to understand the applications of bio-products obtained by biotechnological processes. This paper would help the students to design and develop novel medical diagnostic methods and treatment approach for various genetic and metabolic diseases in human.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Creating mind map for diagnostics process used
- Learning the production of therapeutics using flowchart method
- Seminar presentation and assignment writing for self-study topics

Web resources

1. <https://nptel.ac.in/courses/102/103/102103041/>
2. <https://nptel.ac.in/courses/102/103/102103017/>

Pedagogy

The teaching methods may include chalk and talk, PowerPoint, demonstrations, assignments, group discussions and problem solving.

Course content designer

Dr. P.Vimal

Ms. R. Suguna

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Use biotechnological principles and processes in the development of diagnostic tools	Up to K-3
CLO-2	Illustrate the significance of gene therapy to treat various diseases.	Up to K-3
CLO-3	Point out the processes for recombinant proteins production and its therapeutic use	Up to K-4
CLO-4	Infer the principle behind the vaccine development and their mode of mechanisms	Up to K-4
CLO-5	Describe the applications of stem cell technology	Up to K-2

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	3	2	3
CLO-2	3	3	3	2	2
CLO-3	3	3	3	2	3
CLO-4	3	3	3	2	3
CLO-5	3	2	3	2	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	3	3
CLO-2	3	2	3	3	2
CLO-3	3	2	3	3	2
CLO-4	3	2	2	3	2
CLO-5	3	2	2	2	2

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	DNA based Diagnosis: PCR-principles, nucleic acid hybridization-DNA probes, mechanism of probes, radioactive and non-radioactive detection system	5	Chalk and talk PPT Quiz & assignment
	Microarray-technique and applications. Infectious diseases-malaria and AIDS, genetic diseases-cystic fibrosis, sick-cell anemia.	5	
	DNA fingerprinting, RFLP, VNTR and SNP. Protein based Diagnosis: Sandwich ELISA – Cancer, indirect ELISA.	5	
II	Gene therapy: types-germ cell and somatic cell, approaches – <i>ex-vivo</i> and <i>in-vivo</i> .	5	Chalk and talk PPT Quiz & assignment
	Methods of gene therapy: viral-mediated – retrovirus, adenovirus and adeno-associated, treatment of ADA deficiency, haemophilia and cystic fibrosis.	5	
	Non-viral mediated -DNA constructs lipoplexes, receptor-mediated, RNA interference-mechanism.	3	
III	Pharmaceuticals-production and applications of interferons, erythropoietin, tumour necrosis factor.	5	Chalk and talk PPT Quiz & assignment
	Enzymes- α_1 antitrypsin, glucocerebrosidase, tissue plasminogen activator.	5	
	Hybridoma technology - principle, production and purification. Applications of monoclonal antibodies - Diagnostics and Therapeutics.	5	
IV	Recombinant vaccines – advantages and limitations, types - Subunit vaccine Hepatitis B and Herpes simplex virus, Peptide vaccines against malaria and tumour	5	Chalk and talk PPT Quiz & assignment
	DNA Vaccine against tuberculosis - delivery methods, Advantage, Attenuated vaccine for cholera, typhoid	5	
	Vector Recombinant - vaccines against Vaccinia virus. mRNA vaccine, Reverse vaccinology. Antibody-enhanced dengue virus infection.	5	
V	Significance and classification of stem cells, Induced pluripotent stem cells - production, identification, differentiation.	10	Chalk and talk PPT Quiz & assignment
	Applications of stem cells - heart damage, amyotrophic lateral sclerosis, orthopedics. Stem cell banks: umbilical cord tissue - Collection and preservation, therapeutics use.	5	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Medical Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
7.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
8.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
7.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
8.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Medical Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective-III	20U6LME3	Bioinformatics	3	4	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To gain knowledge on various biological database. - To understand the various algorithms for sequence analysis. - To know about the various structure prediction tools and CADD.				
Unit	Description	Hours	K-level	CLO
I	Overview of Bioinformatics and Biological Databases Bioinformatics definition, history and scope, Bioinformatics- a multi-disciplinary approach, application of Bioinformatics. Major bioinformatics databases- NCBI, Nucleotide database - Genbank, EMBL and DDBJ, protein database - primary sequence database- Swissprot and PIR, secondary sequence database- PROSITE, PRINTS and pfam, protein structural database- PDB, SCOP and CATH	12	Up to K-2	1
II	Sequence Alignment Retrieval of sequence – SRS and ENTREZ, sequence alignment, BLAST, FASTA, local and global alignment. Pair wise sequence alignment – Dot-matrix and K-tuple method, multiple sequence alignment – CLUSTALW, applications of multiple sequence alignment.	12	Up to K-3	2
III	Phylogenetic analysis Phylogenetic tree- structure of typical phylogenetic tree, rooted and unrooted tree, construction of phylogenetic tree, phenetic method - UPGMA and Neighbour Joining, cladistic method - Maximum parsimony and Maximum likelihood, phylogenetic softwares available in the web.	12	Up to K-4	3
IV	Protein structure prediction Secondary structure prediction – Chou Fasman, GOR, Tertiary	12	Up to K-3	4

	protein structure prediction – <i>ab initio</i> modelling, comparative modelling - homology modelling, SWISS modeller, protein threading, evaluation of predicted structure -Ramachandran plot, molecular visualization tools -Rasmol and Swiss PDB viewer.			
V	Computer Aided Drug Design Drug Discovery and design - Target identification, Target Validation, Lead Identification, lead optimization, Lipinski's rule, ADMET, High Through-put screening, steps in molecular modeling, Direct drug design - Docking, Indirect drug design - QSAR, pharmacophore-based drug design.	12	Up to K-4	5

Books for Study

1. Rastogi SC. 2006. Bioinformatics concepts, skills and applications. second edition. CBS
2. Subramanian C. 2015. A text book of Bioinformatics. First edition. Dominant publishers.

Books for Reference

1. Curran BG.2010. Bioinformatics. First edition, CBS Publishers and Distributors Pvt.
2. Ghoshand Z, Mallick B. 2008. Bioinformatics: Principles and Applications. Oxford University Press, New Delhi.
3. Lesk AM. 2002. Introduction to Bioinformatics. Oxford University Press, London.

Web resources

<https://www.youtube.com/watch?v=sREv4rfpbCY>

Rationale for nature of the course

The course on Bioinformatics provides an opportunity to develop the skills and knowledge on working with biological data, organize and computationally predicts the structure, phylogeny and drug design.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Scientific discussion and analysis on theoretical concepts
- Structure prediction and phylogenetic tree construction using online bioinformatics tools.
- Writing assignment and preparation of flow-chart.

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Ms. R. Suguna

Dr. N. Krithiga

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Explain about the concepts in bioinformatics and various biological databases.	Up to K-2
CLO-2	Illustrate various sequence alignments.	Up to K-3
CLO-3	Analyse various phylogenetic analysis.	Up to K-4
CLO-4	Predict the structure with various prediction tools.	Up to K-3
CLO-5	Outline the various stages in drug design.	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	2	2	3
CLO-2	3	2	2	2	2
CLO-3	3	3	2	2	3
CLO-4	3	2	3	2	2
CLO-5	3	3	3	2	3

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	2	2	2
CLO-2	3	2	2	3	3
CLO-3	3	3	3	3	3
CLO-4	3	2	-2	3	2
CLO-5	3	3	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Bioinformatics definition, history and scope of Bioinformatics, Bioinformatics- a multi-disciplinary approach, application of Bioinformatics.	4	Chalk and talk PPT Quiz & assignment
	Major bioinformatics databases- NCBI, Nucleotide database -Genbank, EMBL and DDBJ, protein database - primary sequence database– Swissprot and PIR,	4	
	Secondary sequence database- PROSITE, PRINTS and pfam, protein structural database- PDB, SCOP and CATH	4	
II	Retrieval of sequence – SRS and ENTREZ, sequence alignment, BLAST, FASTA, local and global alignment.	6	Chalk and talk PPT Quiz & assignment
	Pair wise sequence alignment – Dot-matrix and K-tuple method, multiple sequence alignment – CLUSTALW, applications of multiple sequence alignment.	6	
III	Phylogenetic tree- structure of typical phylogenetic tree, rooted and unrooted tree	4	Chalk and talk PPT Quiz & assignment
	Construction of phylogenetic tree, phenetic method - UPGMA and Neighbour Joining	4	
	Cladistic method - Maximum parsimony and Maximum likelihood, phylogenetic softwares available in the web.	4	
IV	Secondary structure prediction – Chou Fasman, GOR, Tertiary protein structure prediction – <i>ab initio</i> modelling,	4	Chalk and talk PPT Quiz & assignment
	Comparative modelling - homology modelling, SWISS modeller, protein threading,	4	
	Evaluation of predicted structure -Ramachandran plot, molecular visualization tools -Rasmol and Swiss PDB viewer.	4	
V	Drug Discovery and design - Target identification, Target Validation, Lead Identification, lead optimization, Lipinski's rule, ADMET.	6	Chalk and talk PPT Quiz & assignment
	Bioinformatics in computer-aided drug design, steps in molecular modeling, Direct drug design - Docking, Indirect drug design - QSAR, pharmacophore-based drug design.	6	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Bioinformatics Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
9.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
10.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
9.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
10.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Bioinformatics Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Elective-II	20U5LME2	Animal Biotechnology	2	3	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To understand the animal cell culture techniques and their applications - To gain the knowledge on products obtained from animal cells, tissues and animals - To know the concepts of gene manipulation for transgenic animal production				
Unit	Description	Hours	K-level	CLO
I	Introduction to animal cell culture History, scope, minimal requirements for cell culture, culture media- definition, types - natural media, artificial media, serum media, serum free media, physiochemical properties of media – pH, CO ₂ , O ₂ , temperature and osmolality.	9	Up to K-2	1
II	Cell culture techniques and characterization Primary cell culture – definition, techniques - mechanical, enzymatic disaggregation, primary, culture techniques – slide culture, flask culture, secondary culture – finite, continuous cell line, selection and maintenance. Characteristics of cultured cells – cell adhesion, proliferation, differentiation, identification of specific cell lines, measurement of growth parameters of cultured cell, cell synchronization and senescence.	9	Up to K-3	2
III	Methods for transgenic animals production and biopharming Methods - retroviral, microinjection, embryonic stem cell and its applications, embryo transfer technology, in-vitro fertilization, transgenesis- methods of transferring genes into animal oocytes, eggs, embryos and specific tissues by physical, chemical and biological methods. Biopharming - Transgenic animals -Mice, Cows, Pigs, Sheep, Goat, Birds and Insects. Artificial insemination and embryo transfer, cryopreservation	9	Up to K-4	3

IV	Animal cells as bioreactors Scale-up in suspension, complexity, Mixing and aeration, rotating chambers, perfused suspension cultures, fluidized bed reactors for suspension culture, scale-up in monolayers, multisurface propagators, multiarray disks, spirals and tubes, roller culture, micro carriers, Perfused monolayer cultures, membrane perfusion, hollow fiber perfusion, matrix perfusion, microencapsulation, Growth monitoring	9	Up to K-3	4
V	Stem cell technology Stem cell –Introduction, definition, properties, proliferation, culture of stem cells, Types of stem cells-Embryonic stem cells, Tissue-specific stem cells, Mesenchymal stem cells, Induced pluripotent stem cells. Isolation of human Embryonic stem cells, generation of human induced pluripotent stem cells. Methods for pluripotent stem cell culture, characterization of pluripotency and differentiation into different lineages. Engineered pluripotent stem cells.	9	Up to K-4	5

Books for Study

1. Gupta PK. 2017. Animal Biotechnology. Rastogi publication, Meerut.
2. Satyanarayana U. 2015. Biotechnology. Books and Allied P (Ltd), Kolkata, India

Books for Reference

1. Prakash M and Arora K. 1999. Cell tissue culture. Anormal Publication.
2. Srivastava Singh and Yadhav MP. 2005. Animal Biotechnology. Oxford publishing.

