



THE MADURA COLLEGE (AUTONOMOUS)

(Affiliated to Madurai Kamaraj University, Reaccredited (4th cycle) with “A” Grade by NAAC)

TPK Road, Madurai – 625 011, Tamil Nadu

www.maduracollege.edu.in

ACADEMIC COUNCIL

03.04.2024



ESTD : 1889

Learning Shines with Righteousness

BOOK 3 of 3

(Corrected Copy)

(Syllabi Pages : 1317-1926)



THE MADURA COLLEGE (AUTONOMOUS)

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Ordinary Meeting of the Academic Council

Venue : Seminar Hall

Date : 03.04.2024

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: 13.03.2024

NOTICE

An ordinary meeting of the Academic Council will be held on **3rd April 2024** 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 16.03.2024. The deadline for withdrawal of resolutions will be 19.03.2024 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.Seetharaman,

President,

Madura College Board,

Madurai.

C.A.S.Natanagopal,

Secretary,

Madura College Board,

Madurai.

Sri.N.Anand Srinivasan,

Treasurer,

Madura College Board,

Madurai.

Dr.K.Perumal

Professor

Department of Computer Applications

School of Information Technology

Madurai Kamaraj University

Madurai – 625 021.

Dr.V.Ramarajapandian

Professor

Department of Modern Literature

School of Tamil Studies

Madurai Kamaraj University

Madurai – 625 021.

Dr.S.Saleema Rabiyyath.

Assistant Professor

Department of Journalism and Mass Communication

Directorate of Distance Education

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)

Vice president – 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) **(Reaccredited with “A” Grade by NAAC)**

ACADEMIC COUNCIL

AGENDA FOR THE MEETING ON 03.04.2024

1. Prayer
2. Welcome Address : The Chairman, Academic Council
3. Confirmation of the Minutes of the previous Academic Council Meeting held on 12.10.2023
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 12.10.2023.**



THE MADURA COLLEGE

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MADURAI -625 011

MEETING OF THE ACADEMIC COUNCIL

Date : 12.10.2023 (Thursday)

Venue: Seminar Hall

Time : 10.30a.m.

MINUTES OF THE ACADEMIC COUNCIL MEETING

The ordinary meeting of the Academic Council was held in the Seminar Hall on Thursday, 12th October 2023 at 10.30 am.

Members Present

1) Dr. J. Suresh (Chairman, Academic Council)	35) Dr. R. Vennila
2) Dr. R. Eswaran (Member Secretary, Academic Council).	36) Dr. A. Karuppusamy
3) Sri. S. Seetharaman (Preseident, MCB)	37) Dr. S. Ramachandran
4) C.A.S. Natanagopal (Secretary, MCB)	38) Dr. S. Karthika
5) Dr. K. Perumal (University Nominee)	39) Prof. P. Jayalakshmi
6) Dr. V. Ramarajapandian (University Nominee)	40) Dr. S. Muthukumar
7) Dr. S. SaleemaRabiyath (University Nominee)	41) Dr. C. Thangapandi
8) Sri. S. Sankaran (Member representing Industry & Director, MCB)	42) Dr. R. Pandiselvi
9) Dr. S. Dhanasamy	43) Dr. K.M. Dharmalingam
10) Dr. A. Atheeswari	44) Dr. V. Ananthaswamy
11) Dr. G. Karunakaran	45) Dr. I. SahulHamid
12) Dr. V. Usha	46) Dr. U. Karthick Raja
13) Dr. M. Kannan	47) Dr. I. Padmavathi
14) Dr. D. Gandhimathi	48) Dr. S. Usha
15) Dr. S. Kannadasan	49) Dr. V. Sangeethasubha
16) Dr. Sheela P. Karthick	50) Dr. P. Vetriselvi
17) Dr. G. Sivasubramanian	51) Dr. R. Madhanagopal
18) Dr. A. Chandrabose	52) Dr. M. Venkateswaran
19) Dr. A. Vigneshkumar	53) Dr. A. Saberunnisa
20) Dr. S. Venkatesh	54) Dr. M. Rabert
21) Prof. B. Tamilselvi	55) Dr. M. Premarani
22) Prof. S. Murali	56) Prof. V. Meenakshisundaram
23) Prof. P. Manikandan	57) Prof. T. Vivekanandan
24) Dr. S. Theenathalayan	58) Prof. S. Sivaramakrishnan
25) Dr. P. Kannan	59) Dr. M. Kavitha
26) Dr. R. Gopi	60) Dr. G. Gowri
27) Dr. V. Sriman Narayanan	61) Dr. K. Neyvasagam
28) Dr. S. Karthikeyan	62) Dr. R. Vishnu Priya
29) Dr. S. Meenakshi	63) Dr. J. Sivasubramanian
30) Dr. A. Mayilmurugan	64) Dr. A. Xavier
31) Dr. S. Selvakumar	65) Dr. M. Karpagavalli
32) Dr. K. HemaMalini	66) Dr. P. Gajendran
33) Dr. Y. Natarajan	67) Dr. M. Malarvizhi
34) Dr. S. Chandrasekar	68) Prof. S. Vidhyasankar

69) Dr. S. Selvakumar	85) Dr. C. Selvakumar
70) Dr. P. Prasanna	86) Er. J. Rajendran
71) Dr. M. Boominathan	87) Prof. R. Umasankari
72) Dr. M. HasmathFarzana	88) Dr. T. SreeRamkumar
73) Dr. J. Shanmugapriya	89) Dr. K. Kathirvelpandian
74) Prof. S. Chella Pandian	90) Dr. N. Paneerselvam
75) Dr. P. Kannan	91) Dr. R. Karthikeyan
76) Dr. S. Karuppusamay	92) Prof. S. Selvaulaganathan
77) Dr. S. Gnaana Saraswathi	93) Dr. J. Premkumar
78) Prof. V. Meenakshisundaram	94) Prof. G. Sreedevi
79) Dr. M. Karpagajothi	95) Dr. R. Chitra
80) Dr. P. Jansirani	96) Dr. P. Pandi
81) Dr. N. Janakiraman	97) Prof. K. Rajasaravanakumar
82) Dr. S. Dinakaran	98) Prof. R. Suguna
83) Dr. L.D. Devasree	99) Dr. K. Rajeswari
84) Dr. B. Latha	100) Mr. M. Venkatraman

1. The meeting was called to order by Dr.J.Suresh, Principal and The Chairman of the Academic Council (*hereafter mentioned as The Chairman*). The meeting started with the college prayer. The Chairman welcomed Sri.S.Seetharaman, President, Madura College Board (MCB), CA.S.Natanagopal, Secretary, MCB, Sri.N.Anand Srinivasan, Treasurer, MCB, University nominees: Dr.K.Perumal, Dr.V.Ramarajapandian and Dr.S.SaleemaRabiyath, all Heads of the Departments (HoDs), Deans, Dr.N.Paneerselvam, Chief Coordinator (Self-Financing Stream), Controller of Examinations, Deputy Controller of Examinations, Assistant Controller of Examinations, Co-ordinators (SF stream) and all other members of the Academic Council.

2. The Chairman, in his welcome address, overviewed the milestones of achievements in the designing and implementation of Outcome Based Education (OBE), and also in the attainment calculation for Under-graduate (UG) & Post-graduate (PG) programmes. He narrated the stages of ceaseless updating of Curriculum based on Tamil Nadu State Council for Higher Education (TANSCH) model. And with delight, he announced that NAAC assessment has given high score (3.61 out of 4) for the Criterion-I (Curricular aspects) covering curriculum design and implementation. Furthermore, he also remembered the successful implementation of job-oriented courses and value-added courses under OBE. The chairman profusely thanked the Madura College Board for their support and encouragement. He also announced the forethought of the College Management's proposal to conduct the value added courses in collaboration with TVS Community College in the forthcoming years. He also correlated the vision & mission of the college with related planning in the curriculum and other aspects. The chairman concluded

by appreciating the support rendered by the faculty for the accomplishment. He also requested the faculty to carry the tradition and legacy of The Madura College forward.

3. The Minutes of the previous Academic Council meeting held on 20.07.2022 was confirmed and passed. The Chairman invited the Heads and Chairmen, Board of Studies (BoS) of all the Departments to present their resolutions one by one.

4. Resolutions No. **1.1. to 1.8.** were moved by **Dr.S.Dhanasamy**, Chairman, BoS of Tamil department and seconded by **Dr.A.Atheeswari**. Dr.S.Muthukumar, questioned the need of resolution 1.3. regarding the separate resolution for Part-I Tamil for B.A. Tamil students. Dr.A.Atheeswari explained that the Part-I Tamil also given for B.A. Tamil students too. After brief deliberations, Chairman (BoS) agreed to **withdraw resolution 1.3.**

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 of Hindi department and seconded by **Dr.S.Dinakaran**. Dr.S.Muthukumar requested to remove the word “curriculum” in the resolution. Prof.S.Murali agreed to correct 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 of Sanskrit department and seconded by **Prof.S.Murali**. He also agreed to remove the word “curriculum” in the resolution.

Then, the motion was put to vote and CARRIED.

8. Resolutions No. **4.1. to 4.8.** were moved by **Dr.Sheela P.Karthick**, Chairperson, BoS of English department and seconded by **Dr.G.Sivasubramanian**. Dr.S.Muthukumar requested to mention B.Sc. Statistics in the tabular column in Page No. 197. He also suggested the department to mention one of the B.Com. courses as B.Com (Financial Marketing Analytics) instead of B.Com (Corporate Markets). He also advised the department to mention General English-I in the Table at page number 220. She agreed for the changes suggested by the member. In response to Resolution 4.8, The chairman questioned the need of resolution for changing the type of course. Dr.Sheela P.Karthick narrated the need of changing and highlighted benefits gain by the students.

Then, the motion was put to vote and CARRIED.

8. Resolutions No. **5.1. to 5.7.** were moved by **Dr.S.Theenathayalan**, Chairman, BoS of Economics department, and seconded by **Dr.P.Kannan**.

Prof.S.Chellapandian questioned the use of the term “revised curriculum” in the resolution. Dr.S.Theenathayalan explained that the department followed the standard format for resolutions supplied by the college. Dr.S.Muthukumar queried about the resolution 5.5 regarding the Skill Enhancement (SEC) offered by the department. He also suggested to include the word “M.A. Economics” in the resolution. Dr.S.Theenathayalan agreed to make changes in the resolution.

Then, the motion was put to vote and CARRIED.

9. Resolution Nos. **6.1. to 6.11.** were moved by **Dr.A.Mayil Murugan**, Chairman, BoS of Commerce department, and seconded by **Dr.S.Selvakumar**. Prof.S.Chellapandian requested to remove the word “curriculum” in the resolution as done by other departments. Dr.S.Muthukumar suggested to include the programme name in bracket for the SEC course, Fundamentals of Accounting software. Dr.S.Muthukumar also queried about resolution no.6.4, regarding programme approval from Madurai Kamaraj University. The chairman intervened and conveyed that since we received the approval from the University, the word “subject to Approval” may be removed in the resolution no.6.4. Dr.S.Muthukumar and Dr.A.Xavier queried about the usage of the term “Multidisciplinary course (MDC)” instead of Inter-disciplinary course (IDC) as used by other departments. Dr.A.Mayilmurugan replied that it was decided in the earlier meeting as the usage as MDC for commerce instead of IDC. Prof.S.Sivaramakrishnan opined that the word “curriculum” can be removed in the resolutions 6.9 and 6.10. Dr.Mayilmurugan requested the approval from the August body to include the quiz in the extended component of the table in page number 461. Then, the motion was put to vote and CARRIED.

9. Resolutions No.**7.1. to 7.12.** were moved by **Dr.S.Muthukumar**, Chairman, BoS of Mathematics department and seconded by **Dr.C.Thangapandi**. While presenting resolution 7.3, Dr.S.Dinakaran requested to clarify whether the resolution is for UG or PG. Dr.A.Xavier and Prof.S.Sivaramakrishnan clarified that Generic Elective courses are for I year and II year UG students and hence suggested to correct the resolution by adding the word ‘UG’ in the resolution. Prof.S.Sivaramakrishnan reiterated that Generic Elective courses cannot be offered for the students by the parent department as we decided to consider Generic Elective courses as equal with allied courses. Dr.S.Muthukumar agreed for the changes in the resolution. Then, the motion was put to vote and CARRIED.

10. Resolutions No.8.1 to 8.10. were moved **Dr.P.Vetriselvi**, Chairperson, BoS of Statistics department and seconded by **Dr.P.Madhanagopal**. Dr.S.Muthukumar pointed out the typographical error in Page number 1007 as the total number of credit was mentioned as 20 instead of 22. Further, he suggested to include the word “PG programmes” in the resolutions 8.4. & 8.5. Dr.P.Vetriselvi agreed to correct the resolutions. Dr.S.Muthukumar also suggested to extend the certificate courses by the department to UG students too. The chairperson also counseled that if the department wishes to extend the courses to UG students, the department can place it in the next BoS and pass the resolution in the ensuing Academic council meeting.

Then, the motion was put to vote and CARRIED.