Web resources

1. <https://www.youtube.com/channel/UCYeNCzcVMjJYPexXKU2UsSA>
2. <https://nptel.ac.in/courses/102/104/102104059/>

Rationale for nature of the course

The course on Animal Biotechnology emphasizes an understanding on the use of animals and animal tissue culture to improve their suitability for agriculture, industrial or pharmaceutical application. Genetically modified animals, tissues and cells are used for the synthesis of therapeutically important protein products. Students can obtain an in-depth understanding about the significance of animal cell based products in human welfare.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar on the bio-products from transgenic animals
- Poster preparation on core concepts of animal Biotechnology
- Scientific discussion on recent trends in animal based biotechnological products

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr. N. Krithiga

Dr. S. Baskaran

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe the physio-chemical properties of animal cell culture medium	Up to K-2
CLO-2	Illustrate the various techniques used for cell culture	Up to K-3
CLO-3	Differentiate the growth parameters and kinetics of normal and cancer cells	Up to K-4
CLO-4	Sketch the methods and techniques used for transgenic animal production	Up to K-3
CLO-5	Appraise the importance of animal cells as bioreactors	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	1	2	1	3
CLO-2	2	1	3	1	3
CLO-3	2	1	2	1	2
CLO-4	1	2	2	2	3
CLO-5	2	1	2	1	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	2	2
CLO-2	2	3	3	3	2
CLO-3	2	3	3	2	2
CLO-4	2	2	2	3	3
CLO-5	2	2	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	History, scope, minimal requirements for cell culture, culture media- definition, types - natural media, artificial media, serum media, serum free media	6	Chalk and talk Quiz & assignments
	Physiochemical properties of media – pH, CO ₂ , O ₂ , temperature and osmolality.	3	
II	Primary cell culture – definition, techniques - mechanical, enzymatic disaggregation	3	Chalk and talk PPT Quiz & assignments
	Primary explants, culture techniques – slide culture, flask culture, secondary culture – finite, continuous cell line, selection and maintenance.	3	
	Characteristics of cultured cells – cell adhesion, proliferation, differentiation, identification of specific cell lines, measurement of growth parameters of cultured cell, cell synchronization and senescence.	3	
III	Methods - retroviral, microinjection, embryonic stem cell and its applications, embryo transfer technology, in-vitro fertilization, transgenesis- methods of transferring genes into animal oocytes, eggs, embryos and specific tissues by physical, chemical and biological methods.	6	Chalk and talk Quiz & assignments
	Biopharming - Transgenic animals -Mice, Cows, Pigs, Sheep, Goat, Birds and Insects. Artificial insemination and embryo transfer, cryopreservation	3	
IV	Scale-up in suspension, complexity, Mixing and aeration, rotating chambers, perfused suspension cultures,	3	Chalk and talk PPT Quiz & assignments
	fluidized bed reactors for suspension culture, scale-up in monolayers, multisurface propagators, multiarray disks, spirals and tubes, roller culture, micro carriers,	3	
	Perfused monolayer cultures, membrane perfusion, hollow fiber perfusion, matrix perfusion, microencapsulation, Growth monitoring	3	
V	Stem cell –Introduction, definition, properties, proliferation, culture of stem cells, Types of stem cells- Embryonic stem cells, Tissue-specific stem cells, Mesenchymal stem cells, Induced pluripotent stem cells.	3	Chalk and talk Quiz & assignments
	Isolation of human Embryonic stem cells, generation of human induced pluripotent stem cells. Methods for pluripotent stem cell culture,	3	
	Characterization of pluripotency and differentiation into different lineages. Engineered pluripotent stem cells.	3	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print - Animal Biotechnology Course
Articulation Mapping - K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Animal Biotechnology Course Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Major Elective-I	20U5LME7	Microbial Biotechnology	3	4	25	75	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	
			Entrepreneurship oriented	

Course Objectives				
- To focus on the identification of microorganism by molecular typing - To understand the role of microbes in industrially important product - To gain knowledge on bio deterioration				
Unit	Description	Hours	K-level	CLO
I	Introduction to microbial Biotechnology Identification and classification of microorganisms- classification and phylogeny, 16s RNA typing and its limitation, plasmids and classification of bacteria. Analysis of microbial population in natural environments. Isolation of a hyperthermophilic, Archaeal organism predicted by in situ RNA analysis. A case study. Culture collection and preservation of microorganism.	12	Up to K-2	1
II	Biotransformation Microbial transformation of steroids and sterols, asymmetric catalysis in pharmaceutical and agrochemical industries, chiral intermediates for the synthesis of β 2 receptor agonists, biocatalytic synthesis of (s)-2 chloropropionic acid, optimization of natural enzyme variants- DNA shuffling gene site saturation mutagenesis, transesterification of fats and oil- production of cocoa butter, lipase catalyzed synthesis of polyesters, biosurfactants.	12	Up to K-3	2

III	Industrial applications Food and beverage fermentation – yeast characteristic, management, nutrition, fermentation process, metabolic products of yeast, post fermentation – treatment and maturation, Cider production and maturation, Vinegar fermentation.	12	Up to K-4	3
IV	Food and microbes Dairy fermentation- Yoghurt production, Cheese production. Food additives and supplements. Food additives of microbial origin – flavor, aroma, Nisin production. Microbial biomass production- Manufacture of baker's yeast, SCP- Bel symba, pekilo, Pruteen process, Quorm production, Mushroom.	12	Up to K-3	4
V	Microbial Biodeterioration and control Introduction-chemical and physio chemical changes. Biodeterioration of stored plant materials- potato, cereals, non-food animal products- leather, cellulosic materials, fuels and lubricants, plastics, cosmetic and pharmaceutical. Factors influencing. Assessment of microbial contamination, preservative.	12	Up to K-4	5

Books for study

1. Waites MJ, Morgan NL, Rockey JS, Higton G. 2001. Industrial Microbiology-An introduction. Blackwell Science Ltd
2. Glazer AN, Nikaido H. 2010. Microbial Biotechnology- fundamentals of applied microbiology. Second Edition. Cambridge University Press.

Books for reference

1. Reddy SM. 2012. Basis of Industrial Biotechnology. New age international publishers.
2. Peppler and Periman, 2004. Microbial Technology. Second edition. Academic Press.

Web resources

1. https://www.youtube.com/watch?v=eLYsGuw5Ofk&feature=emb_imp_woyt
2. <https://www.youtube.com/watch?v=zlRXDi-6j-Y>

Rationale for nature of the course

The elective course on Microbial biotechnology focuses the use of enabled by genome studies, that lead to breakthroughs such as improved vaccines and better disease-diagnostic tools, improved microbial agents for biological control of plant and animal pests, modifications of plant and animal pathogens for reduced virulence, development of new industrial catalysts and fermentation organisms, and development of new microbial agents for bioremediation of soil and water.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Writing assignments on core concepts
- Scientific interaction to discuss the advancement in microbial biotechnology
- Preparation of flow-chart and mind map for production human welfare products using microbes

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Ms R. Suguna

Dr. N. Krithiga

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe the molecular techniques to identify microorganisms	Up to K-2
CLO-2	Illustrate the biotransformation process	Up to K-3
CLO-3	Outline the methods to produce various fermentation products.	Up to K-4
CLO-4	Prepare the flow chart for various fermentation process.	Up to K-3
CLO-5	Illustrate the various microbial Biodeterioration and its control	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	2
CLO-2	3	2	3	2	2
CLO-3	3	3	3	3	2
CLO-4	3	3	3	3	2
CLO-5	3	3	2	3	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	2	3	2
CLO-2	2	2	2	3	2
CLO-3	3	2	2	2	2
CLO-4	3	2	2	2	2
CLO-5	3	3	2	3	2

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Identification and classification of microorganisms- classification and phylogeny, 16s RNA typing and its limitation, plasmids and classification of bacteria.	6	Chalk and talk Quiz and assignments
	Analysis of microbial population in natural environments. Isolation of a hyperthermophilic, Archaeal organism predicted by in situ RNA analysis. A case study. Culture collection and preservation of microorganism.	6	
II	Microbial transformation of steroids and sterols, asymmetric catalysis in pharmaceutical and agrochemical industries,	4	Chalk and talk Quiz and assignments
	Chiral intermediates for the synthesis of β 2 receptor agonists, biocatalytic synthesis of (s)-2 chloropropionic acid, optimization of natural enzyme variants- DNA shuffling gene site saturation mutagenesis,	4	
	Transesterification of fats and oil- production of cocoa butter, lipase catalyzed synthesis of polyesters, biosurfactants.	4	
III	Food and beverage fermentation – yeast characteristic, management, nutrition, fermentation process, metabolic products of yeast	6	Chalk and talk Quiz and assignments
	Post fermentation – treatment and maturation, Cider production and maturation, Vinegar fermentation.	6	
IV	Dairy fermentation- Yoghurt production, Cheese production. Food additives and supplements. Food additives of microbial origin – flavor, aroma, Nisin production.	6	Chalk and talk Quiz and assignments
	Microbial biomass production- Manufacture of baker's yeast, SCP- Bel symba, pekilo, Pruteen process, Quorm production, Mushroom.	6	
V	Introduction-chemical and physio chemical changes. Biodeteriation of stored plant materials- potato, cereals, non- food animal products- leather, cellulosic materials, fuels and lubricants, plastics, cosmetic and pharmaceutical.	6	Chalk and talk Quiz and assignments
	Factors influencing. Assessment of microbial contamination, preservative.	6	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Microbial Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
7.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
8.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
7.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
8.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Microbial Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	SBE IV	20U6LSM4	Nanobiotechnology	2	2	25	75	100

Nature of Course			
Knowledge and Skill oriented	✓		Employability oriented
			Entrepreneurship oriented

Course Objectives				
- To understand the basic concepts in frontier of nanobiotechnology. - To provide students with a basic understanding and knowledge on nanobiotechnology - To learn the applications of the nanoparticle in biotechnology				
Unit	Description	Hours	K-level	CLO
I	Unit 1 introduction, history and development Definition, Nanobiotechnology. Introduction to Nanoscience and basic concepts; Interaction of surface molecules and its chemical and physical properties; Nanoprocessess in nature - lotus effect, colour patterns in butterflies, adhesive pads in lizards; Different types of nanoparticles - metallic nanoparticles - Gold/silver, titanium based, non-metallic nanoparticles - carbon and silicon based. Application of nanoparticles in nanolithography and in biological fields.	6	Up to K2	1
II	Synthesis and characterisation of nanomaterials Synthesis-physical, chemical and biological methods-role of metabolites in the formation of metallic nanoparticles –Top down and bottom up approaches- Advantages and disadvantages. Characterisation of nanomaterial – Spectroscopy (UV-VIS, FTIR, DLS), surface analysis (XRD, AFM), Microscopy (SEM, TEM).	6	Up to K3	2
III	Nano biotechnology in detection and imagination system History and development of Sensors-biosensors-components of biosensors-application of biosensors in various fields-Detection of pathogens-enzyme based and enzyme free method. Aptamer based detection of pathogens DNA probe. Imaging technique; fluorophores, quantum dots and magnetic nanoparticles, Implants: orthopaedic and vascular.	6	Up to K4	3

IV	Nano biotechnology for drug delivery Drug analysis & delivery. Route of drug delivery –rate of delivery-surface modification –bioconjugation, pegylation drug carriers-liposomes, nanoshells, micelles, dendrimers and hydrogels; functionalization of nanomaterials and Targeted drug delivery. Bionanosensors: nano cantilevers based on single stranded DNA methods to coat drug over the nanomaterial for effective delivery- targeted mode of delivery, fate of the nanoparticles after drug delivery.	6	Up to K3	4
V	Nano biotechnology in environmental and food sciences Nanotechnology in food industry -Food contaminants detection – pathogen detection –opportunities for Nanobiotechnology in food industry-Risk analysis of nanotechnology in food industries. Nanotechnology In environment - Health and environmental issues about nanoparticles. Nanotoxicology, Immune response to nanoparticles, Safety concerns about using nanotechnology.The National Personal Protective Technology Laboratory (NIOSH) Guidelines for working with nanomaterials	6	Up to K4	5

Books for Study

1. Balaji, S. 2010. Nanobiotechnology. MJP Publications, New Delhi.
2. Chattopadhyay KK. 2009. Introduction to nanotechnology and nanosciences, PHI Learning Pvt Ltd.

Books for Reference

1. Bhatia, M. 2010. Nanotechnology. Anmol Publications Pvt.Ltd., New delhi.
2. Niemeyer, C.M. and Mirkin, C.A. 2006. Nanobiotechnology: Concepts, Application and properties. Wiley, VCH Publishers.
3. Pradeep, T. 2011. Nano: The Essentials. Tata Mc Graw Education Private Ltd., New Delhi.

Web resources

1. <https://nptel.ac.in/courses/118/107/118107015/>
2. <https://www.youtube.com/watch?v=k61wjab7iUs>

Rationale for nature of the course

The skill based course on Nanobiotechnology to provide the basic understanding about nanoscience and its application in Biotechnology. Understanding about nanotechnology would make the students to become an interdisciplinary researcher in the future.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Preparation of mind map and poster for nanomaterial preparation
- Scientific discussion and analysis on theoretical concepts

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr. N. Krithiga

Ms. R. Suguna

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Explain about the basic concepts in nanobiotechnology	Up to K2
CLO-2	Illustrate about the nanoparticle synthesis and their characterization	Up to K3
CLO-3	Apply the use of nanoparticles in detection system	Up to K4
CLO-4	Prepare the workflow for the drug delivery through nanocarriers	Up to K3
CLO-5	Sketch the use nanoparticles in quality assessment analysis	Up to K4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	2
CLO-2	3	2	2	2	2
CLO-3	2	1	2	3	2
CLO-4	3	2	3	3	1
CLO-5	2	2	3	3	1

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	3	2
CLO-2	3	2	2	2	2
CLO-3	3	2	2	2	2
CLO-4	2	2	2	2	3
CLO-5	3	2	2	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
I	Definition, Nanobiotechnology. Introduction to Nanoscience and basic concepts; Interaction of surface molecules and its chemical and physical properties	2	Chalk and talk PPT Quiz & assignment
	Nanoprocesses in nature - lotus effect, colour patterns in butterflies, adhesive pads in lizards; Different types of nanoparticles - metallic nanoparticles - Gold/silver, titanium based, non-metallic nanoparticles - carbon and silicon based.	2	
	Application of nanoparticles in nanolithography and in biological fields.	2	
II	Synthesis-physical, chemical and biological methods-role of metabolites in the formation of metallic nanoparticles – Top down and bottom up approaches	3	Chalk and talk PPT Quiz & assignment
	Advantages and disadvantages. Characterisation of nanomaterial – Spectroscopy (UV-VIS, FTIR, DLS), surface analysis (XRD, AFM), Microscopy.	3	
III	History and development of Sensors-biosensors-components of biosensors-application of biosensors in various fields	2	Chalk and talk PPT Quiz & assignment
	Detection of pathogens-enzyme based and enzyme free method. Aptamer based detection of pathogens DNA probe.	2	
	Imaging technique; fluorophores, quantum dots and magnetic nanoparticles, Implants: orthopaedic and vascular.	2	
IV	Drug analysis & delivery. Route of drug delivery –rate of delivery-surface modification –bioconjugation, pegylation drug carriers-liposomes, nanoshells, micelles, dendrimers and hydrogels	2	Chalk and talk PPT Quiz & assignment
	Functionalization of nanomaterials and Targeted drug delivery. Bionanosensors: nano cantilevers based on single stranded DNA methods to coat drug over the nanomaterial for effective delivery- targeted mode of delivery, fate of the nanoparticles after drug delivery.	4	
V	Nanotechnology in food industry -Food contaminants detection –pathogen detection –opportunities for Nanobiotechnology in food industry-Risk analysis of nanotechnology in food industries.	2	Chalk and talk PPT Quiz & assignment
	Nanotechnology In environment - Health and environmental issues about nanoparticles. Nanotoxicology, Immune response to nanoparticles, Safety concerns about using nanotechnology.	2	
	The National Personal Protective Technology Laboratory (NIOSH) Guidelines for working with nanomaterials	2	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Nanobiotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
11.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
12.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
11.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
12.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Nanobiotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Practicals	20U6LMP7	Major Practicals-VII	2	3	40	60	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	✓
			Entrepreneurship oriented	

Course Objectives	
- To gain knowledge on isolation of DNA from various organisms and their manipulation. - To understand the cloning strategy - To make the students understand the <i>in silico</i> analysis	
	Experiments
1	Extraction of genomic DNA from Bacterial Cells
2	Extraction of Plasmid DNA from Bacterial Cells
3	Restriction Digestion & Ligation
4	Competent cell preparation & Transformation
5	Selection of recombinants – Blue White Selection and restriction digestion
6	SDS-PAGE
7	Retrieving nucleotide and protein sequences from biological databases
8	Sequence similarity search and multiple sequence alignment
9	Construction of phylogenetic tree
10	<i>In silico</i> PCR Analysis (PCR primer design – amplification primer, sequencing primer, qRT-PCR primer)
	Spotters Cosmid, λDNA, baculovirus, oligonucleotide directed mutagenesis, hGH, ADMET, QSAR, Short gun, 2D PAGE, microarray

Books for study

1. John Vennison. 2009. Laboratory Manual of Genetic Engineering. PHI.
2. Sambrook, Joseph. 2001. Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, N.Y. Cold Spring Harbor Laboratory Press

Course content designers

R. Suguna

Dr. N. Krithiga

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K –Level
CLO-1	Describe the methodology used for DNA extraction	Up to K-2
CLO-2	Prepare the competent cells and transformation of rDNA	Up to K-4
CLO-3	Manipulate the DNA using enzymes	Up to K-3
CLO-4	Practice various sequences analysis tools used in bioinformatics	Up to K-3
CLO-5	Construct the phylogenetic tree using nucleic acid and protein sequences	Up to K-2

Rationale for nature of the course

The laboratory course on rDNA technology, Bioinformatics and Genomics & Proteomics provides an opportunity to understand the theoretical principles that enable the students to carry out the experiments independently. An Understanding about these experiments would provide an advantage for the students to perform and excel in their job or higher studies.

Activities having direct bearing on Skill development /Employability /Entrepreneurship

- Individual experimental activity to the students.
- Hands on training to use instruments.
- Analysis and interpretation of results.

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	2
CLO-2	3	2	3	2	2
CLO-3	3	2	2	3	2
CLO-4	3	2	3	1	1
CLO-5	3	2	3	2	2

Mapping of Course outcomes with Program specific Outcomes

CO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	3	2
CLO-2	3	3	2	2	2
CLO-3	3	3	2	3	2
CLO-4	3	3	2	2	2
CLO-5	3	3	2	3	3

Advance application-3; Intermediate level-2 & Basic level-1

DEPARTMENT OF BIOTECHNOLOGY				CLASS: III B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VIII	Major Practicals	20U6LMP8	Major Practicals-VIII	2	3	40	60	100

Nature of Course				
Knowledge and Skill oriented	✓		Employability oriented	✓
			Entrepreneurship oriented	

Course Objectives	
- To gain knowledge on various analysis of environmentally important parameters - To focus on the isolation of microorganisms from the environment - To understand the various methods of molecular diagnostics.	
Experiments	
1	Estimation of chloride in water
2	Estimation of nitrates in drinking water
3	Estimation of biological oxygen demand and chemical oxygen demand
4	Identification and enumeration of coliform bacteria
5	Isolation of xenobiotic degrading bacteria
6	Isolation of lipase producing bacteria
7	Isolation of cyanobacteria
8	ELISA
9	PCR-VNTR
10	Isolation of phosphate solubilizing bacteria
	Spotters XRD, hybridoma technology, VAM, biosensors, hepatitis B, activated sludge, Azolla, DNA fingerprinting, retroviral mediated gene transfer, Nostac

Books for study

1. Aneja KR. 2010. Experiments in microbiology, plant pathology and biotechnology. New Age International Publishers.
2. Abhijit Dutta. 2011. Experimental Biology: A laboratory Manual. Narosa publications.
3. Rajan & Selvi Christy. 2010. Experimental Procedures in Lifesciences. Anjanaa Book House

Course content designers

Ms. R. Suguna

Dr. S. Baskaran

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K –Level
CLO-1	Estimate COD and BOD level in the given water samples	Up to K-2
CLO-2	Analyse the ecological parameters for microbial contamination	Up to K-4
CLO-3	Write about use of nanoparticles in diagnostic process	Up to K-3
CLO-4	Use appropriate methods for the isolation of microbes from environment	Up to K-3
CLO-5	Analyse the molecular diagnostic results	Up to K-2

Rationale for nature of the course

The laboratory course on environmental, medical and Nanobiotechnology focuses to provide basic knowledge on analytical techniques used in environmental sample, DNA based diagnostic and nanomaterial. Skills obtained from this course enable the students to use appropriate techniques in diagnostic laboratory and environmental impact analysis laboratories.

Activities having direct bearing on Skill development /Employability /Entrepreneurship

- Individual experimental activity to the students.
- Hands on training to use instruments.
- Analysis and interpretation of results.

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	2
CLO-2	3	2	3	2	2
CLO-3	3	2	2	3	2
CLO-4	3	2	3	1	1
CLO-5	3	2	3	2	2

Mapping of Course outcomes with Program specific Outcomes

CO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	3	2
CLO-2	3	3	2	2	2
CLO-3	3	3	2	3	2
CLO-4	3	3	2	2	2
CLO-5	3	3	2	3	3

Advance application-3; Intermediate level-2 & Basic level-1

THE MADURA COLLEGE (AUTONOMOUS), Madurai-625 011

Department of Biotechnology

UG Programme structure

Sem	Course Code	Title of the course	Hours	Credits	Nature of Course			Scope of focus			Percentage of syllabus revision
					Empl	Ent	Skill	Local	National	Global	
I	20U1LMC1	Genetics	3	3			✓			✓	100
	20U1LMC2	Basics of Biotechnology	3	3			✓		✓	✓	51
	20U1LMP1	Major Practicals-I	3	2	✓		✓		✓	✓	100
II	20U2LMC3	General Physiology	3	3			✓		✓		100
	20U2LMC4	Bioinstrumentation	3	3			✓			✓	22
	20U2LMP2	Major Practicals-II	3	2	✓		✓		✓	✓	100
III	20U3LNM1	Introduction to Biotechnology	2	2			✓		✓		100
	20U3LSM1	Biophysics and Bioenergetics	2	2			✓			✓	100
	20U3LMC5	Biochemistry	5	5			✓			✓	44
	20U3LMP3	Major Practicals-III	3	2	✓		✓		✓	✓	100
IV	20U4LNM2	Applied Biotechnology	2	2			✓			✓	100
	20U4LSM2	Food Processing and Preservation	2	2		✓	✓			✓	100
	20U4LMC6	Cell and Molecular Biology	5	5			✓			✓	52
	20U4LMP4	Major Practicals-IV	3	2	✓		✓		✓	✓	100

Se m	Course Code	Title of the course	Hours	Credits	Nature of Course			Scope of focus			Percentage of syllabus revision
					Empl	Ent	Skill	Local	National	Global	
V	20U5LSM3	Bioethics, Biosafety and IPR	2	2			✓			✓	100
	20U5LMC7	Immunology	5	5			✓			✓	27
	20U5LMC8	Industrial Biotechnology	5	5			✓			✓	30
	20U5LMC9	Plant Biotechnology	5	5			✓			✓	45
	20U5LIDC	Computer-Aided Drug Design	4	3			✓			✓	100
	20U5LME1	Biostatistics	3	2			✓			✓	28
	20U5LME3	Pharmaceutical Biotechnology	4	3			✓			✓	100
	20U5LME4	Forensic Biotechnology	3	2			✓		✓	✓	100
	20U5LMP5	Major Practicals-V	3	2	✓		✓		✓	✓	42
	20U5LMP6	Major Practicals-VI	3	2	✓		✓		✓	✓	70
VI	20U6LSM4	Proteomics and Genomics	2	2			✓		✓	✓	100
	20U6LMC10	Environmental Biotechnology	5	5			✓			✓	53
	20U6LMC11	Recombinant DNA Technology	5	5			✓			✓	100
	20U6LMC12	Medical Biotechnology	5	5			✓			✓	45
	20U6LME5	Bioinformatics	4	3			✓			✓	23
	20U6LME6	Animal Biotechnology	3	2			✓			✓	100
	20U6LME7	Microbial Biotechnology	4	3			✓			✓	100
	20U6LME8	Nanobiotechnology	3	2			✓			✓	100
	20U6LMP7	Major Practicals-VII	3	2	✓		✓		✓	✓	55
	20U6LMP8	Major Practicals-VIII	3	2	✓		✓		✓	✓	65

Ancillary Biotechnology Papers for B.Sc Microbiology

Se m	Course Code	Title of the course	Hours	Credits	Nature of Course			Scope of focus			Percentage of syllabus revision
					Empl	Ent	Skill	Local	National	Global	
I	20U1LAC1	Ancillary Theory-I	3	3			✓			✓	100
	20U1LAP1	Ancillary Practicals-I	2	2			✓		✓	✓	100
II	20U2LAC2	Ancillary Theory-II	3	3			✓		✓		100
	20U2LMP2	Ancillary Practicals-II	2	2			✓		✓	✓	100