11. Resolutions No. 9.1. to 9.6. were moved **Dr.M.Prema Rani**, Chairperson, BoS of Physics department, and seconded by **Prof.V.Meenakshi Sundaram**. She requested to correct the typographical errors in Page number 1096 and pleaded the August body for the nod for changing the credits as per standard pattern followed for science departments in the college. Dr.S.Muthukumar suggested to split up the table semester-wise in Page number 1151. He also requested to mention “PG programme” in resolutions 9.4.. Dr.M.Prema Rani agreed to correct the changes suggested by the members.

Then the motion was put to vote and CARRIED.

12. Resolutions No. 10.1. to 10.10. were moved by **Dr.A.Xavier**, Chairman, BoS of Chemistry department and seconded by **Dr.M.Karpagavalli**. Dr.S.Muthukumar requested clarification regarding ancillaries (General Electives) offered to various departments. Dr.A.Xavier reiterated that the pattern followed for clustering of ancillary departments is different for theory and practical. He added that B.Sc. maths students and Zoology students are clustered for the practical, and for theory Zoology is combined with Botany. While reading resolution 10.3., Prof.S.Sivaramakrishnan suggested not to mention the programme name in the resolution. Dr.K.Perumal, University nominee, also supported for mentioning the programme name in the resolution. While passing the resolution 10.5, members requested to remove the term “SF stream” in the resolution. Dr.A.Xavier agreed for the change in resolution. At the end, The chairman, Academic Council, requested the BoS chairmen not to read the page numbers while reading the resolutions.

Then, the motion was put to vote and CARRIED.

13. Resolutions Nos. **11.1. to 11.8.** were moved by **Prof.S.Chellapandian**, Chairman, BoS of Botany department and seconded by **Dr.P.Kannan**. Dr.S.Muthukumar requested to change the word “introduce” instead of “ratify” in the resolutions. The chairman suggested to remove the words, “question paper pattern” in the resolutions 11.1, 11.2 & 11.3. Prof.S.Chellapandian agreed and read all the resolutions by mentioning the changes suggested by the member and The chairman. Dr.S.Muthukumar questioned the need of passing of syllabi for Botany allied papers to be offered in 3rd and 4th semesters in the current meeting. The chairman, Academic Council, intervened and supported the stand of Botany department.

Then, the motion was put to vote and CARRIED.

14. Resolutions No. **12.1. to 12.4.** were moved by **Dr.S.Dinakaran**, Chairman, BoS of Zoology department and seconded by **Dr.L.D.Devasree**. The council unanimously agreed the resolutions.

Then the motion was put to vote and CARRIED.

Dr.S.Dinakaran requested The Chairman, to give one page printout containing resolutions to be read by the particular BoS chairman, which may be easier to carry instead of carrying the voluminous Academic council books containing more than 1900 pages. The chairman agreed to give.

15. Resolutions No. **13.1 to 13.4.** were moved by **Er.J.Rajendran**, Chairman, BoS of Computer Science department and seconded by **Prof.R.Umasankari**. He read the resolutions by mentioning the corrected word “ratify” in the resolutions. He also requested the members to read the course title (23U1DCCT1) as “Programming in C” instead of “C Programming”. Dr.S.Muthukumar questioned on passing the resolution 13.2. since the resolution passed already in the BoS of Mathematics Department. It went on larger deliberation. At the end, members suggested to withdraw the resolution. Er.J.Rajendran, with the approval of The chairman, Academic Council **withdrew the resolution 13.2.**

Then, the motion was put to vote and CARRIED.

16. Resolutions No. **14.1. to 14.6.** were moved by **Prof.K.Rajasaravanakumar**, Chairman, BoS of Information Technology department and seconded by **Dr.K.Rajeswari**. The motion was then thrown open for discussion. Dr.S.Muthukumar requested to mention UG programme and PG programme in the Resolutions 14.3. and 14.4. respectively. Prof.K.Rajasaravanakumar agreed to correct the changes suggested by the member.

Then, the motion was put to vote and CARRIED.

17. Resolutions No.15.1. to 15.6. were moved by **Dr.K.Rajeswari**, Chairperson, BoS of Microbiology department and seconded by **Prof.R.Suguna**. Dr.S.Mutkukumar queried about the department offering the course, Basic and Clinical Chemistry. Dr.K.Rajeswari replied that the paper was offered by the department itself. By indicating page number 1721, Dr.S.Mutkukumar requested to change the marks mentioned in the CIA and semester examinations as 25 and 75 respectively. Prof.S.Chellapandian requested to change the word “pass” in the resolution to “ratify”. Dr.K.Rajeswari agreed to correct the changes suggested by the members. Then, the motion was put to vote and CARRIED.

18. Resolutions No.16.1. to 16.4. were moved by **Prof.R.Suguna**, Chairperson, BoS of Biotechnology department and seconded by **Dr.K.Rajeswari**. Members unanimously agreed for passing the resolutions. Then the motion was put to vote and CARRIED.

19. Resolutions No.17.1. and 17.2. were moved by **Prof.S.Sivaramakrishnan**, Dean (Academics) and seconded by **Dr.I.Sahul Hamid**, Dean (Planning & Development). Then, the motion was put to vote and CARRIED. Dr.S. Gnaana Saraswathi queried about the preparation of question bank for the new courses introduced. The chairman, Academic Council replied that, question banks can be prepared as the basis of necessity. And regarding the supply of new question bank for the courses under TANSCHÉ, as decided in earlier meetings no question bank will be supplied for the courses passed.

The Chairman requested the University nominees to give their observations and remarks. Dr.K.Perumal expressed his views about the deliberations of the academic council as follows:

1. He congratulated all the members for the fruitful deliberations and felt very happy to be a part of it.
2. He also highlighted the difficulty in following TANSCHÉ pattern as it rejects the diversity in the content of syllabi.
3. He suggested to include the recent references and asked books to avoid which are decades old.
4. He recommended to introduce the Skill Based papers in line with core courses.
5. Also, he suggested to include computer science - oriented courses especially Artificial Intelligence in various domains.

Dr.V.Ramarajapandian expressed his views as follows:

1. He cherished the tradition of The Madura College by remembering the achievements made by The Madura College in the arena of academics.
2. He felt happy to be a part of the Academic council of this college.
3. He also suggested to include the recent developments in Part-I language & Part-V.

20. The Member secreatry, Dr.R.Eswaran proposed vote of thanks .

21. The Chairman, Academic Council, adjourned the Academic Council *sine die* and as a mark of completion of this academic exercise National Anthem was sung by all the participants.



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 13.02.2024.

- 1.1. Resolved to introduce the revised syllabus for II year B.A./B.Sc. and B.Com. (other than B.A. Tamil) Part-I Tamil for students who joined the programme from the academic year 2023-24 **(pp 1-11, 13)**.
- 1.2. Resolved to introduce the revised syllabus for II year B.A. Tamil, Part-I Tamil for students who joined the programme from the academic year 2023-24 **(pp 14-18, 46-50)**.
- 1.3. Resolved to introduce the revised curriculum, syllabus, programme structure for II year B.A. Tamil for students who joined the programme from the academic year 2023-24 **(pp 12, 19-42, 45, 51-75)**.
- 1.4. Resolved to introduce the revised Add On courses titled 'IDHAZHİYAL' and 'KAVITHAIK KALAI' to be offered during the III and IV Semester of B.A. Tamil for students who joined the programme from the academic year 2023-24 **(pp 13, 43-44, 76-78)**.
- 1.5. Resolved to introduce the revised Self Study course titled 'PUDHUMAIPITTHAN' of II B.A. Tamil for students who joined the programme from the academic year 2023-24 **(pp 13, 79-80)**.
- 1.6. Resolved to introduce the revised curriculum, syllabus, programme structure for II year M.A. Tamil for students who joined the programme from the academic year 2023-24 **(pp 81-153)**. The curriculum includes a Multi-disciplinary course titled TAMIL AZHAKIYAL offered jointly with the department of Economics and Botany **(pp 112-118)**.

**Resolutions 1.7. & 1.8. – withdrawn*

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 13.02.2024.

- 2.1. Resolved to pass the revised syllabus for Part-1 Language Hindi based on TANSCHÉ model curriculum for Second year B.A./ B.Sc./ B.Com. Programme for students who join the programme from the Academic year 2023-24 (**pp 154-165**).

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 13.02.2024.

- 3.1. Resolved to pass the revised syllabus for Part-1 Language Sanskrit based on TANSCHÉ model curriculum for Second year B.A./B.Sc./ B.Com. Programme for students who join the programme from the Academic year 2023-24. (**pp 166-180**).

4) FROM THE BOARD OF STUDIES OF ENGLISH DEPARTMENT

Dr.SheelaP.Karthick, Chairman, Board of Studies in English, shall move and **Dr.G.Sivasubramanian** shall second the following resolutions, passed in the Board of Studies meeting held on 13.02.2024.

- 4.1. Resolved to pass the syllabi for Part II English based on TANSCHÉ model curriculum for the second year (semester III & IV) B.A./B.Sc./ B.Com. programmes under outcome based education with Choice Based Credit System for students who joined the programmes from the Academic year 2023-2024 (**pp 181-196**).
- 4.2. Resolved to pass the revised curriculum, programme structure and syllabi based on the TANSCHÉ model curriculum, under outcome based education with choice based credit system for the second year (Semester III & IV) B.A. English programme for students who joined the programme from the Academic year 2023-24 (**pp 197-242**).
- 4.3. Resolved to pass the revised curriculum, programme structure and syllabi based on the TANSCHÉ model curriculum for the second year (semester III & IV) M.A. English programme for students who joined the programme from the Academic year 2023-24 (**pp 243-303**).The curriculum includes a Multi –Disciplinary Course on “Green Studies” offered jointly with the department of Tamil and Botany (**pp 264-269**).

- 4.4. Resolved to pass the syllabus for the Generic elective courses to be offered by the department of English to B.A. English programme for students who joined the programme from the Academic year 2023-24 (**pp 207-211, 229-232**).
- 4.5. Resolved to pass the syllabus for the Discipline specific elective courses to be offered to students of M.A.English programme who joined the programme from the Academic year 2023-24 (**pp 259-263, 289-293**).
- 4.6. Resolved to pass the syllabus for Skill Enhancement courses to be offered to the students of B.A.English programme who joined the programme from the Academic year 2023-24 (**pp 212-220, 233-240**).
- 4.7. Resolved to pass the syllabus for Skill Enhancement courses to be offered to the students of M.A.English programme who joined the programme from the Academic year 2023-24 (**pp 294-291**).
- 4.8. Resolved to pass the syllabus for Skill Enhancement course to be offered as NME to all PGprogrammes for students who joined the respective programmes from the Academic year 2023-24 (**pp 270-274**).

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 13.02.2024.

- 5.1. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for II - B.A. Economics Programme for students who have joined from the Academic year 2023-24 and onwards (**pp 304-368**).
- 5.2. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for II - M.A. Economics programme for Students who have joined from the Academic Year 2023-24 and onwards (**pp 369-433**). The curriculum includes a Multi-Disciplinary course offered jointly with the departments of Tamil, Commerce and Statistics (**pp 391-395**).
- 5.3. Resolved to pass the syllabi for the Generic Elective Courses (GEC) to be offered to the students of II – Year B.A. Economics and II – Year M.A. Economics programmes who have joined the respective programmes from the Academic year 2023-24 and onwards (**pp 322-326, 350-353, 386-390, 415-424**).

- 5.4. Resolved to pass the syllabi for Skill Enhancement Courses (SEC) to be offered for the II - Year B.A. Economics and II – Year M.A. Economics programmes for the students who have joined their respective programmes from the Academic Year 2023-24 and onwards **(pp 327-335, 354-358; 425-429)**.
- 5.5. Resolved to introduce a Non-Major Elective Course (NME) titled “Budget and Financial Administration” in the Third Semester for the students who have joined their respective programmes from the Academic Year 2023-24 and onwards **(pp 396-400)**.
- 5.6. Resolved to introduce two Add-on Courses namely Rural Development Studies and Labour Economics for the students of II – B.A. Economics who have joined from the Academic Year 2023-24 and onwards **(pp 359-362)**.
- 5.7. Resolved to introduce a Self Study Course entitled Energy Economics for the students of II – B.A. Economics who have joined from the Academic Year 2023-24 and onwards **(pp 363-364)**.
- 5.8. Resolved to introduce a Certificate Course entitled Economics for Competitive Examinations for the students of all Under Graduate Students (Open to all) who have joined from the Academic Year 2023-24 and onwards **(pp 365-366)**.
- 5.9. Resolved to introduce Internship, Project cum viva-voce and Extension Activity for the II – M.A. Economics students who have joined from the Academic Year 2023-24 and onwards as per TANSCHÉ guidelines **(pp 401-402, 413-414, 430-431)**.

6) FROM THE BOARD OF STUDIES OF COMMERCE DEPARTMENT

Dr.A.Mayilmurugan, 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 13.02.2024.

- 6.1. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for second year B.Com (General) Programme for students who joined the programme from the Academic year 2023-24 **(pp 434-436, 444, 448-657)**.
- 6.2. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for second year B.Com (Professional Accounting) Programme for students who joined the programme from the Academic year 2023-24 **(pp 437-438, 445, 448-657)**.

- 6.3. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for second year B.Com (Banking and Insurance) Programme for students who joined the programme from the Academic year 2023-24 (**pp 439-440, 446, 448-657**).
- 6.4. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for second year B.Com (Financial Marketing Analytics) Programme for students who joined the programme from the Academic year 2023-24 (**pp 441-442, 447, 448-657**).
- 6.5. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for second year M.Com. programme for Students who joined the programme from the Academic Year 2023-24 (**pp 443, 658-733**).
- 6.6. Resolved to pass Multi-Disciplinary Course on “Insurance, Actuarial Statistics and Economy” for II year M.Com students during III Semester for those who have joined from the Academic Year 2023-24. The course is offered with the departments of Economics and Statistics (**pp 688-693**).
- 6.7. Resolved to pass Non Major Elective (NME) course on “Marketing and Salesmanship” for PG students (other than Commerce) during III Semester for the students who have joined their respective programmes from the Academic Year 2023 -24 (**pp 694-698**).
- 6.8. Resolved to pass the revised syllabi for Generic elective courses ‘Financial Accounting’ and ‘Cost and Management Accounting’ based on TANSCHÉ model curriculum for second year B.Sc (IT) Programme during III Semester and IV Semester respectively for students who have joined the programme from the Academic year 2023-24 (**pp 734-743**).
- 6.9. Resolved to pass the revised syllabi for Skill Enhancement Course ‘Basic Accountancy’ based on TANSCHÉ model curriculum for second year B.A (Economics) Programme during IV Semester for students who joined the programme from the Academic year 2023-24 (**pp 744-747**).

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 13.02.2024.

- 7.1. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for II B.Sc. Mathematics students who joined the programme from the Academic year 2023-24 **(pp 748-785)**.
- 7.2. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for II M.Sc. Mathematics Students who joined the programme from the Academic Year 2023-24 **(pp 786-864)**.
- 7.3. Resolved to pass the revised syllabus for the Generic Elective courses offered to the students of programme other than their programme of study and who joined their respective programmes from the Academic year 2023-24 **(pp 865-883)**.
- 7.4. Resolved to pass the revised syllabus for Skill Enhancement Courses offered to the students of II B.Sc. Mathematics students who joined the programmes from the Academic year 2023-24 **(pp 760-767, 776-783)**.
- 7.5. Resolved to pass the revised syllabus for Skill Enhancement courses in the third semester offered to the students of M.Sc. Mathematics who joined the programme from the Academic Year 2023-24 **(pp 849-852)**.
- 7.5. Resolved pass the revised syllabus for the NME courses offered to students of PG programmes in the third semester for students of programmes other than their programme of study who joined from the Academic Year 2023-24 **(pp 814-818)**.
- 7.6. Resolved to ratify the presentation of elaborate form of syllabus and the inclusion of section numbers in the textbook content for the paper “Computational Mathematics” 23U2MSED3 for the first year under graduate students in second semester **(pp 884-888)**.
- 7.7. Resolved to ratify the inclusion of one more elective paper in each of the core elective theory course namely “Fuzzy sets and its applications”, subject code 23P1MECT1(B) as core elective –I and one core elective theory course namely ”Object Oriented System Development”, subject code 23P1MECT2(B) and the respective practical paper namely “Practical in Object Oriented System Development”, subject code 23P1MECP1(B) as core elective –II in first semester **(pp 889-901)**.
- 7.8. Resolved to ratify the inclusion of one more elective paper in each of the core elective theory course namely “Mechanics” subject code 23P2MECT3(B) as core elective –III , “Numerical Analysis”, subject code 23P2MECT4(B) as core elective –IV and “Formal Languages”, subject code 23P2MECT5(B) as core elective –V in second semester **(pp 902-916)**.

- 7.9. Resolved to pass the syllabus for “Certificate Course entitled “Industrial Quality Techniques” to post graduate students of all programmes (pp 917-918).

8) FROM THE BOARD OF STUDIES OF STATISTICS DEPARTMENT

Dr.P.Vetriselvi, Chairman, Board of Studies in Statistics, shall move and **Dr.R.Madhanagopal** shall second the following resolutions, passed in the Board of studies meeting held on 13.02.2024.

- 8.1. Resolved to pass the revised curriculum and syllabus based on TANSCHÉ model curriculum for second year B.Sc. Statistics programme for students who join the programme from the Academic year 2023-24 onwards (pp 919-963).
- 8.2. Resolved to pass the revised curriculum and syllabus based on TANSCHÉ model curriculum for second year M.Sc. Statistics programme for Students who join the programme from the Academic Year 2023-24 onwards (pp 966-1041).
- 8.4. Resolved to pass the syllabus for Skill Enhancement Courses (NME) to be offered to the students of programmes other than their programme of study and who join their respective programmes from the Academic Year 2023-24 onwards (pp 997-1001).
- 8.5. Resolved to pass the syllabus for Skill Enhancement Courses to be offered to the students of II B.Sc. Statistics and II M.Sc. Statistics Programme(s) who join these programmes from the Academic Year 2023-24 (pp 934-938, 952-955; 1031-1035).
- 8.6. Resolved to introduce the certificate course entitled “Official Statistics” to Under-graduate students from the Academic year 2023-2024 (pp 964-965).

**Resolution 8.3. – withdrawn*

9) FROM THE BOARD OF STUDIES OF PHYSICS DEPARTMENT

Dr.M.PremaRani, 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 13.02.2024.

- 9.1. Resolved to introduce the revised curriculum and syllabus based on TANSCHÉ model curriculum for second year B.Sc. Physics Programme for students who joined the programme from the Academic year 2023-24 (pp 1042-1080).

- 9.2. Resolved to pass the revised curriculum and syllabus based on TANSCHÉ model curriculum for second year M.Sc. programme for Students who joined the programme from the Academic Year 2023-24 (**pp 1081-1145**).
- 9.3. Resolved to pass the syllabus for the Discipline Specific Elective courses to be offered to the students of M.Sc. Physics and who joined the programme from the Academic year 2023-24 (**pp 1095-1105, 1126-1136**).
- 9.4. Resolved to pass the syllabus for Skill Enhancement Courses (NME) to be offered to the students of programmes other than their programme of study and who joined their respective programmes from the Academic Year 2023-24 (**pp 1111-1115**).
- 9.5. Resolved to pass the syllabus for Skill Enhancement Courses to be offered to the students of B.Sc. & M.Sc. Physics Programme(s) who join these programmes from the Academic Year 2023-24 (**pp 1052-1061, 1070-1079; 1137-1141**).
- 9.6. Resolved to pass Multi-Disciplinary Course “Material Science” for M.Sc. students those who have joined from the Academic Year 2023-24. The course is offered jointly with the departments of Mathematics and Chemistry (**pp 1106-1110**).

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 13.02.2024.

- 10.1. Resolved to pass the curriculum and syllabus based on TANSCHÉ model curriculum for second year B.Sc., Chemistry Programme for students who joined the programme from the Academic year 2023-24 onwards (**pp 1146-1168, 1184-1203, 1217-1220, 1237-1241**).
- 10.2. Resolved to pass the curriculum and syllabus based on TANSCHÉ model curriculum for second year M.Sc., Chemistry programme for Students who joined the programme from the Academic Year 2023-24 onwards (**pp 1242-1316**).
- 10.3. Resolved to pass the syllabus for the Generic elective courses to be offered to the students of programmes other than their programme of study and who join their respective programmes from the Academic year 2023-24 onwards (**pp 1169-1183, 1204-1216, 1221-1236**).

- 10.4. Resolved to pass the syllabus for Skill Enhancement Courses (NME) to be offered to the all PG students who join their respective programmes from the Academic Year 2023-24 onwards (**pp 1276-1280**).
- 10.5. Resolved to pass the syllabus for Skill Enhancement Course (SEC) to be offered to students of second year B.Sc., Chemistry who joined the programme from the Academic year 2023-2024 onwards (**pp 1159-1168, 1194-1203**).
- 10.6. Resolve to ratify the change of course title as Foundation Course should be renamed as Introductory Chemistry (23U1CFCT1) for the first year B.Sc., students who have joined during the Academic Year 2023 – 24 onwards. pg. no. 1244

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 13.02.2024.

- 11.1. Resolved to pass the revised curriculum and syllabus based on TANSCHÉ model curriculum for second year B.Sc. Botany Programme for students who joined the programme from the Academic year 2023-24 (**pp 1317-1353**).
- 11.2. Resolved to pass the revised curriculum and syllabus based on TANSCHÉ model curriculum for second year M.Sc. Botany programme for students who joined the programme from the Academic Year 2023-24 (**pp 1354-1410**).
- 11.3. Resolved to pass the syllabus for the Generic elective courses to be offered to the second year Zoology major students from the Academic year 2023-24.
- 11.4. Resolved to pass the syllabus for Skill Enhancement Courses to be offered to the students of second year of B.Sc. Botany who joins the programme from the Academic Year 2023-24 (**pp 1330-1339, 1346-1353**).
- 11.5. Resolved to pass the syllabus for Skill Enhancement Courses (NME) to be offered to PG students who joined their respective programmes from the Academic Year 2023-24 (**pp 1382-1386**).

11.6. Resolved to pass the syllabus for Certificate course 'Flower arrangement' from the academic year 2024-25 to the students of all the UG and PG courses (**pp 1411-1414**).

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 13.02.2024.

12.1. Resolved to ratify the syllabi for II semester of B.Sc. Zoology programme for students who joined the programme from the academic year 2023-2024 (**pp 1415-1416, 1419-1434**).

12.2. Resolved to ratify the syllabi for the Generic Elective courses offered to the II semester of B.Sc. Botany students who joined the programme from the Academic year 2023-24 (**pp 1418, 1435-1441**).

12.3. Resolved to pass the curriculum and syllabi based on TANSCHÉ model curriculum for III semester and IV semester of B.Sc. Zoology programme for students who joined the programme from the Academic year 2023-24 (**pp 1417-1418, 1442-1482**).

12.4. Resolved to pass the syllabus for Skill Enhancement Courses offered to the students of II B.Sc. Zoology who joined the programmes from the Academic year 2023-24 (**pp 1456-1460, 1470-1479**).

**Resolutions 12.5.& 12.6. - withdrawn*

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.Uma Sankari** shall second the following resolutions, passed in the Board of studies meeting held on 13.02.2024.

13.1. Resolved to pass and implement the Revised curriculum and syllabus based on the TANSCHÉ model curriculum for Semester III and Semester IV of II B.Sc. Computer Science Programme for students who joined the programme from the Academic year 2023-24 (**pp 1483-1529**).

13.2. Resolved to pass the syllabus for the Generic elective courses based on the TANSCHÉ model curriculum to be offered in the III and IV semesters to the students of II B.Sc. Computer Science programme who joined the programme from the Academic year 2023-24 (**pp 1492-1495, 1514-1518**).

13.3. Resolved to pass the syllabus for Skill Enhancement Courses to be offered in the III and IV semesters to the students of II year B.Sc. Computer Science Programme who joined the programme from the Academic year 2023-24 (**pp 1496-1505, 1519-1528**).

14) FROM THE BOARD OF STUDIES OF INFORMATION TECHNOLOGY DEPARTMENT

Prof.K.RajaSaravanaKumar, Chairman, Board of Studies in Information Technology, shall move and **Dr.K.Rajeswari** shall second the following resolutions, passed in the Board of Studies meeting held on 13.02.2024.

14.1. Resolved to pass the revised Curriculum and Syllabi based on TANSCHÉ Model Curriculum for Second Year B.Sc. Information Technology students who joined the Programme from the Academic year 2023-24 (**pp 1530-1577, 1582-1585**).

14.2. Resolved to pass the revised Curriculum and Syllabi based on TANSCHÉ Model Curriculum for Second Year M.Sc. Computer Science Students who joined the Programme from the Academic Year 2023-24 (**pp 1586-1662**).

14.3. Resolved to pass the Syllabi for Skill Enhancement Courses to be offered to the Second year B.Sc. Information Technology students who joined the Programme from the Academic Year 2023-24 (**pp 1546-1554, 1564-1573**).

14.4. Resolved to pass the Syllabus for Multi Disciplinary Course to be offered to the Second Year M.Sc. Computer Science students who joined the Programme from the Academic Year 2023-24. This Course is offered jointly with the Departments of Mathematics and Physics (**pp 1615-1619**).

14.5. Resolved to pass the Syllabus for Skill Enhancement Course (NME) titled “Basic Excel Techniques” to be offered to the students of Second year PG Programmes other than their Programme of study and who joined their respective Programmes from the Academic Year 2023-24 (**pp 1620-1625**).

14.6. Resolved to pass the Syllabus for Professional Competency Skill Course titled “Quantitative Aptitude” to be offered to the Second Year M.Sc. Computer Science students who joined the Programme from the Academic Year 2023-24 (**pp 1650-1654**).