THE MADURA COLLEGE
An Autonomous Institution affiliated to Madurai Kamaraj University
Re-accredited (3rd cycle) with 'A' grade by NAAC
Vidya Nagar, T.P.K. Road, Madurai – 625 011

SELF FINANCED STREAM

DEPARTMENT OF BIOTECHNOLOGY
Programme : B.Sc (Biotechnology)
Metric and weight calculation

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U1TLA1/20U1HLA1/ 20U1SLA1	CLO1	0.000	0.043	0.043	0.085	0.085	1.365
	CLO2	0.000	0.085	0.085	0.128	0.085	
	CLO3	0.000	0.128	0.043	0.000	0.085	
	CLO4	0.128	0.000	0.043	0.000	0.085	
	CLO5	0.000	0.000	0.128	0.000	0.085	
	Total	0.128	0.256	0.341	0.213	0.427	
20U1NEN1	CLO1	0.000	0.085	0.128	0.085	0.000	1.493
	CLO2	0.000	0.085	0.128	0.128	0.000	
	CLO3	0.000	0.085	0.085	0.085	0.000	
	CLO4	0.000	0.085	0.085	0.085	0.000	
	CLO5	0.000	0.085	0.128	0.128	0.000	
	Total	0.000	0.427	0.555	0.512	0.000	
20U1VEN1	CLO1	0.128	0.128	0.128	0.128	0.128	2.559
	CLO2	0.128	0.000	0.085	0.128	0.128	
	CLO3	0.128	0.000	0.085	0.128	0.128	
	CLO4	0.085	0.000	0.085	0.128	0.128	
	CLO5	0.128	0.085	0.085	0.128	0.128	
	Total	0.597	0.213	0.469	0.640	0.640	
20U1CAC1	CLO1	0.128	0.085	0.000	0.000	0.000	1.066
	CLO2	0.128	0.085	0.000	0.000	0.000	
	CLO3	0.128	0.085	0.000	0.000	0.000	
	CLO4	0.128	0.085	0.000	0.000	0.000	
	CLO5	0.128	0.085	0.000	0.000	0.000	
	Total	0.640	0.427	0.000	0.000	0.000	
20U1CAP1	CLO1	0.128	0.085	0.000	0.000	0.000	1.237
	CLO2	0.128	0.085	0.000	0.000	0.000	
	CLO3	0.128	0.085	0.000	0.000	0.000	
	CLO4	0.128	0.085	0.000	0.000	0.000	
	CLO5	0.128	0.085	0.085	0.085	0.000	
	Total	0.640	0.427	0.085	0.085	0.000	

20U1LMC1	CLO1	0.128	0.128	0.000	0.128	0.085	2.090
	CLO2	0.085	0.000	0.043	0.000	0.128	
	CLO3	0.128	0.128	0.043	0.085	0.128	
	CLO4	0.043	0.085	0.085	0.085	0.043	
	CLO5	0.128	0.085	0.085	0.085	0.128	
	Total	0.512	0.427	0.256	0.384	0.512	
20U1LMC2	CLO1	0.128	0.000	0.085	0.085	0.000	2.175
	CLO2	0.128	0.128	0.085	0.085	0.128	
	CLO3	0.128	0.085	0.085	0.000	0.128	
	CLO4	0.128	0.085	0.085	0.128	0.000	
	CLO5	0.128	0.128	0.085	0.128	0.000	
	Total	0.640	0.427	0.427	0.427	0.256	
20U1LMP1	CLO1	0.128	0.085	0.128	0.085	0.085	2.474
	CLO2	0.128	0.085	0.128	0.085	0.085	
	CLO3	0.128	0.085	0.085	0.128	0.085	
	CLO4	0.128	0.085	0.128	0.043	0.043	
	CLO5	0.128	0.085	0.128	0.085	0.085	
	Total	0.640	0.427	0.597	0.427	0.384	
20U2TLA2/20U2HLA2/ 20U2SLA2	CLO1	0.043	0.000	0.128	0.000	0.085	1.408
	CLO2	0.000	0.000	0.085	0.000	0.128	
	CLO3	0.043	0.000	0.128	0.043	0.085	
	CLO4	0.085	0.043	0.128	0.043	0.128	
	CLO5	0.000	0.000	0.128	0.043	0.043	
	Total	0.171	0.043	0.597	0.128	0.469	
20U2NENG2	CLO1	0.000	0.085	0.128	0.085	0.000	1.493
	CLO2	0.000	0.085	0.128	0.128	0.000	
	CLO3	0.000	0.085	0.085	0.085	0.000	
	CLO4	0.000	0.085	0.085	0.085	0.000	
	CLO5	0.000	0.085	0.128	0.128	0.000	
	Total	0.000	0.427	0.555	0.512	0.000	
20U2EVS1	CLO1	0.085	0.000	0.000	0.043	0.128	1.792
	CLO2	0.085	0.000	0.085	0.043	0.128	
	CLO3	0.085	0.128	0.000	0.043	0.128	
	CLO4	0.085	0.000	0.000	0.128	0.128	
	CLO5	0.085	0.128	0.000	0.128	0.128	
	Total	0.427	0.256	0.085	0.384	0.640	
20U2CAC2	CLO1	0.128	0.085	0.000	0.000	0.000	1.066
	CLO2	0.128	0.085	0.000	0.000	0.000	
	CLO3	0.128	0.085	0.000	0.000	0.000	
	CLO4	0.128	0.085	0.000	0.000	0.000	
	CLO5	0.128	0.085	0.000	0.000	0.000	
	Total	0.640	0.427	0.000	0.000	0.000	

20U2CAP2	CLO1	0.128	0.085	0.000	0.000	0.000	1.280
	CLO2	0.128	0.085	0.000	0.000	0.000	
	CLO3	0.128	0.085	0.000	0.000	0.000	
	CLO4	0.128	0.085	0.000	0.000	0.000	
	CLO5	0.128	0.085	0.085	0.085	0.043	
	Total	0.640	0.427	0.085	0.085	0.043	
20U2LMC3	CLO1	0.128	0.000	0.085	0.000	0.000	1.664
	CLO2	0.128	0.085	0.085	0.000	0.000	
	CLO3	0.128	0.085	0.085	0.128	0.000	
	CLO4	0.128	0.085	0.085	0.128	0.000	
	CLO5	0.128	0.000	0.128	0.043	0.000	
	Total	0.640	0.256	0.469	0.299	0.000	
20U2LMC4	CLO1	0.128	0.085	0.085	0.085	0.128	1.920
	CLO2	0.128	0.085	0.000	0.085	0.128	
	CLO3	0.128	0.128	0.043	0.000	0.000	
	CLO4	0.128	0.128	0.085	0.000	0.000	
	CLO5	0.128	0.128	0.085	0.000	0.000	
	Total	0.640	0.555	0.299	0.171	0.256	
20U2LMP2	CLO1	0.128	0.085	0.128	0.085	0.085	2.474
	CLO2	0.128	0.085	0.128	0.085	0.085	
	CLO3	0.128	0.085	0.085	0.128	0.085	
	CLO4	0.128	0.085	0.128	0.043	0.043	
	CLO5	0.128	0.085	0.128	0.085	0.085	
	Total	0.640	0.427	0.597	0.427	0.384	
20U3TLA3/17U3HLA3/ 20U3SLA3	CLO1	0.000	0.043	0.043	0.085	0.085	1.365
	CLO2	0.000	0.085	0.085	0.128	0.085	
	CLO3	0.000	0.128	0.043	0.000	0.085	
	CLO4	0.128	0.000	0.043	0.000	0.085	
	CLO5	0.000	0.000	0.128	0.000	0.085	
	Total	0.128	0.256	0.341	0.213	0.427	
20U3NENG3	CLO1	0.000	0.085	0.128	0.085	0.000	1.493
	CLO2	0.000	0.085	0.128	0.128	0.000	
	CLO3	0.000	0.085	0.085	0.085	0.000	
	CLO4	0.000	0.085	0.085	0.085	0.000	
	CLO5	0.000	0.085	0.128	0.128	0.000	
	Total	0.000	0.427	0.555	0.512	0.000	
20U3LSM1	CLO1	0.128	0.085	0.085	0.043	0.085	2.261
	CLO2	0.128	0.043	0.128	0.085	0.043	
	CLO3	0.128	0.085	0.085	0.085	0.085	
	CLO4	0.128	0.085	0.128	0.085	0.128	
	CLO5	0.128	0.043	0.085	0.085	0.043	
	Total	0.640	0.341	0.512	0.384	0.384	

20U3RAC1	CLO1	0.128	0.043	0.043	0.043	0.043	2.474
	CLO2	0.128	0.085	0.043	0.085	0.128	
	CLO3	0.128	0.128	0.128	0.128	0.128	
	CLO4	0.128	0.128	0.085	0.128	0.085	
	CLO5	0.128	0.128	0.085	0.128	0.043	
	Total	0.640	0.512	0.384	0.512	0.427	
20U3RAP1	CLO1	0.128	0.085	0.128	0.043	0.128	2.474
	CLO2	0.085	0.128	0.085	0.043	0.085	
	CLO3	0.085	0.085	0.128	0.085	0.128	
	CLO4	0.128	0.128	0.085	0.043	0.085	
	CLO5	0.085	0.085	0.128	0.128	0.128	
	Total	0.512	0.512	0.555	0.341	0.555	
20U3LMC5	CLO1	0.128	0.128	0.043	0.085	0.085	2.559
	CLO2	0.128	0.085	0.085	0.085	0.043	
	CLO3	0.128	0.128	0.128	0.128	0.128	
	CLO4	0.128	0.043	0.085	0.085	0.043	
	CLO5	0.128	0.128	0.128	0.128	0.128	
	Total	0.640	0.512	0.469	0.512	0.427	
20U3LMP3	CLO1	0.128	0.085	0.128	0.085	0.085	2.474
	CLO2	0.128	0.085	0.128	0.085	0.085	
	CLO3	0.128	0.085	0.085	0.128	0.085	
	CLO4	0.128	0.085	0.128	0.043	0.043	
	CLO5	0.128	0.085	0.128	0.085	0.085	
	Total	0.640	0.427	0.597	0.427	0.384	
20U4TLA4/17U4HLA4/ 20U4SLA4	CLO1	0.000	0.043	0.043	0.085	0.085	1.365
	CLO2	0.000	0.085	0.085	0.128	0.085	
	CLO3	0.000	0.128	0.043	0.000	0.085	
	CLO4	0.128	0.000	0.043	0.000	0.085	
	CLO5	0.000	0.000	0.128	0.000	0.085	
	Total	0.128	0.256	0.341	0.213	0.427	
20U4NEN4	CLO1	0.000	0.085	0.128	0.085	0.000	1.493
	CLO2	0.000	0.085	0.128	0.128	0.000	
	CLO3	0.000	0.085	0.085	0.085	0.000	
	CLO4	0.000	0.085	0.085	0.085	0.000	
	CLO5	0.000	0.085	0.128	0.128	0.000	
	Total	0.000	0.427	0.555	0.512	0.000	
20U4LSM2	CLO1	0.128	0.085	0.085	0.085	0.043	2.175
	CLO2	0.128	0.085	0.085	0.085	0.043	
	CLO3	0.128	0.085	0.085	0.085	0.043	
	CLO4	0.128	0.085	0.085	0.085	0.043	
	CLO5	0.128	0.085	0.085	0.128	0.043	
	Total	0.640	0.427	0.427	0.469	0.213	