- 14.7. Resolved to pass the Syllabi for Add-On Courses titled “Multimedia Tools” and “R Programming” to be offered during Third and Fourth Semester of B.Sc. Information Technology for students who joined the Programme from the Academic Year 2023-24 (pp 1574-1577).
- 14.8. Resolved to pass the Syllabus for Add-On Course titled “Values and Ethics in Research” to be offered in the Second Year to M.Sc. Computer Science students who joined the Programme from the Academic Year 2023-24 (pp 1657-1659).
- 14.9. Resolved to pass the Syllabi for Certificate Courses titled “Web Designing Tools” and “PC Hardware & Troubleshooting” to be offered to the students who joined from the Academic Year 2023-24 (pp 1578-1581).
- 14.10. Resolved to pass the Syllabus for Self Study Course titled “Quantitative Aptitude” to be offered to the Second Year B.Sc. Information Technology students who joined the Programme from the Academic Year 2023-24 (pp 1582-1583).

15) FROM THE BOARD OF STUDIES OF MICROBIOLOGY DEPARTMENT

Dr.K.Rajeswari, Chairman, Board of Studies in Microbiology, shall move and **Prof.R.Suguna** shall second the following resolutions, passed in the Board of studies meeting held on 13.02.2024.

- 15.1. Resolved to pass the revised syllabus based on TANSCHÉ model curriculum for second year B.Sc Microbiology Programme for students who join the programme from the Academic year 2023-24 (pp 1663-1707, 1724-1731).
- 15.2. Resolved to pass the revised syllabus based on TANSCHÉ model curriculum for second year M.Sc Microbiology programme for students who join the programme from the Academic Year 2023-24 (pp 1732-1819).
- 15.3. Resolved to pass the syllabus for the Generic elective courses to be offered to the students of programmes II year B.Sc., Biotechnology who join their respective programmes from the Academic year 2023-24 (pp 1666, 1708-1723).
- 15.4. Resolved to pass the syllabus for add-on courses titled “Biostatistics and Bioinformatics”, “Introduction to Medical Coding” semester III, IV respectively and self-study course titled ‘Bioenergy’ for B.Sc., Microbiology programme for students who join the programme from the Academic Year 2023-24 (pp 1724-1728).

15.5. Resolved to pass the syllabus for Skill Enhancement Courses as NME to be offered to the PG students of programmes other than their programme of study who join their respective programmes from the Academic Year 2023-24 (**pp 1768-1772**).

15.6. Resolved to pass the syllabus for Multi-disciplinary course (MDC) for III semester of second year M.Sc Microbiology programme for students who join the programme from the Academic Year 2023-24. The course is offered jointly with the departments of Mathematics and Computer Science (**pp 1762-1767**).

Resolution 15.7. - withdrawn

16) FROM THE BOARD OF STUDIES OF BIOTECHNOLOGY DEPARTMENT

Prof.R.Suguna, Chairman, Board of Studies of Biotechnology, shall move and **Dr.K.Rajeswari** shall second the following resolutions passed in the Board of Studies meeting held on 13.02.2024.

16.1. Resolved to ratify the programme structure for B.Sc. Biotechnology Programme for II semester from the Academic year 2023-24 (**pp 1820-1824**).

16.1. Resolved to pass the programme structure for B.Sc. Biotechnology Programme for II Year from the Academic year 2023-24 (**pp 1820-1824**).

16.2. Resolved to ratify the syllabi for B.Sc. Biotechnology II semester for the students who joined the programme from the Academic year 2023-24 (**pp 1825-1841**).

16.3. Resolved to ratify the syllabi for Generic Elective Biotechnology offered to I B.Sc. Microbiology II semester for the students who joined the programme from the Academic year 2023-24 (**pp 1875-1888**).

16.4. Resolved to pass the curriculum and syllabi for Second year B.Sc. Biotechnology Programme for students who joined the programme from the Academic year 2023-24 (**pp 1842-1874, 1889-1893**).

16.5. Resolved to pass the syllabi for Add-on courses titled “Forensic Biotechnology” and “Herbal Medicine” offered to Second year B.Sc. Biotechnology Programme for students who joined the programme from the Academic year 2023-24 (**pp 1889-1890**).

16.6. Resolved to pass the syllabus for Self-study course titled “Good Laboratory Practices” offered to Second year B.Sc. Biotechnology Programme for students who joined the programme from the Academic year 2023-24 (**P 1891**).

17) FROM THE BOARD OF STUDIES IN NATIONAL CADET CORPS (NCC)

Dr.S.V.Karthikeyan, Chairman, Board of studies in NCC, shall move and **Dr.K.Kathirvelpandian**, shall second the following resolutions passed in the meeting of the Board of studies in NCC held on 13.02.2024.

17.1. Resolved to pass the revised syllabus for Part-V NCC in the fourth semester for students who joined their respective programmes from the academic year 2023-24 and onwards (**pp 1899-1902**).

17.2. Resolved to ratify the revised syllabus for Part-V NCC in the second semester for students who joined their respective programmes from the academic year 2023-24 and onwards (**pp 1894-1898**).

18) FROM THE BOARD OF STUDIES IN NATIONAL SERVICE SCHEME (NSS)

Dr.Y.Natarajan, Chairman, Board of studies in NSS, shall move and **Dr.M.Kannan**, shall second the following resolutions passed in the meeting of the Board of studies in NSS held on 13.02.2024.

18.1. Resolved to pass the revised syllabus for Part-V NSS in the fourth semester for students who joined their respective programmes from the academic year 2023-24 and onwards (**pp 1907-1910**).

18.2. Resolved to ratify the revised syllabus for Part-V NSS in the second semester for students who joined their respective programmes from the academic year 2023-24 and onwards (**pp 1903-1906**).

19) FROM THE BOARD OF STUDIES IN YOUTH RED CROSS (YRC)

Dr.S.Selvakumar, Chairman, Board of studies in YRC, shall move and **Dr.S.Krithika**, shall second the following resolutions passed in the meeting of the Board of studies in YRC held on 13.02.2024.

19.1. Resolved to pass the revised syllabus for Part-V YRC in the fourth semester for students who joined their respective programmes from the academic year 2023-24 and onwards (**pp 1915-1918**).

19.2. Resolved to ratify the revised syllabus for Part-V YRC in the second semester for students who joined their respective programmes from the academic year 2023-24 and onwards (**pp 1911-1914**).

20) FROM THE BOARD OF STUDIES IN PHYSICAL EDUCATION

Dr.K.Kathirvelpandian, Chairman, Board of studies in Physical Education, shall move and **Dr.S.V.Karthikeyan**, shall second the following resolution passed in the meeting of the Board of studies in Physical Education held on 13.02.2024.

20.1. Resolved to pass the revised syllabus for Part-V Physical education in the fourth semester for students who joined their respective programmes from the academic year 2023-24 and onwards (**pp 1923-1926**).

20.2. Resolved to ratify the revised syllabus for Part-V Physical education in the second semester for students who joined their respective programmes from the academic year 2023-24 and onwards (**pp 1919-1922**).

21) FROM DEAN (ACADEMICS)

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

21.1. Resolved to offer Add-on courses passed by the respective Board of Studies during semesters 3 and 5 for students who joined all UG programmes offered by the institution from the academic year 2023-2024.

22) FROM THE MEMBER – PRIVATE RESOLUTION

Prof.S.Chellapandi, Head, Department of Botany, shall move and **Dr.S.Dinakaran**, Head, Department of Zoology shall second the following resolution:

22.1. Resolved to adopt the existing syllabus for “Environmental science and Gender Awareness” course (Regulation 2020) for students who joined all UG programmes offered by the institution from the academic year 2023-2024. The end semester examination would held at the end of fourth semester.

ADDENDUM

Dr.S.V.Karthikeyan, Associate NCC officer, shall move and **Dr.K.Kathirvelpandian**, Physical Director shall second the following resolution:

- 22.2. Resolved to permit NCC cadets of our college to avail 35 days of leave on-duty (OD) to attend camps like RDC, TSC and special camps like Mountaineering, Trekking, attachment camps, EBSB, CATC, etc. and however excluding this OD leave, the minimum attendance requirement to avoid repeating the course remains same.

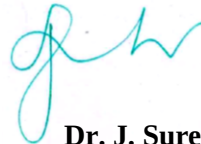
Prof.S.Sivaramakrishnan, Dean (Academics), shall move and **Dr.I.Sahul Hamid**, Dean (Planning and Development) shall second the following resolution:

- 22.3. Resolved to award two extra credits to students who successfully complete a community project listed under Nan Muthalvan scheme from the academic year 2023-24.

IV. Any Other Subject



Dr. R. Eswaran
Member Secretary



Dr. J. Suresh
Principal & Chairman



DEPARTMENT OF BOTANY

Revised Curriculum

**TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION (TANSCH)
(Choice Based Credit system with Outcome Based Education)**

Academic Year 2023-2024 onwards

III and IV semesters (B.Sc. Botany)

III and IV semesters (M.Sc. Botany)

Certificate Course



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

UG-BOTANY

Vision

Producing Botany students as ambassadors of sustainable development in all spheres of human activity and leaving the earth to the successive generation as intact as possible.

Mission

To sensitize the Botany students to the classification, structure, physiology, ecology, genetics and economic importance of plants

To inculcate the students with an environment that fosters the development of appropriate scientific vocabulary, reasoning skills and effective oral and written communication ability for students.

To create holistic understanding of the allied subjects through interdisciplinary learning.

Programme: B.Sc. Botany	
Programme Code:	
Duration: 3years	
Programme Outcomes (POs)	
The B.Sc. Botany programmes designed to achieve the following objectives	
PO1	Apply the knowledge of science and technology fundamentals for findings solution for complex problems.
PO2	To provide up-to-date theoretical knowledge on various forms of plants, their interactions with biotic and abiotic entities in the ecosystem and relevant practical skills.
PO3	To comprehend and interpret various facets of Botany including the importance and judicious utilization and conservation of plant resources.
PO4	To disseminate knowledge on the design and execution of experiments in Botany with emphasis on the operation of relevant sophisticated instruments.
PO5	To promote proficiency in designing the research problems, review of literature, laboratory experiments, data analyses and preparation of reports with professional ethics.
PO6	To enable the students to take up various qualifying examinations concerning Botany and to face the challenges in career opportunities.

Programme Specific Outcomes (PSOs)

PSO1	Implement the concept of science and technology to foster the traditional and modern techniques for solving the complex problems in Plant Biology.
PSO2	Develop the scientific problem-solving skills during experimentation, research projects, analysis and interpretation of data
PSO3	Design scientific experiments independently and to generate useful information to address various issues in Botany.
PSO4	Apply appropriate techniques, resources, and modern ICT tools for understanding plant resources.
PSO5	Demonstrate the contextual knowledge in sustainable exploitation of medicinal, economically important and endangered plants as per the National Biodiversity Act.
PSO6	Communicate proficiently with various stakeholders and society, to comprehend and to write and present reports effectively

THE MADURA COLLEGE (AUTONOMOUS), MADURAI - 11
DEPARTMENT OF BOTANY
TANSCHÉ - Curriculum Structure for B.Sc. Botany (Major) to be
implemented from June 2023- 2024

Programme Structure:

Semester I				
Part	Course description	Course Code	Hours	Credits
I	Language – I Tamil / Hindi / Sanskrit	23U1TLAN1 23U1HLAN1 23U1SLAN1	6	3
II	Language – II English	23U1NENG1	6	3
III	Core Course – Plant Diversity I – Algae	23U1BCCT1	5	4
	Core Practical – I	23U1BCCP1	3	3
	Generic Elective – 1 Allied Zoology	23U1ZACT1	4	3
	Generic Elective –1 Allied Zoology Practical	23U1ZACP1	2	1
IV	Skill Enhancement Course (NME1) – Organic farming	23U1BNME1	2	2
	Foundation course (FC)	23U1BFCT1	2	2
Total			30	23
Semester II				
Part	Course description	Course code	Hours	Credits
I	Language - I Tamil / Hindi / Sanskrit	23U2TLAN2 23U2HLAN2 23U2SLAN2	6	3
II	Language – II English	23U2NENG2	6	3
III	Core Course – Plant Diversity II	23U2BCCT2	5	4
	Core Course – Practical – II	23U2BCCP2	3	3
	Generic Elective – 2 Allied Zoology Theory	23U2ZACT2	4	2
	Generic Elective – 2 Allied Zoology Practical	23U2ZACP2	2	1
	Skill Enhancement Course (SEC-2; NME2) – Mushroom cultivation	23U2BNME2	2	2
	SEC – Subject Specific (SEC-3) – Botanical gardening and landscaping	23U2BSEC2	2	2
Total			30	23
Semester III				
Part	Course description	Course code	Hours	Credits
I	Language – I Tamil / Hindi / Sanskrit	23U3TLAN3 23U3HLAN3 23U3SLAN3	6	3
II	Language – II English	23U3NENG3	6	3
III	Core Course –3 Plant Diversity III - Bryophytes	23U3BCCT3	4	4

	and Pteridophytes			
	Core Course – 3 Practical III	23U3BCCP3	3	3
	Allied Elective – 3 – Chemistry paper - III	23U3CACT3	4	4
	Allied Practical - 3	23U3CACP3	2	1
	Skill Enhancement Course - (SEC-4) – Herbal Technology	23U3BSED4	2	2
	Skill Enhancement Course - (SEC 5) – Entrepreneurial opportunities in Botany	23U3BSED5	2	2
IV	Environmental Studies	23U3EVST1	1	1
Total			30	23
Semester IV				
Part	Course description	Course code	Hours	Credits
I	Language – I Tamil / Hindi / Sanskrit	23U4TLAN4 23U4HLAN4 23U4SLAN4	6	3
II	Language – II English	23U4NENG4	6	3
III	Core Course –2 Plant Diversity IV – Gymnosperms, Palaeobotany and Evolution	23U4BCCT4	4	4
	Core Course – 2 Practical IV	23U4BCCP4	3	3
	Allied Elective – 4 – Chemistry paper - IV	23U4CACT4	4	4
	Allied Practical – 4	23U4CACP4	2	1
	Skill Enhancement Course (SEC-6) – Fermentation Technology	23U4BSED6	2	2
	Skill Enhancement Course (SEC-7) – Biostatistics	23U4BSED7	2	2
IV	Environmental Studies	23U3EVST2	1	1
Total			30	23

DEPARTMENT OF BOTANY				CLASS: II B.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext	Total
III	Core	23U3BCCT3	Plant Diversity III: Bryophytes and Pteridophytes	4	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives: The Course will enable the students to,

1. have an overview of non-vascular and vascular cryptogams,
2. familiarize the morphological diversity of Bryophytes and Pteridophytes,
3. know the evolution of Bryophytes and Pteridophytes,
4. study the economic importance of Bryophytes and Pteridophytes
5. understand the anatomy, reproduction and life cycle of Bryophytes and Pteridophytes.

Unit	Description	Hours	K-level	CLO
I	BRYOPHYTES: Introduction, general characters, outline classification (Rothmaler, 1951) up to order level. Ecological, evolutionary and economic importance.	12	Upto K4	1
II	Structure, reproduction and life cycles of the following classes: Hepaticopsida (<i>Marchantia</i>); Anthocerotopsida (<i>Anthoceros</i>) and Bryopsida (<i>Funaria</i>).	12	Upto K4	2
III	PTERIDOPHYTES: Introduction, general characters, telome concept, classification (Reimers, 1954), life cycle patterns: homosporous and heterosporous.	12	Upto K4	3
IV	Apogamy and apospory, stelar variation, evolution of sorus, heterospory and origin of seed habit, economic importance.	12	Upto K4	4
V	Structure, reproduction and life cycle of the following classes: Psilotopsida (<i>Psilotum</i>), Lycopsidea (<i>Lycopodium</i>), Sphenopsida (<i>Equisetum</i>) and Pteropsida (<i>Marsilea</i>).	12	Upto K4	5

Books for Study:

1. Rashid, A (2000). An Introduction to Bryophyta, Vikas Publications, New Delhi.
2. Pandey, BP (1998). A Text Book of Botany Vol. II. S Chand, New Delhi.
3. Rashid, A (2013). An Introduction to Pteridophyta - Diversity, Development and Differentiation (2nd edition), Vikas Publications, New Delhi.

Books for References:

1. Johri, RM, Lata S, Tyagi, K (2012). A Textbook of Bryophyta. Dominant Publishers & Distributors Pvt., Ltd., New Delhi.
2. Suresh Kumar (2014) Textbook of Bryophyta. K.K. Publication, New Delhi.

3. Vashishta, PC Sinha, AK Anilkumar (2006). Pteridophyta (Revised edition), S. Chand and Company, Pvt. Ltd. New Delhi.
4. Sporne, KR (1976). Morphology of Pteridophytes. B.I. Publishers, New Delhi.

Web Resources:

1. <https://www.biologydiscussion.com/bryophyta>
2. <https://byjus.com/neet/classification-of-bryophytes/>
3. <https://plantlet.org/classification-of-pteridophytes/>
4. <https://www.britannica.com/plant/lower-vascular-plant>

Rationale for Nature of the Course:

This course helps the students to identify the members of bryophytes and pteridophytes by observing its characteristic vegetative and reproductive morphology and by referring appropriate floras.

Activities having direct bearing on Skill development / Employability / Entrepreneurship:

The skills learned by the students will help them to make a comparison between bryophytes and pteridophytes thereby tracing the evolutionary lineages of living and fossil members.

Pedagogy:

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System.

Course Designer: Dr. N. JANAKIRAMAN, Assistant Professor

Course Schedule:

Unit	Topics	Hrs	Mode
Unit I	Bryophytes: Introduction, general characters and outline classification (Rothmaler, 1951) up to order level.	8	Chalk and Talk, Test, Assignment, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Ecological, evolutionary and economic importance of bryophytes.	4	
Unit II	Structure, reproduction and life cycle of Hepaticopsida (<i>Marchantia</i>) and Anthocerotopsida (<i>Anthoceros</i>).	8	
	Structure, reproduction and life cycle of Bryopsida (<i>Funaria</i>).	4	
Unit III	Pteridophytes: Introduction, general characters and telome concept.	5	
	Classification (Reimers, 1954) and life cycle patterns: homosporous and heterosporous	7	
Unit IV	Apogamy, apospory and stelar variation.	6	
	Evolution of sorus, heterospory and origin of seed habit, economic importance.	6	
Unit V	Structure, reproduction and life cycle of Psilotopsida (<i>Psilotum</i>) and Lycopsidea (<i>Lycopodium</i>).	6	
	Structure, reproduction and life cycle of Sphenopsida (<i>Equisetum</i>) and Pteropsida (<i>Marsilea</i>).	6	

Course Learning Outcomes: On successful completion of the course, the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO 1	Understand the general characters, evolution, classification and economic importance of Bryophytes	Up to K4
CLO 2	Compare the morphology, anatomy, reproduction and life history of selected Bryophytes	Up to K4
CLO 3	Comprehend the general features and classification of Pteridophytes	Up to K4
CLO 4	Distinguish the stelar and soral evolution in Pteridophytes	Up to K4
CLO 5	Analyze the morphology, anatomy, reproduction and life history of selected Pteridophytes	Up to K4

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CLO 1	1	2	2	1	2	3
CLO 2	2	2	3	2	2	2
CLO 3	2	2	1	2	2	2
CLO 4	2	3	3	2	3	1
CLO 5	1	3	3	1	3	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	3	3	2	3	2	2
CLO 2	3	3	3	2	3	3
CLO 3	2	2	3	3	1	1
CLO 4	3	3	3	3	3	2
CLO 5	3	3	2	2	2	1

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

Blue Print – Model for External Examination
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section – A		Section – B		Section C (Either/ Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K – Level		
1	CLO 1	Up to K 4	2	K1 or K2	1	K1	2(K1&K1)	1 (K2)
2	CLO 2	Up to K 4	2	K1 or K2	1	K1	2(K2&K2)	1 (K3)
3	CLO 3	Up to K 4	2	K1 or K2	1	K2	2(K3&K3)	1 (K3)
4	CLO 4	Up to K 4	2	K1 or K2	1	K2	2(K4&K4)	1 (K4)
5	CLO 5	Up to K 4	2	K1 or K2	1	K2	2(K3&K3)	1 (K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark 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 fact 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 BOTANY				CLASS: II B.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
III	Core Practical	23U3BCCP3	Core Practical - III	4	3	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives: The course will enable the students to,

- train for identifying plants based on morphological observations.
- dissect the various members of Bryophytes and Pteridophytes by examining their anatomical characters.
- enrich the knowledge on the use of economically important plants in daily life.

Practicals:

1. Study of morphology, anatomy and structure of the vegetative and reproductive organs of Hepaticopsida (*Marchantia*); Anthocerotopsida (*Anthoceros*) and Bryopsida (*Funaria*).
2. Study of morphology, anatomy and structure of the vegetative and reproductive organs of Psilotopsida (*Psilotum*), Lycopsidea (*Lycopodium*), Sphenopsida (*Equisetum*), Pteropsida (*Marsilea*).
3. Identification of microscopic slides relevant to the syllabus.
4. Field trips within or outside the state under the guidance of teachers to study plants in their natural habitats.
5. Submission of record note book and field report note.

Rationale for Nature of the Course:

The students acquire profound practical skills in the laboratory with scientific observations in the field of Bryophytes and Pteridophytes thereby enriching a thorough understanding on the field aspects of identifying plants.

Activities having direct bearing on Skill development / Employability / Entrepreneurship:

The course will help the students to develop their skills on the nuances of morphological and anatomical aspects of Bryophytes and Pteridophytes.

Pedagogy:

Hands on training, dissection, chalk and talk, power point, group discussion, seminar, interaction, problem solving, quiz, virtual labs, you tube videos & learning management system (canvas).

Course Designer:

Dr. N. Janakiraman, Assistant Professor

Course Schedule:

S. No.	Description	Hours	Mode
I	Study of morphology, anatomy and structure of the vegetative and reproductive organs of Hepaticopsida (<i>Marchantia</i>); Anthocerotopsida (<i>Anthoceros</i>) and Bryopsida (<i>Funaria</i>).	18	Plant specimens, Dissection and Microscopic Slides, Tests
	Study of morphology, anatomy and structure of the vegetative and reproductive organs of Psilotopsida (<i>Psilotum</i>), Lycopsidea (<i>Lycopodium</i>), Sphenopsida (<i>Equisetum</i>), Pteropsida (<i>Marsilea</i>).	18	
	Identification of microscopic slides relevant to the syllabus	9	

Course Learning Outcomes:

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

CLOs	CLO Statement	Knowledge Level
CLO 1	Know the morphology and anatomy of Bryophytes	Upto K4
CLO 2	Understand the structure of the vegetative and reproductive organs of Bryophytes	Upto K4
CLO 3	Know the morphology and anatomy of Pteridophytes	Upto K4
CLO 4	Analyse the structure of the vegetative and reproductive organs of Pteridophytes	Upto K4
CLO 5	Identify microscopic slides relevant to the syllabus	Upto K4

Mapping Programme Specific Outcomes with Course Learning Outcomes:

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CLO 1	3	2	1	3	3	2
CLO 2	3	3	2	2	2	3
CLO 3	3	3	2	2	1	3
CLO 4	3	2	1	2	1	2
CLO 5	3	2	-	-	-	3

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Mapping Programme Outcomes with Course Learning Outcomes:

#	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CLO 1	3	2	2	2	1	1
CLO 2	3	3	3	3	3	2
CLO 3	3	3	3	3	3	2
CLO 4	2	2	2	2	2	3
CLO 5	1	2	1	1	3	1

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

DEPARTMENT OF BOTANY				CLASS: II B.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
III	SEC	23U3BSED4	Herbal Technology	2	2	25	75	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓	

Objectives: The objectives are to,

1. understand various plants-based drugs used in ayurvedha, unani, homeopathy, siddha,
2. gain an insight into the commercially important secondary products and significance of bioprospecting,
3. provide students with knowledge of herbal drug industry, the quality of raw material, and guidelines for quality maintenance,
4. know the pharmacological importance of medicinal plants and
5. apply the knowledge to cultivate medical plants.

Unit	Description	Hours	K-level	CLO
I	Herbal medicines: Introduction, history and scope, definition. Traditional systems of medicine (ayurveda, unani, siddha and homeopathy) overview of AYUSH.	6	Up to K4 level	1
II	Value-added Plant products: Herbs and herbal products. Plant parts used, major chemical constituents of certain herbs used in herbal medicines: nutraceuticals (<i>Andrographis paniculata</i>), cosmetics (<i>Curcuma longa</i>) and biopesticides (<i>Allium sativum</i>).	6	Up to K4 level	2
III	Morphology of plant parts used and active principles of the following herbs: <i>Zingiber officinale</i> , <i>Phyllanthus emblica</i> , <i>Catharanthus roseus</i> , <i>Withania somnifera</i> and <i>Centella asiatica</i> .	6	Up to K4 level	3
IV	Pharmacognosy: Scope and importance, Primary metabolites, secondary metabolites (alkaloids, flavonoids, terpenoids and their functions). Organoleptic evaluation of crude drugs.	6	Up to K4 level	4
V	Cultivation: Cultivation of <i>Aloe vera</i> and <i>Gloriosa superba</i> . A brief account of Tissue culture and Micro propagation methods.	6	Up to K4 level	5

Books for study:

1. AYUSH (www.indianmedicine.nic.in). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India
2. Evans, W.C. 2009: Trease and Evans PHARMACOGNOSY. 16th Edition, SAUNDERS / Elsevier.
3. Sivarajan, V.V. and India, B. 1994. Ayurvedic Drugs and Their Plant Sources. Oxford & IBH Publishing Company, 1994 - Herbs - 570 pages.