20U4LMC6	CLO1	0.128	0.085	0.128	0.085	0.085	2.346
	CLO2	0.128	0.085	0.128	0.085	0.043	
	CLO3	0.128	0.085	0.128	0.085	0.043	
	CLO4	0.128	0.085	0.085	0.085	0.043	
	CLO5	0.128	0.085	0.128	0.085	0.043	
	Total	0.640	0.427	0.597	0.427	0.256	
20U4LMP4	CLO1	0.128	0.128	0.085	0.085	0.085	2.602
	CLO2	0.128	0.128	0.128	0.128	0.128	
	CLO3	0.128	0.085	0.128	0.128	0.043	
	CLO4	0.128	0.043	0.085	0.043	0.085	
	CLO5	0.128	0.128	0.128	0.085	0.085	
	Total	0.640	0.512	0.555	0.469	0.427	
20U4RAC2	CLO1	0.128	0.128	0.043	0.085	0.128	2.517
	CLO2	0.085	0.085	0.043	0.128	0.085	
	CLO3	0.128	0.085	0.043	0.128	0.128	
	CLO4	0.128	0.085	0.085	0.085	0.128	
	CLO5	0.128	0.085	0.085	0.128	0.128	
	Total	0.597	0.469	0.299	0.555	0.597	
20U4RAP2	CLO1	0.128	0.085	0.128	0.085	0.128	2.602
	CLO2	0.085	0.128	0.085	0.085	0.085	
	CLO3	0.085	0.085	0.128	0.085	0.128	
	CLO4	0.128	0.128	0.085	0.085	0.085	
	CLO5	0.085	0.085	0.128	0.128	0.128	
	Total	0.512	0.512	0.555	0.469	0.555	
20U5LSM3	CLO1	0.128	0.043	0.128	0.085	0.043	2.005
	CLO2	0.128	0.043	0.128	0.085	0.043	
	CLO3	0.128	0.043	0.085	0.043	0.085	
	CLO4	0.128	0.043	0.085	0.085	0.043	
	CLO5	0.128	0.043	0.085	0.043	0.085	
	Total	0.640	0.213	0.512	0.341	0.299	
20U5LMC7	CLO1	0.085	0.085	0.128	0.085	0.085	2.474
	CLO2	0.085	0.085	0.128	0.085	0.085	
	CLO3	0.085	0.085	0.128	0.085	0.085	
	CLO4	0.128	0.085	0.128	0.085	0.085	
	CLO5	0.085	0.128	0.128	0.085	0.128	
	Total	0.469	0.469	0.640	0.427	0.469	
20U5LMC8	CLO1	0.128	0.085	0.128	0.085	0.085	2.730
	CLO2	0.128	0.085	0.128	0.085	0.085	
	CLO3	0.128	0.128	0.128	0.085	0.085	
	CLO4	0.128	0.128	0.128	0.085	0.085	
	CLO5	0.085	0.128	0.128	0.128	0.128	
	Total	0.597	0.555	0.640	0.469	0.469	

20U5LMC9	CLO1	0.085	0.085	0.085	0.085	0.043	2.431
	CLO2	0.128	0.128	0.085	0.085	0.085	
	CLO3	0.085	0.043	0.128	0.085	0.128	
	CLO4	0.085	0.128	0.128	0.128	0.085	
	CLO5	0.128	0.128	0.085	0.085	0.085	
	Total	0.512	0.512	0.512	0.469	0.427	
20U5LME1	CLO1	0.085	0.085	0.085	0.085	0.085	2.090
	CLO2	0.043	0.043	0.085	0.085	0.085	
	CLO3	0.085	0.085	0.128	0.043	0.085	
	CLO4	0.128	0.085	0.128	0.085	0.043	
	CLO5	0.085	0.085	0.085	0.085	0.085	
	Total	0.427	0.384	0.512	0.384	0.384	
20U5LIDC	CLO1	0.128	0.085	0.128	0.085	0.085	2.645
	CLO2	0.128	0.085	0.128	0.085	0.085	
	CLO3	0.128	0.085	0.128	0.085	0.085	
	CLO4	0.128	0.128	0.128	0.085	0.085	
	CLO5	0.128	0.128	0.128	0.085	0.085	
	Total	0.640	0.512	0.640	0.427	0.427	
20U5LMP5	CLO1	0.128	0.085	0.128	0.085	0.085	2.474
	CLO2	0.128	0.085	0.128	0.085	0.085	
	CLO3	0.128	0.085	0.085	0.128	0.085	
	CLO4	0.128	0.085	0.128	0.043	0.043	
	CLO5	0.128	0.085	0.128	0.085	0.085	
	Total	0.640	0.427	0.597	0.427	0.384	
20U5LMP6	CLO1	0.128	0.085	0.128	0.085	0.085	2.474
	CLO2	0.128	0.085	0.128	0.085	0.085	
	CLO3	0.128	0.085	0.085	0.128	0.085	
	CLO4	0.128	0.085	0.128	0.043	0.043	
	CLO5	0.128	0.085	0.128	0.085	0.085	
	Total	0.640	0.427	0.597	0.427	0.384	
20U6LSM4	CLO1	0.128	0.085	0.128	0.085	0.085	2.389
	CLO2	0.128	0.085	0.085	0.085	0.085	
	CLO3	0.085	0.043	0.085	0.128	0.085	
	CLO4	0.128	0.085	0.128	0.128	0.043	
	CLO5	0.085	0.085	0.128	0.128	0.043	
	Total	0.555	0.384	0.555	0.555	0.341	
20U6LMC10	CLO1	0.128	0.128	0.128	0.128	0.085	2.815
	CLO2	0.128	0.085	0.085	0.085	0.085	
	CLO3	0.128	0.128	0.128	0.128	0.085	
	CLO4	0.128	0.128	0.085	0.128	0.085	
	CLO5	0.128	0.128	0.128	0.128	0.085	
	Total	0.640	0.597	0.555	0.597	0.427	

20U6LMC11	CLO1	0.085	0.085	0.085	0.128	0.085	2.303
	CLO2	0.128	0.085	0.085	0.085	0.128	
	CLO3	0.085	0.128	0.085	0.043	0.085	
	CLO4	0.085	0.085	0.128	0.085	0.043	
	CLO5	0.085	0.085	0.128	0.085	0.085	
	Total	0.469	0.469	0.512	0.427	0.427	
20U6LMC12	CLO1	0.128	0.128	0.128	0.085	0.128	2.858
	CLO2	0.128	0.128	0.128	0.085	0.085	
	CLO3	0.128	0.128	0.128	0.085	0.128	
	CLO4	0.128	0.128	0.128	0.085	0.128	
	CLO5	0.128	0.085	0.128	0.085	0.085	
	Total	0.640	0.597	0.640	0.427	0.555	
20U6LME3	CLO1	0.128	0.128	0.085	0.085	0.128	2.687
	CLO2	0.128	0.085	0.085	0.085	0.085	
	CLO3	0.128	0.128	0.085	0.085	0.128	
	CLO4	0.128	0.085	0.128	0.085	0.085	
	CLO5	0.128	0.128	0.128	0.085	0.128	
	Total	0.640	0.555	0.512	0.427	0.555	
20U6LME4	CLO1	0.085	0.043	0.085	0.043	0.128	1.920
	CLO2	0.085	0.043	0.128	0.043	0.128	
	CLO3	0.085	0.043	0.085	0.043	0.085	
	CLO4	0.043	0.085	0.085	0.085	0.128	
	CLO5	0.085	0.043	0.085	0.043	0.085	
	Total	0.384	0.256	0.469	0.256	0.555	
20U6LMP7	CLO1	0.128	0.085	0.128	0.085	0.085	2.474
	CLO2	0.128	0.085	0.128	0.085	0.085	
	CLO3	0.128	0.085	0.085	0.128	0.085	
	CLO4	0.128	0.085	0.128	0.043	0.043	
	CLO5	0.128	0.085	0.128	0.085	0.085	
	Total	0.640	0.427	0.597	0.427	0.384	
20U6LMP8	CLO1	0.128	0.085	0.128	0.085	0.085	2.474
	CLO2	0.128	0.085	0.128	0.085	0.085	
	CLO3	0.128	0.085	0.085	0.128	0.085	
	CLO4	0.128	0.085	0.128	0.043	0.043	
	CLO5	0.128	0.085	0.128	0.085	0.085	
	Total	0.640	0.427	0.597	0.427	0.384	
	Total	23.120	19.067	21.243	17.617	15.953	97

NME COURSES

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	
20U3LNM1	CLO1	0.058	0.019	0.038	0.038	0.038	
	CLO2	0.058	0.019	0.019	0.019	0.038	
	CLO3	0.058	0.038	0.038	0.058	0.019	
	CLO4	0.058	0.019	0.058	0.038	0.019	
	CLO5	0.058	0.058	0.058	0.058	0.019	
	Total	0.288	0.154	0.212	0.212	0.135	1
20U4LNM2	CLO1	0.061	0.041	0.041	0.041	0.020	
	CLO2	0.061	0.020	0.041	0.041	0.020	
	CLO3	0.061	0.041	0.041	0.041	0.020	
	CLO4	0.061	0.020	0.041	0.041	0.020	
	CLO5	0.061	0.041	0.041	0.041	0.041	
	Total	0.306	0.163	0.204	0.204	0.122	1

All the course outcomes are adequately mapped against the programme outcomes and all the programme outcomes carry adequate weight against the cumulative outcome of the programme.

Ancillary Biotechnology Papers for B.Sc., Microbiology

Semester	Subject Code	Paper	Title of the paper	H	C
I	20U1LAC1	Ancillary-I Theory	Concepts in Biotechnology	4	4
	20U1LAP1	Ancillary-I Practicals	Lab in Biotechnology - I	2	1
II	20U2LAC2	Ancillary-II Theory	Biotechnology in Human Welfare	4	4
	20U2LAP2	Ancillary-II Practicals	Lab in Biotechnology-II	2	1

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Ancillary-I	20U1LAC1	Concepts in Biotechnology	4	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

- To introduce fundamental concepts, tools and techniques of Biotechnology
- To make students aware of various types of fermenters
- To motivate the students to aspire for research in Biotechnology
- To make students aware of bioethics and patenting process of biological materials

Unit I: Introduction to Biotechnology

12h

Biotechnology-introduction and historical perspectives. Tools of genetic engineering: Nucleases, Ligases, Polymerases, alkaline phosphatase. Vectors –types of vectors: Plasmid - pBR322, pUC, lambda bacteriophage vectors & M13 vectors. Gene transfer methods – transformation, transduction, electroporation, particle bombardment, Calcium mediated gene transfer. Screening of clones – Insertional inactivation, Blue white colony selection, replica plating method.

Unit II: Industrial & Microbial Biotechnology

12h

Fermentation - definition, process. Bioreactor - types - continuous stirred tank, bubble column, airlift, fluidized and packed bed. Media for industrial fermentation - substrates used as carbon, nitrogen, growth factor sources. Isolation of microbes - enrichment methods, strains from unusual environment, preservation. Genetic improvement of strains-selection of mutants. Regulation of production – feedback, nutrients and induction.

Unit III: Plant & animal Biotechnology

12h

Plant tissue culture – Composition of plant tissue culture medium. Culture methods -callus culture, suspension culture, Protoplast culture, organ culture – anther & pollen, embryo. Agrobacterium mediated gene transfer – Ti plasmids. Animal Biotechnology – Primary and Secondary cell culture, culture medium, cloning methods – microinjection, embryonic stem cell transfer.

Unit IV: Environmental Biotechnology

12h

Sewage– composition, waste water treatment : Primary, Secondary – Aerobic and Anaerobic treatment, Tertiary Treatment – Solids removal, nitrogen removal, phosphorous removal, bioremediation types–*in situ*, *ex-situ*, Biopesticides – *Bacillus thuringiensis*, *Beauveria bassiana*, *Metarhizium* spp, Nuclear Polyhedrosis virus, Phytoremediation.

Unit V: Intellectual Property Rights & Ethics**12h**

Intellectual Property Rights, Intellectual Property Protection, Forms of protection. Patents, Copyrights, Trademarks, Ethics- construction and usage of genetically engineered microbes, plants, animals - drug trials.

Books for Study

1. Satyanarayana. U. 2009. Biotechnology. Books and Allied Pvt. Ltd.
2. Dubey RC. 2012. A textbook of Biotechnology, S. Chand Publications.

Books for Reference

1. Brown TA. 2012. Gene Cloning and DNA Analysis- An Introduction. Wiley Blackwell.
2. Primrose SB and Twyman R. Principles of Gene Manipulation and Genomics, Blackwell.
3. Dubey RC. 2016. Advanced Biotechnology, S. Chand Publications

Web References

<http://dbtindia.gov.in/>

<https://www.easybiologyclass.com/topic-biotechnology/>

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments and group discussions and Problem solving.