Books for References:

1. Agarwal, P., Shashi, Alok., Fatima, A. and Verma, A. 2013. Current scenario of Herbal Technology worldwide: An overview. Int J Pharm Sci Res; 4(11): 4105-17.
2. Arber, Agnes. 1999. Herbal Plants and Drugs. Mangal Deep Publications, Jaipur
3. Varzakas, T., Zakynthinos, G, and Francis Verpoort, F. 2016. Plant Food Residues as a Source of Nutraceuticals and Functional Foods. Foods 5: 88.
4. Aburjai, T. and Natsheh, F.M. 2003. Plants Used in Cosmetics. Phytotherapy Research 17 :987-1000.
5. Patri, F. and Silano, V. 2002. Plants in cosmetics: Plants and plant preparations used as ingredients for cosmetic products - Volume 1. ISBN 978-92-871-8474-0, pp 218.

Web Resources

1. <https://www.kopykitab.com/Herbal-Science>
2. https://kadampa.org/books/free-ebook-download-howtotyl?gclid=CjwKCAiA6vXwBRBKEiwAYE7iS5t8yenurCIUCTdV9oIKo9TbyAh4fsoFqPYWGs5qBTbytD22z7lo0BoCYnUQAvD_BwE
3. [https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-natural-healing/herbal-medicine/ /](https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-natural-healing/herbal-medicine/)
4. <http://cms.herbalgram.org/heg/volume8/07July/HerbalEBooks.html?t=1310004932&ts=1579066352&signature=1dd0d5aef818b19bcdcd6c063a78e404>
5. <https://www.dattanibookagency.com/books-herbs-science.html>
6. <https://www.springer.com/gp/book/9783540791157>

Rationale for Nature of the course

Activities having direct bearing on Skill development / Employability Entrepreneurship

Pedagogy

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System.

Course Designer(s): Dr. P. JANSIRANI, Assistant Professor

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	• Introduction, history, scope and definition.	3	Chalk &Talk
	• Traditional systems of medicine (ayurveda, unani, siddha and homeopathy) overview of AYUSH.	3	
Unit II	• Herbs and herbal products. • Plant parts used; major chemical constituents of certain herbs used in herbal medicines: nutraceuticals (<i>Andrographis paniculata</i>).	3	Power point Presentation
	• Cosmetics (<i>Curcuma longa</i>) • Biopesticides (<i>Allium sativum</i>)	3	
Unit III	• Morphology of plant parts used and active principles: <i>Zingiber officinale</i> , <i>Phyllanthus emblica</i> ,	3	Power point Presentation
	• Morphology of plant parts used and active • Principles of the <i>Catharanthus roseus</i> , • <i>Withania somnifer</i> • <i>Centella asiatica</i>	3	
Unit IV	• Pharmacognocny -Scope and importance, Primary metabolites, • secondary metabolites	3	Chalk &Talk
	• Alkaloids, flavonoids, terpenoids and their functions • Organoleptic evaluation of crude drugs.	3	
Unit V	• Cultivation of <i>Aloe vera</i> and <i>Gloriosa superba</i>	3	Power point Presentation
	• A brief account of Tissue culture and Micro propagation methods	3	

Course Learning Outcomes: On successful completion of the course, the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Know the traditional systems of medicine.	Up to K4 Level
CLO-2	Understand the major herbs, their botanical name and chemical constituents of Herbal Medicine.	Up to K4 Level
CLO-3	Analyze the cultivation of herbal products. Analyze and decipher the significance of various methods of harvesting, drying and storage of medicinal herbs.	Up to K4 Level
CLO-4	Apply the techniques for monitoring drug adulteration through the biological testing.	Up to K4 Level
CLO-5	Develop the skills for cultivation of plants and their value-added processing / storage.	Up to K4 Level

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6
CLO-1	3	3	3	2	3	1
CLO-2	3	3	3	3	2	2
CLO-3	3	3	3	3	3	1
CLO-4	3	3	3	3	1	3
CLO-5	3	3	3	3	3	3

Mapping of CLOs with Pos

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	2	3	3	3	3
CLO2	2	3	3	3	3	3
CLO3	2	2	3	3	2	2
CLO4	2	2	2	2	2	2
CLO5	3	3	3	1	3	3

Advance application– 3;

Intermediate level–2;

Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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
2	CLO 2	Up to K3	2	K2&K3	1	K1	2(K2&K2)	1
3	CLO 3	Up to K4	2	K2&K3	1	K2	2(K3&K3)	1
4	CLO 4	Up to K4	2	K3&K4	1	K2	2(K4&K4)	1
5	CLO 5	Up to K4	2	K4&K4	1	K3	2(K4&K4)	1
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 with choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.66	
K3	4	2	10	20	36	30.00	30%
K4	2	-	20	20	42	35.00	35%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF BOTANY				CLASS: II B.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
III	SEC	23U3BSED5	Entrepreneurial Opportunities in Botany	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives: The course objectives are to,

1. understand the concept of Entrepreneurial Opportunities in Botany,
2. enable students to understand about establishment of various ventures after graduates in Botany using medicinal plants, and marketing of bioproducts,
3. create a mindset among students to start their own companies for income generation,
4. introduce organizations and agencies that can backup entrepreneurial initiatives,
5. encourage students to build proposals and projects to become an entrepreneur and
6. the new strategies to describe marketing and business management strategy.

Unit	Description	Hours	K-level	CLO
I	Introduction, Scope and identification of new ventures using plant resources. Mechanism of product selection and commercialization, Entrepreneurship skill development. Start-ups.	6	Up to K4	1
II	BIOVENTURE: Establishment of medicinal, herbal and zodiac gardens, Terrace & Kitchen Garden, <i>Spirulina</i> cultivation, Bonsai, Bouquet making, Terrarium. Straight Vegetable Oil (SVO) and Pure Plant Oil (PPO).	6	Up to K4	2
III	Product commercialization and business strategies, Cosmetics and Perfumes, <i>Arecaleaf</i> plates, cups & bags, Jute products. Fruits and vegetables-based products- ready to serve (RTS) (syrup, pulp, soup, jam and jellies).	6	Up to K4	3
IV	Organizations and Agencies: TIIC, NABARD, DBT, Sarvodaya – SIDCO – Micro, Small and Medium Enterprises (MSME) – support structure for promoting entrepreneurship – various government schemes.	6	Up to K4	4
V	Bio-Business plans, IPR and Bioethics: Marketing and Business management strategies, Bank loans, Intellectual property rights, Patent laws - Bioethics and legal issues, public perceptions in product development.	6	Up to K4	5

Books for study:

1. Gurinder Shahi. 2004. Bio-Business in Asia: How countries Can Capitalize on the Life Science Revolution, Pearson Prentice Hall, New Delhi, India.
2. Karthikeyan, S. and Arthur Ruf. 2009. Biobusiness, MJP Publications. Chennai, India.
3. Richard Oliver. 2000. The coming Biotech age: The Business of Biomaterials, McGraw Hill Publications, New York, USA.

Books for References:

1. Robin Lowe and Sue Marriott 2009. Enterprise: Entrepreneurship and Innovation: Concepts, Contexts and Commercialization, Routledge Publisher, London, UK.
2. Peter F. Drucker, 2009. Innovation and Entrepreneurship, Harper Collins Publisher, New York, US.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands (Nature Guides). Mukherjee D. Gardening in India, Oxford IBH publishing co, New Delhi.
4. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
5. Manohar, D., 1989. Entrepreneurship of small-scale industries, vol.III. Deep and deep publication, New Delhi. ISSN: 09735925.
6. Ranganna, S., 2001. Hand book of analysis and quality control of fruits and vegetable products, Second edition, Tata mcgraw hill, New Delhi. ISBN: 9780074518519.

Web Resources

1. https://www.brainkart.com/article/Entrepreneurial-Botany_38321/
2. <https://www.slideshare.net/krishnashah5891004/ram-power-point-presentation>
3. http://www.brainkart.com/article/Economically-Useful-Plants-and-Entrepreneurial-Botany_38301
4. <https://www.ebooks.com/en-us/subjects/gardening/>
5. <https://www.amazon.in/Preservation-Techniques-Publishing-Technology-Nutrition->

Rationale for Nature of the course

By gaining a deep understanding of the entrepreneurial process, including how to develop a bio-business plan, access resources from plants and plant products and funding, build a network of support and public perceptions in product development.

Activities having direct bearing on Skill development / Employability Entrepreneurship

This course is designed to help students gain the know-how on contemporary opportunities in business situations and develop skills needed to successfully convert them into entrepreneurial ventures. The basics of entrepreneurship as a concept and the fundamentals training, they may require to meet their livelihoods will be explored.

Pedagogy

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem solving, Quiz, Virtual Labs & Learning Management System (CANVAS)

Course Designer: R. Saranya, Assistant Professor

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction to Entrepreneurship, Scope and identification of new ventures using plant resources.	3	Chalk and talk, PPT, LMS and Group discussion, Quiz, Seminar, Test
	Mechanism of product selection and commercialization, Entrepreneurship skill development.	3	
Unit II	Establishment of medicinal, herbal and zodiac gardens, Terrace & Kitchen Garden, Spirulina cultivation.	3	Chalk and talk, PPT, LMS and Group discussion, Quiz, Seminar, Test
	Bonsai, Bouquet making, Terrarium. Straight Vegetable Oil (SVO) and Pure Plant Oil (PPO)	3	
Unit III	Product commercialization and business strategy, Cosmetics and Perfumes, Areca Leaf Plates, cups & bags.	3	Chalk and talk, PPT, LMS and Group discussion, Quiz, Seminar, Test.
	Jute Products. Fruit and vegetable-based products- ready to serve (RTS) (syrup, pulp, soup, jam and jellies).	3	
Unit IV	TIIC, NABARD, DBT – case study – sarvodaya – SIDCO.	3	Chalk and talk, PPT, LMS and Group discussion, Quiz, Seminar, Test
	Micro Small and Medium Enterprises – support structure for promoting entrepreneurship – various government schemes.	3	
Unit V	Marketing and Business management strategy, Bank loan, Intellectual property rights, Patent laws.	3	Chalk and talk, PPT, LMS and Group discussion, Quiz, Seminar, Assignment.
	Bioethics and current legal issues, public perceptions in product development – Technology licensing and branding concerns.	3	

Course Learning Outcomes: On completion of this course, the students will be able to,

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Know the various fields of botany could be understood with an entrepreneurial approach.	UptoK4
CLO-2	Understand the concept of Entrepreneurial Opportunities in Botany.	UptoK4
CLO-3	Analyse the plant products for commercial exploitations.	UptoK4
CLO-4	Evaluate the organizations and agencies that can possibly provide full or partial support to kick start their projects that stabilize the same for making their livelihood.	UptoK4
CLO-5	Develop new strategies to describe marketing and business management strategy including the role of IPR and bioethics regulations for licensing.	UptoK4

Mapping of CLOs with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	1	2	2	3	2	1
CLO2	2	2	3	2	3	3
CLO3	-	3	3	2	3	3
CLO4	1	3	3	3	2	3
CLO5	2	2	3	3	3	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	1	2	2
CLO2	3	3	2	2	3	2
CLO3	2	2	3	1	2	1
CLO4	3	3	1	2	3	1
CLO5	3	3	2	3	1	3

Advance application– 3;

Intermediate level–2;

Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 K4	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	K4&K4	1	K3	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			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 with choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.66	
K3	4	2	10	20	36	30.00	30%
K4	2	-	20	20	42	35.00	35%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF BOTANY				CLASS: II B.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
IV	Core	23U4BCCT4	Plant diversity IV - Gymnosperms, Palaeobotany and Evolution	4	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives: The course objectives are to,

1. understand the characteristic features and classification of Gymnosperms,
2. enable the students to understand internal and the reproductive structures of Gymnosperms and the importance of evolution,
3. acquaint students with evidences of the past history of plant groups and significance of the fossilization,
4. know the scope of palaeobotany, types of fossils and geological time scale and
5. understand the various fossil genera representing different fossil groups.

Unit	Description	Hours	K-level	CLO
I	Gymnosperms: Introduction, general characters, classification (Sporne, 1965) up to family, Salient features of Progymnosperms. Phylogeny. Economic importance.	12	Up to K4	1
II	Morphology, anatomy and reproduction of the following types: <i>Cycas</i> (Cycadales), <i>Pinus</i> (Coniferales) and <i>Gnetum</i> (Gnetales).	12	Up to K4	2
III	Palaeobotany: Introduction, fossils and fossilization: compression, impressions, petrification, casts, molds and coal balls. Geological time-scale. Carbon dating.	12	Up to K4	3
IV	Contributions of Birbal Sahni. Study of the following fossils: <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Pentoxylon</i> and <i>Calamites</i> .	12	Up to K4	4
V	Evolution – Introduction, importance, origin of life. Theories of Darwin, Lamarck and Hugo de Vries, Modern Synthetic theory. Speciation - Allopatric and sympatric.	12	Up to K4	5

Books for study:

1. Vashishta, P.C. Sinha, A.K and Anil Kumar. 2016. Botany for Degree students. Gymnosperms. S. Chand and Company Ltd., New Delhi.
2. Stewart, W.N and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.