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Discover tools and methods used in biotechnology	Up to K-3
CLO-2	Identify various types fermenters and fermentation process	Up to K-3
CLO-3	Dissect strategies and applications of animal and plant biotechnology	Up to K-4
CLO-4	Analyse significance of biotechnological principles in environmental protection	Up to K-4
CLO-5	Explain the patenting process and elaborate ethics related to biotechnology	Up to K-2

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	3	3	1	1	1	--	3
CLO-2	3	2	1	2	2	--	--
CLO-3	3	3	2	2	1	2	--
CLO-4	3	3	3	3	2	1	--
CLO-5	3	3	3	2	2	3	2

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	--	3	2
CLO-2	2	--	1	--	3
CLO-3	3	3	1	2	3
CLO-4	1	2	2	2	1
CLO-5	3	2	2	2	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Staff Name	Hours	Mode
I	Biotechnology-introduction and historical perspectives. Tools of genetic engineering: Nucleases, Ligases, Polymerases, alkaline phosphatase.		4	Chalk and talk PPT
	Vectors –types of vectors: Plasmid - pBR322, pUC, lambda bacteriophage vectors & M13 vectors		4	Chalk and talk
	Gene transfer methods – transformation, transduction, electroporation, particle bombardment, Calcium mediated gene transfer. Screening of clones – Insertional inactivation, Blue white colony selection, replica plating method.		4	Chalk and talk PPT
II	Fermentation – process. Bioreactor – types - continuous stirred tank, bubble column,airlift, fluidized and packed bed.		4	Chalk and talk
	Media for industrial fermentation - substrates used as carbon, nitrogen, growth factor sources.		4	Chalk and talk
	Isolation of microbes - enrichment methods, strains from unusual environment, preservation. Genetic improvement of strains-selection of mutants, Regulation of production – feedback, nutrients and induction.		4	Chalk and talk PPT
III	Plant tissue culture – Composition of plant tissue culture medium.		3	Chalk and talk
	Culture methods -callus culture, suspension culture, Protoplast culture, organ culture – anther & pollen, embryo.		5	Chalk and talk PPT
	Agrobacterium mediated gene transfer – Ti plasmids.		2	PPT
	Animal Biotechnology – Primary and Secondary cell culture, culture medium, cloning methods – microinjection, embryonic stem cell transfer.		2	Chalk and talk PPT
IV	Sewage– composition, Waste water Treatment : Primary, Secondary – Aerobic and Anaerobic treatment, Tertiary Treatment		5	Chalk and talk PPT
	bioremediation types– <i>in situ</i> , <i>ex-situ</i> , Phytoremediation		2	Chalk and talk
	Biopesticides – <i>Bacillus thuringiensis</i> , <i>Beauveria bassiana</i> , <i>Metarhizium</i> spp, Nuclear Polyhedrosis virus.		5	Chalk and talk PPT
V	Intellectual Property Rights, Intellectual Property Protection, Forms of protection. Patents, Copyrights, Trademarks		8	Chalk and talk Chalk and talk
	Ethics- construction and usage of genetically engineered microbes, plants, animals-drug trials.		4	Chalk and talk
			60	

BLUE PRINT FOR INTERNAL ASSESSMENT – I

Articulation mapping – K levels with Course Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
2	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

Articulation mapping – K levels with Course Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
3	CLO 3	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
4	CLO 4	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Concepts in Biotechnology Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
2.	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
5.	CLO 5	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (NoChoice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K3 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K4 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K2Level)	1Question from Unit-V (K2 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Course content designed by Dr. P. Vimal

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Ancillary Practicals-I	20U1LAP1	Lab in Biotechnology-I	1	2	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

- To introduce basic techniques used in biotechnology
- To understand and design a cloning process
- To identify problem, Interpret results and modify the techniques used in biotechnology

Lab Experiments

1. Extraction of genomic DNA from Bacterial Cells
2. Extraction of Plasmid DNA from Bacterial Cells
3. Agarose gel electrophoresis
4. DNA quantification by DPA method
5. Restriction Digestion & Ligation
6. Competent cell preparation & Transformation
7. Selection of recombinants – Blue White Colony Selection
8. Plant tissue culture media preparation & shoot culture
9. Separation of serum and plasma
10. Immobilization of yeast cells
11. Estimation of alcohol in the sample
12. Isolation of lipolytic microorganisms from butter

Spotters

Karyotyping, Ti plasmid, Bioreactor, α complementation, Activated sludge, Dolly., Cloning Vectors maps –pBR322, pUC 18, Microinjection, electroporation

Books for Study

1. John Vennison. 2009. Laboratory Manual of Genetic Engineering. PHI.
2. Sambrook, Joseph. 2001. Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, N.Y. Cold Spring Harbor Laboratory Press.

Books for Reference

1. Abhijit Dutta. 2011. Experimental Biology: A laboratory Manual. Narosa.
2. Rajan&Selvi Christy. 2010. Experimental Procedures in Lifesciences. Anjanaa Book House

Pedagogy

The teaching methods may include: Demonstrations, hands on experiments and Problem solving

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Demonstrate techniques to construct recombinant DNA	Up to K-2
CLO-2	Correlate the results and develop critical thinking skills	Up to K-4
CLO-3	Apply biotechnological concepts to develop new techniques	Up to K-3
CLO-4	Solve the problem associated with disease diagnosis strategies	Up to K-3
CLO-5	Elaborate principle behind the analytical methods	Up to K-2

Mapping of Course outcomes with Program specific Outcomes

CO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	3	3	3	3	2	--	--
CLO-2	3	1	2	1	1	2	--
CLO-3	3	3	1	3	1	1	1
CLO-4	3	3	2	2	2	2	1
CLO-5	3	3	2	3	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

Course content designed by R.Suguna&Dr. P. Vimal

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Ancillary-II	20U2LAC2	Biotechnology in Human Welfare	4	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives

- To learn production of biological products at industry level
- To understand role of DNA in diagnostic and treatment of diseases
- Describe development of transgenic plants and animals and its uses

Unit I: Industrial products in human welfare

12h

Production of organic solvents - ethanol, organic acids - citric acid, antibiotics - penicillins, amino acids - glutamic acid, Vitamin - B12. Polysaccharide – production of Xanthan, biomass – composition: cellulose, hemicellulose, lignin, biomass to ethanol production.

Unit II: Development of transgenic plants & animals

12h

Germplasm conservation - types - *in-situ* and *ex-situ* and cryopreservation. GM crops: Flavr - Savr tomato, golden Rice, Pest resistant, virus resistant, drought resistant. Animal propagation - *In vitro* fertilization technology, artificial insemination in cattle, embryo transfer technique and superovulation in farm animals - MOET.

Unit III: Environmental Biotechnology

12h

Biodegradation – definition, Factors affecting biodegradation, metabolic effects of microbes on xenobiotics, Biodegradation of hydrocarbons, pesticides, genetically engineered bacteria for bioremediation, Biofilters – micro-organisms used in biofilters, mechanisms, Microbial Leaching – copper, uranium, gold, silver, silica.

Unit IV: DNA as a diagnostic tool

12h

Nucleic acid hybridization - DNA probes, mechanism of action of DNA probes, PCR and signal amplification, DNA chip - Microarray - techniques and applications. DNA in diagnosis – RFLP and SNP. Infectious diseases - Malaria, genetic diseases - sickle cell anemia..

Unit V: Medical Biotechnology

12h

Gene therapy - types, treating - ADA deficiency, haemophilia, Cystic Fibrosis. Gene delivery methods. Production of recombinant therapeutic agents - Insulin, hGH, Tissue Plasminogen Activator.

RecombinantSubunit vaccines - Hep B, attenuated recombinant vaccine – Cholera vaccine, DNA Vaccines

Books for Study

1. Satyanarayana. U. 2009. Biotechnology. Books and Allied Pvt. Ltd.
2. Glick BR, Delovitch TL, Patten CL. 2014. Medical Biotechnology. ASM Press, Washington

Books for Reference

1. Primrose SB and Twyman R. Principles of Gene Manipulation and Genomics, Blackwell.
2. Dubey RC. 2016. Advanced Biotechnology, S. Chand Publications.
3. Slater A. 2006. Plant Biotechnology – The Genetic Manipulation of Plants. Oxford press.

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments and group discussions and Problem solving

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Identify biological compounds produced using bioreactors at industry	Up to K-3
CLO-2	Plan strategies for the development of transgenic plants and animals	Up to K-3
CLO-3	Analyse various organisms for degradation waste from environment	Up to K-4
CLO-4	Describe DNA based technologies for diseases diagnostic and treatment	Up to K-2
CLO-5	Survey new therapy methods and vaccines against various diseases	Up to K-4

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	2	--	3	--	2	3	--
CLO-2	3	--	1	1	3	2	1
CLO-3	2	3	1	3	1	2	--
CLO-4	2	2	3	3	2	1	2
CLO-5	1	2	2	3	1	2	--

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	2	--	--	3
CLO-2	2	1	--	--	3
CLO-3	3	3	1	2	3
CLO-4	1	2	2	2	1
CLO-5	3	2	2	2	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Staff Name	Hours	Mode
I	Production of organic solvents - ethanol, organic acids - citric acid, antibiotics - penicillins, amino acids - glutamic acid		6	Chalk and talk PPT
	Vitamin - B12. Polysaccharide – production of Xanthan, biomass – composition: cellulose, hemicellulose, lignin, biomass to ethanol production.		6	Chalk and talk PPT
II	Germplasm conservation - types - <i>in-situ</i> and <i>ex-situ</i> and cryopreservation. GM crops – FlavrSavr, golden Rice		5	Chalk and talk PPT
	Pest resistant, virus resistant, drought resistant		2	Chalk and talk
	Animal propagation - In vitro fertilization technology, artificial insemination in cattle, embryo transfer technique and superovulation in farm animals - MOET.		5	Chalk and talk PPT
III	Biodegradation – Factors affecting biodegradation, metabolic effects of microbes on xenobiotics		3	Chalk and talk PPT
	Biodegradation of hydrocarbons, pesticides, genetically engineered bacteria for bioremediation		3	Chalk and talk
	Biofilters – micro-organisms used in biofilters, mechanisms		3	Chalk and talk
	Microbial Leaching - copper, uranium, gold, silver, silica.		3	Chalk and talk PPT
IV	Nucleic acid hybridization - DNA probes, mechanism of action of DNA probes,		3	Chalk and talk PPT
	PCR and signal amplification, DNA chip - Microarray - techniques and applications.		3	Chalk and talk PPT
	DNA in diagnosis - infectious diseases - Malaria, AIDS, genetic diseases - Cystic fibrosis, sickle cell anemia.		3	Chalk and talk
	DNA fingerprinting, RFLP, VNTR and SNP in diagnosis.		3	Chalk and talk PPT

V	Gene therapy - types, treating - ADA deficiency, haemophilia, Cystic Fibrosis. Gene delivery methods.		4	Chalk and talk PPT
	Gene delivery methods. Production of recombinant therapeutic agents-Insulin, hGH, Clotting Factor VIII, Tissue Plasminogen Activator, Interferons.		4	Chalk and talk PPT
	Recombinant Vaccines - Subunit vaccines - Hep B, HIV, DNA Vaccine, RNA vaccines		4	Chalk and talk
			60	

BLUE PRINT FOR INTERNAL ASSESSMENT – I

Articulation mapping – K levels with Course Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
5	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
6	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

Articulation mapping – K levels with Course Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
7	CLO 3	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
8	CLO 4	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Biotechnology in Human Welfare Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
2	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
3	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K 4	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
5	CLO 5	Up to K 2	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (NoChoice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K3 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K2 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K4 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Course content designed by Dr. P. Vimal

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Ancillary Practicals -II	20U2LAP2	Lab in Biotechnology-II	1	2	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented	✓		Entrepreneurship oriented	

Course Objectives

- To introduce basic techniques used in biotechnology
- To understand and design a cloning process
- To identify problem, Interpret results and modify the techniques used in biotechnology

Lab Experiments

1. Extraction of genomic DNA from Bacterial Cells
2. Extraction of Plasmid DNA from Bacterial Cells
3. Agarose gel electrophoresis
4. DNA quantification by DPA method
5. Restriction Digestion & Ligation
6. Competent cell preparation & Transformation
7. Selection of recombinants – Blue White Colony Selection
8. Plant tissue culture media preparation & shoot culture
9. Separation of serum and plasma
10. Immobilization of yeast cells
11. Estimation of alcohol in the sample
12. Isolation of lipolytic microorganisms from butter

Spotters

Karyotyping, Syndromes, Diseases - Cystic fibrosis, sickle cell Anemia, Duchenne's muscular dystrophy, SNP, Cloning Vectors maps –pBR322, pUC 18, Microinjection, electroporation

Books for Study

1. John Vennison. 2009. Laboratory Manual of Genetic Engineering. PHI.
2. Sambrook, Joseph. 2001. Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, N.Y. Cold Spring Harbor Laboratory Press.