3. Raup, D.M and Steven, M. Stanley. 2004. Principles of paleontology. San Francisco: W.H. Freeman, 1971.

Books for References

1. Johri, R.M, Lata, S, Tyagi, K. 2005. A text book of Gymnosperms, Dominate pub and Distributer, New Delhi.
2. Taylor, E, Taylor, T, Krings, M. 2008. Paleobotany: The Biology and Evolution of FossilPlants, 2 nd Edition, Academic Press.
3. Arnold A.C. 2005. An Introduction to Paleobotany. Agrobios (India). Jodhpur

Web Resources

1. <https://www.palaeontologyonline.com/>
2. <https://books.google.co.in/books/about/Gymnosperms.html?id=4dvyNckni8wC>
3. <https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf>

Rationale for Nature of the course

Knowledge, Problem Solving, Analytical ability, Professional, Competency, Professional Communication and Transferrable Skill. And origin of life and trace the evolution of organism on the earth.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Pedagogy

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System (CANVAS).

Course Designer: DR. M. KARPAGA JOTHI, Assistant Professor

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	General characteristics, Classification of Gymnosperms (Sporne, 1954)	8	Discussion Power Point, Assignment, Test
	Economic importance of Gymnosperms with special reference to oil, resin, timber, etc.	7	
Unit II	Morphology, anatomy taxa belonging to each of the following orders: Cycadales (<i>Cycas</i>), Coniferales (<i>Pinus</i>). Gnetales (<i>Gnetum</i>).	8	Power point Black board LMS, Seminar, test
	Reproduction of the taxa belonging to each of the following orders: Cycadales (<i>Cycas</i>), Coniferales (<i>Pinus</i>). Gnetales (<i>Gnetum</i>).	7	
Unit III	Concepts of palaeobotany Geological Time scale Concepts of palaeobotany	7	Power point Black board LMS, test
	Carbon dating, Types Fossil and Contributions of Birbal Sahni to Palaeobotany	8	

Unit IV	Morphological, anatomical and geological era of fossil Rhynia and Calamites.	8	Black Board Virtual Lab, test
	Morphological, anatomical and geological era of fossil Lepidodendron	7	
Unit V	Evolution – Definition and importances, Origin of life. Theories by Darwin, Lamark and De veries,	7	Group discussion Seminar, test
	Modern Synthetic theory. Variation - analysis and sources, adaptive radiation, Concept of species - Allopatric and sympatric.	8	

Course Learning Outcomes: On completion of this course, the students will be able to,

CLOs	Course Learning Outcomes	Knowledge Level
CLO–1	Understand the concept of identification, classification and economic importance of Gymnosperms and fossils	K3
CLO–2	Analyze the phylogeny of Gymnosperms	K4
CLO–3	Compare and contrast the reproductive structures of Gymnosperms & fossil forms	K3
CLO–4	Analyze the anatomy and reproduction Gymnosperms along with their ecological and economical importance.	K4
CLO–5	Determine the various fossilization methods and their significance in paleobotany	K4

Mapping of CLOs with PSOs

#	PSO–1	PSO–2	PSO–3	PSO–4	PSO–5	PSO–6
CLO–1	2	3	3	3	3	3
CLO–2	3	3	3	2	3	3
CLO–3	3	3`	3	3	3	3
CLO–4	3	3	2	3	3	3
CLO–5	3	3	3	3	3	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	2	3	2	2
CLO2	3	3	2	3	3	3
CLO3	2	2	1	-	2	2
CLO4	1	-	2	2	1	1
CLO5	-	1	-	2	-	-

Advance application– 3;

Intermediate level–2;

Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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&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 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			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 with 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 BOTANY				CLASS: II B.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
IV	Core Practical	23U4BCCP4	Core Practical - IV	4	3	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives: The course objectives are to,

1. enable students, observe and record the morphological feature of selected species of Gymnosperms,
2. enable the students, observe and record the anatomical features of selected species of Gymnosperms,
3. develop the skill of preparation of microslides of the gymnosperm samples,
4. enable students to gain insights into the basics of palaeobotany and methods of fossilization and
5. understand the anatomy of the fossil plants through microscopy.

Practicals:

1. Study of morphology, anatomy and structure of the vegetative and reproductive organs of *Cycadales* (*cycas*); *Coniferales* (*pinus*) and *Gnetales* (*Gnetum*) through permanent slides and hand sections.
2. Identification of microscopic slides of *Cycas*, *Pinus* and *Gnetum*.
3. Field visits the habitats (Hill station).
4. Study the following fossil members: *Rhynia*, *Lepidodendron*, and *Willamsonia sewardiana*
5. Photograph of evolution scientists.
6. Plant examples of homology and analogy.
7. Submission of record note book and field report note.

Rationale for Nature of the Course:

The students acquire profound practical skills in the laboratory with scientific observations in the field of Gymnosperms thereby enriching a thorough understanding on the field aspects of identifying plants.

Activities having direct bearing on Skill development / Employability / Entrepreneurship:

The course will help the students to develop their skills on the nuances of morphological and anatomical aspects of Gymnosperms.

Pedagogy:

Hands on training, dissection, chalk and talk, power point, group discussion, seminar, interaction, problem solving, quiz, virtual labs, you tube videos & learning management system (canvas).

Course Designer: Dr. M. Karpaga Jothi, Assistant Professor

Lecture Schedule:

S.No.	Description	Hours	Mode
I	Study of morphology, anatomy and structure of the vegetative and reproductive organs of <i>Cycadales (cycas)</i> ; <i>Coniferales (pinus)</i> and <i>Gnetales (Gnetum)</i>	18	Plant specimens, Dissection and Microscopic Slides
	Study the following fossil members: <i>Rhynia</i> , <i>Lepidodendron</i> , and <i>Willamsonia seawardian</i>	18	
	Identification of microscopic slides relevant to the syllabus	9	

Course Learning Outcomes:

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

Mapping of CLOs with PSOs

CLOs	CLO Statement	Knowledge Level
CLO 1	Know the morphology and anatomy of Gymnosperms	Upto K4
CLO 2	Understand structure of the vegetative and reproductive organs of Gymnosperms	Upto K4
CLO 3	Analyze the following fossil members; <i>Rhynia</i> , <i>Lepidodendron</i> , and <i>willamsonia seawardian</i> .	Upto K4
CLO 4	Photograph of evolution scientists.	Upto K4
CLO 5	Analyze the identification of microscopic slides relevant to the syllabus	Upto K4

Mapping Programme Specific Outcomes with Course Learning Outcomes:

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CLO 1	1	2	2	2	3	2
CLO 2	3	2	3	2	2	3
CLO 3	2	1	3	3	3	3
CLO 4	2	2	3	3	3	2
CLO 5	3	2	3	2	2	3

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Mapping Programme Outcomes with Course Learning Outcomes:

#	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CLO 1	3	3	2	3	2	1
CLO 2	3	3	2	2	3	2
CLO 3	2	2	3	3	1	2
CLO 4	3	3	3	3	3	3
CLO 5	3	3	2	2	3	1

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

DEPARTMENT OF BOTANY				CLASS: II B.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
IV	SEC	23U4BSED6	Fermentation Technology	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives: This course will enable the students to,

1. understand principles and application of fermentation technologies
2. gain insights on safety and quality control in large scale production of fermentative products
3. study design and operation of fermenter in mass production of fermented products
4. know about the production of various fermentative products and
5. learn about the production of enzymes and role computers in fermentation industry.

UNIT	CONTENT	CLO	K LEVEL	HOURS
I	Introduction- Principle- scope and opportunities of fermentation technology. Major types of organisms used in fermentation- Preparation and sterilization of media.	1	Upto K4	6
II	Microbial culture: Isolation, preservation and improvement of industrially important microorganisms. Metabolic regulations and mass production of metabolites.	2	Upto K4	6
III	Fermenter design, types and functions- Batch, submerged, solid state and continuous culture methods.	3	Upto K4	6
IV	Fermentative production of vinegar, alcohol (ethanol), amino acids (glutamic acid) and antibiotics (penicillin).	4	Upto K4	6
V	Microbial production of enzymes: Amylase and Protease. Computers in fermentation- modelling. Sensors, control and supervision of fermentation process.	5	Upto K4	6

Books for Study

1. Pelczar M.J., Chan E.C.S. and Krieg N.R (2003). Microbiology. 5th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Casida L.E (2015). Industrial Microbiology, 3rd Edition, New Age International (P) Limited Publishers, New Delhi, India.
3. Waites M.J (2008). Industrial Microbiology: An Introduction, 7th Edition, Blackwell Science, London, UK.

Books for References

1. Prescott S.C., Dunn C.G., Reed G. 1982. Prescott & Dunn's Industrial Microbiology, 4th Edition, AVI Pub. Co., USA.
2. Reed G. 2004. Prescott & Dunn's industrial microbiology, 4th Edition, AVI Pub. Co., USA.
3. Peppler, H. J. D. Perlman. 2014. Microbial Technology: Fermentation Technology. Aca. Press.
4. Peter F Stanbury, Allan Whitaker, Stephen J Hall. 2016. Principles of Fermentation Technology. Butterworth-Heinemann Press. UK.

Web Resources

1. <https://ebooks.foodtechlearning.xyz/2020/12/principal-of-fermentation-technology-by.html>
2. <https://www.amazon.in/Principles-Fermen.-Techno-Peter-Stanbury-ebook/dp/B01LMDYFNQ>
3. <https://www.amazon.in/Principles-Ferment.-Tech.-Peter-Stanbury-ebook/dp/B01E3IC73W>

Rationale for Nature of the Course

To empower the students to know scope and applications of fermentation technology by imbibe the knowledge on microbial culture techniques, isolation and selection of value-added cells to produce ethanol, enzymes, antibiotics and amino acids and various designs and computer modelling of fermenter

Activities having direct bearing on Skill development / Employability / Entrepreneurship

The knowledge on fermentation process enables the students to manipulate and improve microbial and other living cells to apply for large scale production of high value products in industry.

Pedagogy

Chalk and Talk, Power Point, Group Discussion, Seminar, Interaction, Tests, Assignment, Quiz, Google classroom & LMS (CANVAS).

Course Designer: Dr. P. Kannan, Associate Professor

Course Schedule

Unit	Description	Hours	Mode
1	Introduction- Principle- scope and opportunities of fermentation technology.	2	Chalk and Talk, Power Point, Tests, Quiz & Seminar
	Major types of organisms used in fermentation-	2	
	Preparation and sterilization of media.	2	
II	Microbial culture: Isolation	2	Power Point, Quiz, Seminar, Group Discussion & Tests
	Preservation and improvement of industrially important microorganisms.	2	
	Metabolic regulations and mass production of metabolites.	2	
III	Fermenter design, types and functions	2	Chalk and Talk, Seminar, Quiz & Tests
	Batch, submerged, solid state methods	2	
	Continuous culture methods.	2	

IV	Fermentative production of vinegar, alcohol (ethanol)	2	Chalk and Talk, Power Point, Assignment, Quiz, Seminar & Tests,
	Production of amino acids (glutamic acid)	2	
	Production of antibiotics (penicillin).	2	
V	Microbial production of enzymes: Amylase and Protease.	2	Assignment, Power Point & LMS (CANVAS).
	Computers in fermentation- modelling.	2	
	Sensors, control and supervision of fermentation process.	2	

Course Learning Outcomes: On successful completion of the course, the students will be able to

CLOs	CLO Statement	Knowledge Level
CLO 1	Know the significance of fermentation technology and industrially useful microbes.	Up to K4
CLO 2	Explain the process of maintenance and preservation of micro-organisms.	Up to K4
CLO 3	Inculcate the design and operation of industrial practices in mass production of fermented products.	Up to K4
CLO 4	Analyze the various aspects of the fermenter design and various culture types for mass cultivation of products.	Up to K4
CLO 5	Validate the experimental techniques for microbial production of enzymes and computer modelling for fermentation process.	Up to K4

Mapping Programme Specific Outcomes with Course Learning Outcomes:

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	1	2	2	1	2	2
CLO2	2	-	2	2	3	1
CLO3	1	2	-	-	2	1
CLO4	2	1	3	2	1	-
CLO5	2	3	3	2	3	2

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Mapping Programme Outcomes with Course Learning Outcomes:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	1	3	2	2
CLO2	3	3	-	2	1	1
CLO3	2	2	3	1	-	1
CLO4	3	3	2	-	3	-
CLO5	3	2	2	1	2	1

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Blue Print – Model for External Examination
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section – A		Section – B		Section C (Either/ Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K – Level		
1	CLO 1	Up to K 4	2	K1 or K2	1	K1	2(K1&K1)	1 (K2)
2	CLO 2	Up to K 4	2	K1 or K2	1	K1	2(K2&K2)	1 (K3)
3	CLO 3	Up to K 4	2	K1 or K2	1	K2	2(K3&K3)	1 (K3)
4	CLO 4	Up to K 4	2	K1 or K2	1	K2	2(K4&K4)	1 (K4)
5	CLO 5	Up to K 4	2	K1 or K2	1	K2	2(K3&K3)	1 (K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark 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 fact 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 BOTANY				CLASS: II B.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
IV	SEC	23U4BSED7	BIostatISTICS	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives: The course objectives are to,

1. understand the concept, scope and principles of biostatistics.
2. gain knowledge on methods of collection and presentation of data.
3. become familiar with theory and applications.