Books for Reference

1. Abhijit Dutta. 2011. Experimental Biology: A laboratory Manual. Narosa.
2. Rajan & Selvi Christy. 2010. Experimental Procedures in Lifesciences. Anjanaa Book House

Pedagogy

The teaching methods may include: Demonstrations, hands on experiments and Problem solving

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K –Level
CLO-1	Demonstrate techniques to construct recombinant DNA	Up to K-2
CLO-2	Correlate the results and develop critical thinking skills	Up to K-4
CLO-3	Apply biotechnological concepts to develop new techniques	Up to K-3
CLO-4	Solve the problem associated with disease diagnosis strategies	Up to K-3
CLO-5	Elaborate principle behind the analytical methods	Up to K-2

Mapping of Course outcomes with Program specific Outcomes

CO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	3	3	3	3	2	--	--
CLO-2	3	1	2	1	1	2	--
CLO-3	3	3	1	3	1	1	1
CLO-4	3	3	2	2	2	2	1
CLO-5	3	3	2	3	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

Course content designed by R.Suguna & Dr. P. Vimal



THE MADURA COLLEGE

(An Autonomous institution affiliated to Madurai Kamaraj University)

Re-accredited (3rd Cycle) with 'A' grade by NAAC

Vidya Nagar, TPK Road, Madurai - 625 011

METHODOLOGY FOR CALCULATION OF COURSE AND PROGRAMME OUTCOMES

Student attainments :

The student attainments are calculated for each student and is indicative of the performance of the student in the attainment of outcomes.

For UG programmes (Regulation 2020),

- the attainments are calculated from the performance of the students in the CIA components only
- Attainments are calculated for each CLO individually.
- After trial run, will be considered for extension for implementation for both CIA and semester examination from the next syllabus regulation, subject to feasibility.

For PG programmes (Regulation 2021),

- the attainments are calculated from the performance in the overall score of the students combining both CIA and semester examinations.
- Attainments are calculated for each course (and not for each CLO)
- After trial run, will be considered for extension for attainment mapping across individual CLOs.

Derivation of weights of programme outcomes for each course learning outcome (UG) / course (PG)

For deriving the weights of each programme outcome corresponding to a course outcome, the mapping of course outcomes against programme outcomes is taken.

Let us assume the following mapping of course outcomes against programme outcomes.

SAMPLE	PO1	PO2	PO3	PO4	PO5
CLO1	3	2		3	1
CLO2	3	2		1	1
CLO3	3	2	1	1	
CLO4	2			2	
CLO5	1			2	

In the above table, 3 indicates high correlation between the course outcome against the programme outcome indicated in the corresponding column. 2 indicates medium correlation and 1 indicates low correlation.

The number 3,2 and 1 shall be used going forward.

Alternatively, using the six-sigma tool - cause effect matrix, we apply the weights 9 corresponding to high correlation, 3 corresponding to medium correlation and 1 corresponding to low correlation.

The decision to use 9:3:1 or 3:2:1 shall be taken for each regulation by the principal.

The revised mapping table after applying the concept of six-sigma becomes

SAMPLE	PO1	PO2	PO3	PO4	PO5
CLO1	9	3		9	1
CLO2	9	3		1	1
CLO3	9	3	1	1	
CLO4	3			3	
CLO5	1			3	

The cumulative weight of each course in the attainment of programme outcomes is calculated by adding all the individual weights corresponding to each programme outcome.

SAMPLE	PO1	PO2	PO3	PO4	PO5	Total
CLO1	9	3		9	1	
CLO2	9	3		1	1	
CLO3	9	3	1	1		
CLO4	3			3		
CLO5	1			3		
Cumulative weight	31	9	1	17	2	60

The weights corresponding to each course (except NME and Part V) against various programme outcomes is tabulated. Since NME has 2 credits out of a total credit of 141, this corresponds to a weight of 1.4% ~ 1%. Part - V having 1 credit out of a total of 141 credits, has a weight of 0.7% ~ 1%.

Course code	Course title	PO1	PO2	PO3	PO4	PO5	Total
20U1PMC1	XYZ	31	9	1	17	60	
Total		1218	698	960	1313	530	4719

After adjusting for two NME courses and Part - V, which contribute to 3% weight to the entire programme, the above cumulative points of 4719 corresponds to 97% of the entire programme. Hence, the weights of each CLO contributing to the Programme Outcomes can be derived by dividing the points corresponding to each CLO by 4719 and multiplying by 97.

SAMPLE	PO1	PO2	PO3	PO4	PO5	Total
CLO1	9/4719*97	3/4719*97		9/4719*97	1/4719*97	
CLO2	9/4719*97	3/4719*97		1/4719*97	1/4719*97	
CLO3	9/4719*97	3/4719*97	1/4719*97	1/4719*97		
CLO4	3/4719*97			3/4719*97		
CLO5	1/4719*97			3/4719*97		
Cumulative weight	31/4719*97	9/4719*97	1/4719*97	17/4719*97	2/4719*97	60/4719*97

Calculating, we get the weights for each programme outcome as below.

SAMPLE	PO1	PO2	PO3	PO4	PO5	Total
CLO1	0.185	0.062		0.185	0.021	
CLO2	0.185	0.062		0.021	0.021	
CLO3	0.185	0.062	0.021	0.021		
CLO4	0.062			0.062		
CLO5	0.021			0.062		
weight	0.637	0.185	0.021	0.349	0.041	1.233

Weights as indicated above are calculated for all the courses of the programme (excluding NME and Part-V). The total weights of all courses will sum up to 97. Each NME course will have a weight of 1% and Part V will have a weight of 1% against the Programme attainments.

The weights against each programme outcome shall be calculated independently for NME and Part V courses and added against the cumulative programme attainment table indicated above.

The procedure of calculating weights is the same for all UG and PG programmes except that :
For PG programmes,

- Since each NME course carry a 2% weight against programme attainments. For two NME courses that correspond to a total of 4%.
- The weights of each CLO contributing to the Programme Outcomes can be derived by dividing the points corresponding to each CLO by cumulative points for the entire programme across all programme outcomes and multiplying by 96.
- The weights against each programme outcome shall be calculated independently for NME courses and added against the cumulative programme attainment table indicated above.

Calculation of Programme attainments for UG programmes at individual student level

In all UG programmes, marks scored by the student against each CLO and against the knowledge level is revised bloom's taxonomy is recorded for marks scored in Continuous internal assessment (CIA). The percentage of marks scored by the students in questions he is deemed to have attended is considered.

Let us consider that a student has scored the following marks in the internal assessment

CLO	K1	K2	K3	K4	K5
CLO 1	-	11/11	-	-	-
CLO 2	3/3	7/13	1/1	-	-
CLO 3	1/1	7/13	15/21	-	-
CLO 4	3/3	3/3	0/10	2/11	-
CLO 5	1/1	3/3	14/21	-	-

Also, the marks scored by each student for all the CLOs and K levels are calculated (across and down)

Using the six-sigma method, the attainments for each K-level against all CLOs is tabulated using the following rule

- >=60% - 9 (High attainment)
- 40-59% - 3 (Medium attainment)
- 0-39% - 1 (Low attainment)

The following table is prepared for each student based on the above rule

	K1	K2	K3	K4	Overall
CLO1					
CLO2					
CLO3					
CLO4					
CLO5					

Sample values for the above mentioned student (given in previous table) will be

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	9
CLO 3	9	3	9	0	9
CLO 4	9	9	0	1	1
CLO 5	9	9	9	0	9
Course attainment for the student					7.4

The student's attainment for the given course is $7.4/9 \times 100 = 82.22\%$

The student's attainments against the programme outcomes corresponding to the particular course is calculated by multiplying the marks scored by the student corresponding to the weight for the particular CLO.

SAMPLE	PO1	PO2	PO3	PO4	PO5	Total
CLO1	$0.185 \times 11/11$	$0.062 \times 11/11$		$0.185 \times 11/11$	$0.021 \times 11/11$	
CLO2	$0.185 \times 11/17$	$0.062 \times 11/17$		$0.021 \times 11/17$	$0.021 \times 11/17$	
CLO3	$0.185 \times 23/35$	$0.062 \times 23/35$	$0.021 \times 23/35$	$0.021 \times 23/35$		
CLO4	$0.062 \times 8/27$			$0.062 \times 8/27$		
CLO5	$0.021 \times 18/25$			$0.062 \times 18/25$		
Weight obtained						
weight	0.637	0.185	0.021	0.349	0.041	1.233

SAMPLE	PO1	PO2	PO3	PO4	PO5	Total
CLO1	0.185	0.062		0.185	0.021	
CLO2	0.120	0.040		0.014	0.014	
CLO3	0.122	0.041	0.014	0.014		
CLO4	0.018			0.018		
CLO5	0.015			0.045		
Weight obtained	0.460	0.143	0.014	0.276	0.035	0.928
weight	0.637	0.185	0.021	0.349	0.041	1.233

The weights obtained for all courses are tabulated to calculate the attainment for the entire programme

Course code	Course title	PO1	PO2	PO3	PO4	PO5	Total
20U1PMC1	XYZ	0.460	0.143	0.014	0.276	0.035	0.928
Weight attained (including NME and Part - V) (A)							
Total		25.036	14.348	19.733	26.989	10.894	97
NME							2
Part - V							1
Weights for each PO (B)		25.036+	14.348+	19.733+	26.989+	10.894+	100

The value (A)/(B)X100 will give the attainment for each Programme outcome and the total.

Programme attainment

PO1	PO2	PO3	PO4	PO5	Total
(A)	(A)	(A)	(A)	(A)	(A)
(B)	(B)	(B)	(B)	(B)	(B)
(A)/(B)*100	(A)/(B)*100	(A)/(B)*100	(A)/(B)*100	(A)/(B)*100	(A)/(B)*100

For PG programmes, the cumulative marks scored in CIA + Semester examination is considered and corresponding weights are calculated from the cumulative weights for each course.

Consider the course for which the weights of Programme outcomes corresponding to course outcomes are as below.

SAMPLE	PO1	PO2	PO3	PO4	PO5	Total
CLO1	0.185	0.062		0.185	0.021	
CLO2	0.185	0.062		0.021	0.021	
CLO3	0.185	0.062	0.021	0.021		
CLO4	0.062			0.062		
CLO5	0.021			0.062		
weight	0.637	0.185	0.021	0.349	0.041	1.233

If a student scored 69% cumulatively in CIA and semester examination, the weights of programme outcomes for the course will be calculated as under

SAMPLE	PO1	PO2	PO3	PO4	PO5	Total
CLO1	0.185	0.062		0.185	0.021	
CLO2	0.185	0.062		0.021	0.021	
CLO3	0.185	0.062	0.021	0.021		
CLO4	0.062			0.062		
CLO5	0.021			0.062		
Weight attained	0.637*69/100 =0.440	0.185*69/100 =0.128	0.021*69/100 =0.014	0.349*69/100 =0.241	0.041*69/100 =0.028	0.851
weight	0.637	0.185	0.021	0.349	0.041	1.233

The weights obtained for all courses are tabulated to calculate the attainment for the entire programme

Course code	Course title	PO1	PO2	PO3	PO4	PO5	Total
20U1PMC1	XYZ	0.440	0.128	0.014	0.241	0.028	0.851
Weight attained (including NME and Part - V) (A)							
Total							96
NME							4
Weights for each PO (B)							100

The value $(A)/(B) \times 100$ will give the attainment for each Programme outcome and the total.

Programme attainment

PO1	PO2	PO3	PO4	PO5	Total
(A)	(A)	(A)	(A)	(A)	(A)
(B)	(B)	(B)	(B)	(B)	(B)
(A)/(B)*100	(A)/(B)*100	(A)/(B)*100	(A)/(B)*100	(A)/(B)*100	(A)/(B)*100

Class attainments

Class attainments are calculated from individual student attainments using two tools

1. Direct attainment
2. Indirect attainment

Direct attainment is calculated from the attainments derived from consolidating the performance of the students in tests, exam, seminar, assignment and any other component of assessment.

Indirect attainment is calculated from the perceived attainment derived from feedback of students on their perceived outcome attainments.

Methodology of deriving Course outcome of the class

The course attainments of the individual students calculated from our previous exercise is taken as the base data.

Let the sample course attainments be as follows for a class.

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	9
CLO 3	9	3	9	0	3
CLO 4	9	9	3	9	9
CLO 5	9	9	9	0	9
					7.8

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	3
CLO 3	9	3	9	0	3
CLO 4	9	3	3	3	3
CLO 5	9	9	3	0	3
					4.2

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	9
CLO 3	9	3	9	0	9
CLO 4	9	3	3	9	9
CLO 5	0	9	3	0	3
					7.8

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	3
CLO 3	9	3	9	0	3
CLO 4	9	9	0	1	1
CLO 5	9	9	3	0	9
					5

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	9
CLO 3	9	3	9	0	3
CLO 4	3	3	3	9	9
CLO 5	0	3	9	0	3
					6.6

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	3
CLO 3	9	3	9	0	9
CLO 4	9	9	3	9	9
CLO 5	9	9	9	1	9
					7.8

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	9
CLO 3	9	3	9	0	9
CLO 4	3	3	3	9	9
CLO 5	0	3	3	0	3
					7.8

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	3
CLO 3	9	3	9	0	9
CLO 4	9	9	3	9	9
CLO 5	9	9	9	0	9
					7.8

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	3.00	1.00	1	0	1
CLO 3	9	1	1	0	1
CLO 4	9	9	3	9	9
CLO 5	9	9	1	0	1
					4.2

REGISTER
NUMBER :

	K1	K2	K3	K4	OVERALL
CLO 1	0	9	0	0	9
CLO 2	9.00	3.00	9	0	9
CLO 3	9	3	9	0	9
CLO 4	9	9	3	9	9
CLO 5	9	9	3	0	3
					7.8

The CLO wise attainments for each student is tabulated separately for consolidation. It is done by taking the attainments for each CLO of each student. The tables consolidated CLO wise for each course will look like the following.

MAPPING OF ATTAINMENT FOR CLO 1

REGISTER NUMBER	K1	K2	K3	K4	OVERALL
	0	9	0	0	9
	0	9	0	0	9
	0	9	0	0	9
	0	9	0	0	9
	0	9	0	0	9
	0	9	0	0	9
	0	9	0	0	9
	0	9	0	0	9
	0	9	0	0	9
	0	9	0	0	9
OVERALL	0	9	0	0	9
K-level attainment	0/9*100 = 0% (Not attained)	9/9*100 = 100% (attained)	0/9*100 = 0% (Not attained)	0/9*100 = 0% (Not attained)	100%

Highest K-level attained : K2

MAPPING OF ATTAINMENT FOR CLO 2

REGISTER NUMBER	K1	K2	K3	K4	OVERALL
	9.00	3.00	9	0	9
	9.00	3.00	9	0	3
	9.00	3.00	9	0	9
	9.00	3.00	9	0	3
	9.00	3.00	9	0	9
	9.00	3.00	9	0	3
	9.00	3.00	9	0	9
	9.00	3.00	9	0	3
	3.00	1.00	1	0	1
	9.00	3.00	9	0	9
OVERALL	8.40	2.80	8.20	0.00	5.80
K-level attainment	$8.4/9 \times 100 = 93.33\%$ (attained)	$2.8/9 \times 100 = 31.33\%$ (not attained)	$8.2/9 \times 100 = 91.11\%$ (attained)	$0/9 \times 100 = 0\%$ (Not attained)	77.77%

Highest K-level attained : K3

MAPPING OF ATTAINMENT FOR CLO 3

REGISTER NUMBER	K1	K2	K3	K4	OVERALL
	9	3	9	0	3
	9	3	9	0	3
	9	3	9	0	9
	9	3	9	0	3
	9	3	9	0	3
	9	3	9	0	9
	9	3	9	0	9
	9	3	9	0	9
	9	1	1	0	1
	9	3	9	0	9
OVERALL	9	2.8	8.2	0	5.8
K-level attainment	$9/9 \times 100 = 100\%$ (attained)	$2.8/9 \times 100 = 31.33\%$ (not attained)	$8.2/9 \times 100 = 91.11\%$ (attained)	$0/9 \times 100 = 0\%$ (Not attained)	77.77%

Highest K-level attained : K3

MAPPING OF ATTAINMENT FOR CLO 4

REGISTER NUMBER	K1	K2	K3	K4	OVERALL
	9	9	3	9	9
	9	3	3	3	3
	9	3	3	9	9
	9	9	0	1	1
	3	3	3	9	9
	9	9	3	9	9
	3	3	3	9	9
	9	9	3	9	9
	9	9	3	9	9
	9	9	3	9	9
OVERALL	7.8	6.6	2.7	7.6	7.6
K-level attainment	$7.8/9 \times 100 = 86.66\%$ (attained)	$6.6/9 \times 100 = 73.33\%$ (attained)	$2.7/9 \times 100 = 30\%$ (not attained)	$7.6/9 \times 100 = 84.44\%$ (attained)	84.44%

Highest K-level attained : K4

MAPPING OF ATTAINMENT FOR CLO 5

REGISTER NUMBER	K1	K2	K3	K4	OVERALL
	9	9	9	0	9
	9	9	3	0	3
	0	9	3	0	3
	9	9	3	0	9
	0	3	9	0	3
	9	9	9	1	9
	0	3	3	0	3
	9	9	9	0	9
	9	9	1	0	1
	9	9	3	0	3
OVERALL	6.3	7.8	5.2	0.1	5.2
K-level attainment	$6.3/9*100 = 70\%$ (attained)	$7.8/9*100 = 86.66\%$ (attained)	$5.2/9*100 = 57.77\%$ (not attained)	$0.1/9*100 = 1\%$ (not attained)	

Highest K-level attained : K2

The direct attainment of Course Outcome is calculated from the attainments of the individual CLOs. This is done by consolidating the CLO wise attainments.

OVERALL DIRECT ATTAINMENT FOR THE COURSE

Course Code :

Course title :

CLO	OVERALL	CLO attainment	Highest K-level attained
CLO 1	9	100.00%	K2
CLO 2	5.8	64.44%	K3
CLO 3	5.8	64.44%	K3
CLO 4	7.6	84.44%	K4
CLO 5	5.2	57.77%	K2
Course attainment	6.68	74.22%	

Indirect attainment :

For measuring the indirect attainment, a questionnaire is created as per the model mentioned below.

Sample questionnaire

How will you rate your attainment of Course Learning Outcomes?

CLO1	0 - 19%	20-39%	40-59%	60-79%	80-100%
CLO2	0 - 19%	20-39%	40-59%	60-79%	80-100%
CLO3	0 - 19%	20-39%	40-59%	60-79%	80-100%
CLO4	0 - 19%	20-39%	40-59%	60-79%	80-100%
CLO5	0 - 19%	20-39%	40-59%	60-79%	80-100%

The answers are weighted based on the rule :

>=60 - 9 (High attainment)

40-59 - 3 (Medium attainment)

0-39 - 1 (Low attainment)

The response for each student is recorded and his attainment is marked 1 or 3 or 9 based on his perceived attainment. The average scores for each CLO is calculated and tabulated.

CLO	Indirect attainment
CLO1	8.33 (example)
CLO2	7.18
CLO3	5.66
CLO4	6.22
CLO5	4.01
Course attainment (average of all CLO attainments)	$31.4 / 5 = 6.28$
Course attainment percentage	69.77%

Course attainment for the entire class :

Overall attainment is calculated by considering 80% of direct attainment and 20% of indirect attainment.

OVERALL DIRECT ATTAINMENT FOR THE COURSE

Course Code :

Course title :

CLO	DIRECT ATTAINMENT	INDIRECT ATTAINMENT	OVERALL ATTAINMENT	Highest attained	K-level
CLO 1	9	8.33	$(0.8*9+0.2*8.33)/9*100$ =98.51%	K2	
CLO 2	5.8	7.18	67.51%	K3	
CLO 3	5.8	5.66	64.13%	K3	
CLO 4	7.6	6.22	81.37%	K4	
CLO 5	5.2	4.01	55.13%	K2	
Course attainm ent	6.68 => 74.22%	6.28 => 69.77%	73.33%		

The overall attainment for the course is 73.33%

For PG programmes, the course attainment for the student is the percentage of marks scored by the student in the course (both CIA and semester examination).

If a student scored 18/25 in CIA and 62/75 in Semester examination, his course attainment is 80.00%.

To find the class attainment, the average course attainments of all students are taken. Using the six-sigma method, the course attainments for each student is tabulated using the following rule

- >=60% - 9 (High attainment)
- 40-59% - 3 (Medium attainment)
- 0-39% - 1 (Low attainment)

Course Code :

Course title :

Register number	Course attainment
	9
	6
	9
Class attainment	=Average(:) = (3)

Indirect attainment is calculated in the same manner in which it is calculated for UG programmes.

The course attainment for the entire class will be

$$((\text{DIRECT ATTAINMENT}) \times 0.8 + (\text{INDIRECT ATTAINMENT}) \times 0.2) / 9 \times 100\%$$

Calculation of Programme attainments (for both UG and PG programmes)

Programme attainments are calculated from each course as per the weights assigned for each course against the programme outcomes.

Let us consider the sample course with the following weights against various programme outcomes as follows.

SAMPLE	PO1	PO2	PO3	PO4	PO5	Total
CLO1	0.185	0.062		0.185	0.021	
CLO2	0.185	0.062		0.021	0.021	
CLO3	0.185	0.062	0.021	0.021		
CLO4	0.062			0.062		
CLO5	0.021			0.062		
weight	0.637	0.185	0.021	0.349	0.041	1.233

For the sample attainment table given by

OVERALL DIRECT ATTAINMENT FOR THE COURSE

Course Code :

Course title :

CLO	DIRECT ATTAINMENT	INDIRECT ATTAINMENT	OVERALL ATTAINMENT	Highest attained	K-level
CLO 1	9	8.33	$(0.8*9+0.2*8.33)/9*100$ =98.51%	K2	
CLO 2	5.8	7.18	67.51%	K3	
CLO 3	5.8	5.66	64.13%	K3	
CLO 4	7.6	6.22	81.37%	K4	
CLO 5	5.2	4.01	55.13%	K2	
Course attainm ent	6.68 => 74.22%	6.28 => 69.77%	73.33%		

The overall attainment for the course is 73.33%

The Programme attainments corresponding to the weights of this course will be

SAMPLE	PO1	PO2	PO3	PO4	PO5	Total
CLO1	0.185	0.062		0.185	0.021	
CLO2	0.185	0.062		0.021	0.021	
CLO3	0.185	0.062	0.021	0.021		
CLO4	0.062			0.062		
CLO5	0.021			0.062		
weight	$0.637*73.3$ 3/100 =0.467	$0.185*73.3$ 3/100 =0.136	$0.021*73.33$ /100 =0.015	$0.349*73.33$ /100 =0.255	$0.041*73.33$ /100 =0.030	$1.233*73.33$ /100 =0.904

The weights obtained for all courses are tabulated to calculate the class attainment for the entire programme

Sample for UG

Course code	Course title	PO1	PO2	PO3	PO4	PO5	Total
20U1PMC 1	XYZ	0.460	0.143	0.014	0.276	0.035	0.928
Weight attained (including NME and Part - V) (A)							
Total		25.036	14.348	19.733	26.989	10.894	97
NME							2
Part - V							1
Weights for each PO (B)		25.036+	14.348+	19.733+	26.989+	10.894+	100

The value $(A)/(B) \times 100$ will give the attainment for each Programme outcome and the total.

Programme attainment

PO1	PO2	PO3	PO4	PO5	Total
(A)	(A)	(A)	(A)	(A)	(A)
(B)	(B)	(B)	(B)	(B)	(B)
(A)/(B)*100	(A)/(B)*100	(A)/(B)*100	(A)/(B)*100	(A)/(B)*100	(A)/(B)*100

Sample for PG

Course code	Course title	PO1	PO2	PO3	PO4	PO5	Total
20U1PMC 1	XYZ	0.440	0.128	0.014	0.241	0.028	0.851
Weight attained (including NME and Part - V) (A)							
Total							96
NME							4
Weights for each PO (B)							100

The value $(A)/(B) \times 100$ will give the attainment for each Programme outcome and the total.

Programme attainment

PO1	PO2	PO3	PO4	PO5	Total
(A)	(A)	(A)	(A)	(A)	(A)
(B)	(B)	(B)	(B)	(B)	(B)
$(A)/(B) \times 100$	$(A)/(B) \times 100$	$(A)/(B) \times 100$	$(A)/(B) \times 100$	$(A)/(B) \times 100$	$(A)/(B) \times 100$

Note:

Till deep integration with examination software, attainment shall be calculated using any revised methodology as decided by the exam cell.

**** THE END ****