Unit	Description	Hours	K-level	CLO
I	Introduction: Principles and practices. Various probability distribution's stages of statistics: collection, presentation, analysis, interpretation of results and tests. Primary and secondary data.	6	Upto K4	1
II	Collection of data by sampling methods. Presentation of data as tables, diagrams and graphs.	6	Upto K4	2
III	Analysis: Measures of central tendency – Mean, Mode and Median. Measures of dispersion – Standard deviation.	6	Upto K4	3
IV	A brief account and applications of correlation and regression.	6	Upto K4	4
V	Tests and their significance. Chi-square test in biological samples.	6	Upto K4	5

Books for Study:

1. Khan and Khanum Shiba Khan. 1994. Fundamentals of biostatistics. Ukaaz publications. Hyderabad.
2. Veer Bala Rastogi. 2017. Biostatistics. Scientific International, New Delhi.
3. Pranab Kumar Banerjee. 2006. Introduction to biostatistics (A textbook of Biometry). S. Chand Publication.

Books for References:

1. Principles of Biostatistics. 2022. Marcello Pagano, Kimberlee Gauvreau, Heather Mattie. Chapman & Hall, CRC Press.
2. Biostatistics: Basic concepts and Methodology. 2014. Wayne W. Daniel, Chad L. Cross. John Wiley & Sons Inc. USA.
3. Fundamentals of Biostatistics. 1995. Bernard Rosner. Duxbury Press. London.
4. Introductory Biostatistics. 2019. T. Le. Chap. L. E. Eberly. Wiley Publications.
5. A textbook of Biostatistics. 2010. A. Madeshwaran. Lambert Academic publishers.

Web Resources:

1. <https://www.biostat.washington.edu/about/biostatistics>
2. <https://publichealth.jhu.edu/departments/biostatistics>
3. <https://academic.oup.com/biostatistics>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4763618/>
5. <https://www.sydney.edu.au/courses/courses/pc/master-of-biostatistics.html>

Rationale for Nature of the Course:

Students are aware that understanding the analysis of biological samples will require an understanding of biostatistics theory. For the students, it is quite helpful in presenting data in a variety of ways.

Activities having direct bearing on Skill development / Employability / Entrepreneurship:

Students are taught analytical skills through group discussions, software use, and biological sample analysis.

Pedagogy:

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System.

Course Designer: Prof. S. CHELLA PANDIAN, Associate Professor and Head

Course Schedule:

Unit	Topics	Hrs	Mode
Unit I	Introduction: Principles and practices.	2	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Various stages of statistics: collection, presentation, analysis, interpretation of results and tests. Primary and secondary data.	4	
Unit II	Collection of data by sampling methods.	3	
	Presentation of data as tables, diagrams and graphs.	3	
Unit III	Analysis: Measures of central tendency – Mean, Mode and Median.	3	
	Measures of dispersion – Standard deviation.	3	
Unit IV	A brief account and applications of correlation and regression.	6	
Unit V	Tests and their significance. Chi-square test in biological samples.	6	

Course Learning Outcomes:

CLOs	Course Learning Outcomes	Knowledge Level
CLO 1	Know the concept, scope and principles of biostatistics	Up to K4
CLO 2	Comprehend the collection and sampling methods of data	Up to K4
CLO 3	Evaluate the analytical knowledge of probability distribution	Up to K4
CLO 4	Distinguish the correlation and regression	Up to K4
CLO 5	Apply the Chi-square test	Up to K4

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CLO 1	1	2	2	1	2	3
CLO 2	2	2	3	2	2	2
CLO 3	2	2	1	2	2	2
CLO 4	2	3	3	2	3	1
CLO 5	1	3	3	1	3	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	3	3	2	3	2	2
CLO 2	3	3	3	2	3	3
CLO 3	2	2	3	3	1	1
CLO 4	3	3	3	3	3	2
CLO 5	3	3	2	2	2	1

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

Summative - Blue - Print - Model
(Mapping with Course 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 or K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO 2	Up to K3	2	K1 or K2	1	K1	2 (K2 & K2)	1 (K3)
3	CLO 3	Up to K3	2	K1 or K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO 4	Up to K4	2	K1 or K2	1	K2	2 (K4 & K4)	1 (K4)
5	CLO 5	Up to K5	2	K1 or 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			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 with 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%



THE MADURA COLLEGE
An Autonomous Institution affiliated to Madurai Kamaraj University
Re-accredited (4th cycle) with 'A' grade by NAAC
Vidya Nagar, T.P.K. Road, Madurai – 625 011

BOTANY DEPARTMENT- POST GRADUATE (P.G)

Vision

- Producing Botany students as ambassadors of sustainable development in all spheres of human activity and leaving the earth to the successive generation as intact as possible.

Mission

- To sensitize the Botany students to the classification, structure, physiology, ecology, genetics and economic importance of plants
- To inculcate the students with an environment that fosters the development of appropriate scientific vocabulary, reasoning skills and effective oral and written communication ability for students
- To create holistic understanding of the allied subjects through interdisciplinary learning.

Programme: M.Sc. Botany	
Duration: 2 years	
Programme Outcomes (PO)	
The M.Sc. Botany program is designed to achieve the following objectives	
PO1	To impart knowledge on the fundamental, advanced and emerging concepts in Botany.
PO2	To provide up to date theoretical knowledge on various forms of plants, their interactions with biotic and abiotic entities in the ecosystem and relevant practical skills.
PO3	To comprehend and interpret various facets of Botany including the importance and judicious utilization of plant sources.
PO4	To disseminate knowledge on the design and execution of experiments in Botany with emphasis on the operation of relevant sophisticated instruments.
PO5	To promote proficiency in designing the research problems, review of literature, laboratory experiments, data analyses and preparation of reports with professional ethics.
PO6	To enable the students to take up various qualifying examinations concerning Botany and to face the challenges in career opportunities.

Program Specific Outcomes (PSO)	
On successful completion of the M.Sc. Botany program, the students are expected to	
PSO1	Identify the potency of plant resources in contemporary research and visualize future thrust areas in Botany.
PSO2	Design scientific experiments independently and to generate useful information to address various issues in Botany.
PSO3	Acquire basic knowledge on principles and applications of laboratory instruments and adequate skills to handle them.
PSO4	Carryout scientific experiments independently or in collaboration with inter-disciplinary or multidisciplinary approaches.
PSO5	Awareness on the sustainable utilization of plant/microbial resources following the bioethical norms.
PSO6	Demonstrate proficiency in communicating with various stakeholders like students, teachers, scientists and society.

EVALUATION (Theory)

Internal (Formative): 25 Marks

External (Summative): 75 Marks

Total: 100 Marks

Continuous Internal Assessment (CIA): (Major & Electives: 25 marks)

S. No.	Components	Marks
1.	Test (Average of two tests conducted for 25 marks and converted into 10 marks)	10
2.	Assignment	05
3.	Seminar	05
3.	Model Making/ / Poster or Chart presentation/Quiz/Documentation/ Case lets/ICT based Assignment/ Mini Project/Attendance	05
Total		25

Question Paper pattern for Theory external examination (Major & Electives: 75 marks)

S. No.	Section	Marks
1.	A. Multiple Choice Question (10x1)	10
2.	B. Short Answer type (5x2)	10
3.	C. Either/or Type (5x5)	25
4.	D. open Choice Type (3 out of 5 questions, 3x10)	30
Total		75

EVALUATION (Practical)

Internal (Formative): 40 Marks

External (Summative): 60 Marks

Total: 100 Marks

Question Paper pattern for Internal /Model practical examination (Major: 40 marks)

S. No.	Components	Marks
1.	Major question (sections/dissections/experiments)	15
2.	Minor Question (sections/dissections/experiments)	08
3.	Spotters	12
4.	Record	05
	Total	40

Question Paper pattern for external practical examination (Major: 60 marks)

S. No.	Components	Marks
1.	Major question (sections/dissections/experiments)	20
2.	Minor Question (sections/dissections/experiments)	15
3.	Spotters	20
4.	Record	05
	Total	60

THE MADURA COLLEGE (AUTONOMOUS), MADURAI - 11
DEPARTMENT OF BOTANY
TANSCHÉ - Curriculum Structure for M.Sc. Botany (Major) to be implemented from June
2023- 2024

Semester – I					
Part	Course	Subject Code	Course Title	Hours / Week	Credits
A	Core Course - 1 (Theory) (CC1)	23P1BCCT1	Plant diversity- I: Algae, Fungi, Lichens and Bryophytes	6	5
	Core Course - 2 (Theory) (CC2)	23P1BCCT2	Plant diversity- I: Pteridophytes, Gymnosperms and Palaeobotany	6	5
	Core Course - 3 (Practical) (CC3)	23P1BCCP1	Laboratory course- I: Covering Papers I and II	6	4
	Elective Course-I (EC1)	23P1BECT1	Microbiology, Immunology and Plant Pathology	5	3
	Elective Course-II (EC2)	23P1BECT2	Horticulture	5	3
B	Skill Enhancement Course (SEC1)	23P1BSED1	Nursery and Gardening	2	2
	Total			30	22
Semester – II					
A	Core Course - 4 (Theory) (CC4)	23P2BCCT3	Taxonomy of Angiosperms and Economic Botany	6	5
	Core Course - 5 (Theory) (CC5)	23P2BCCT4	Plant Anatomy and Embryology of Angiosperms	6	5
	Core Course – 6 (Practical) (CC6)	23P2BCCP2	Laboratory course- II: Covering Papers III and IV	6	4
	Elective Course-III (EC3)	23P2BECT3	Research Methodology, Computer applications & Bioinformatics	5	3
	Elective Course-IV (EC4)	23P2BECT4	Ecology and Conservation Biology	5	3
B	Skill Enhancement Course (NME-I)	23P2BSEN1	Organic Farming	2	2
	Total			30	22
Semester – III					
A	Core Course - 7 (Theory) (CC7)	23P3BCCT5	Cell and Molecular Biology	6	5
	Core Course-8 (Theory) (CC8)	23P3BCCT6	Genetics, Plant Breeding and Biostatistics	6	5
	Core Course – 9 (Practical) (CC9)	23P3BCCP3	Laboratory course- III: Covering Papers V and VI	6	4

	Elective Course-III (EC3)	23P3BECT3	Industrial Botany	5	3
	Elective Course-IV (EC4)	23P3BECT4	Forestry	5	3
B	Skill Enhancement Course (NME-II)	23P3BSEN2	Mushroom Cultivation	2	2
	Internship/ Industrial Activity			-	2
	Total			30	24
Semester – IV					
A	Core Course - 10 (Theory) (CC10)	23P4BCCT7	Plant Physiology	6	5
	Core Course – 11 (Practical) (CC11)	23P4BCCP4	Laboratory course- IV: Covering Papers X and XI	6	4
	Elective Course-V (EC5)	23P4BPROV	Project with Viva-voce	8	8
	Elective Course-VI (EC6)	23P4BECT6	Biochemistry and Applied Biotechnology	6	3
B	Skill Enhancement Course (SEC-I)	23P4BSEN1	Training Competitive Examinations Botany for NET/UGC-CSIR/SET/TRP	4	2
	Extension Activity			-	1
	Total			30	23

DEPARTMENT OF BOTANY				CLASS: I M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
III	Core	23P3BCCT5	Cell and Molecular Biology	5	6	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Course Objectives: This course will enable the students to

1. know the various cell structures and functions of prokaryotes and eukaryotes
2. understand the salient features and functions of cellular organelles
3. understand the cell division and its molecular mechanism
4. examine nucleic acid structure, replication, transcription and translation processes and
5. enlighten students to study the recent developments in molecular biology.

UNIT	CONTENT	CLO	K LEVEL	HOURS
I	Cell Biology: Ultra structure and organization of Prokaryotic and Eukaryotic cells. Plant cell structure, specialized plant cell types- Cell wall: chemistry and functions. Plasma membrane- structural model (Fluid Mosaic Model) and functions. Plasmodesmata and its role in movement of molecules. Molecular basis for cell wall mediated signalling mechanisms. Cell to cell communication mechanisms in plants. Endocytosis and Exocytosis. Cell divisions and regulations- Mitosis and Meiosis.	1	Upto K4	20
II	Cell Organelles: Chloroplast-structure and function, genome organization Mitochondria; structure, genome organization, biogenesis. Plant Vacuole - Tonoplast membrane, ATPases transporters as a storage organelle. Structure and function of other cell organelles- Golgi apparatus, lysosomes, endoplasmic reticulum, Ribosomes and microbodies, Ergastic substances – Raphides and Cystolith.	2	Upto K4	15
III	Nucleus: Structure and function, Nucleosome organization, euchromatin and heterochromatin. DNA Structure. A, B and Z forms. DNA damage and repair (Thymine dimerization, photo-reactivation, excision repair). Cell cycle and Apoptosis and its Control mechanisms. Cytokinesis and cell plate formation.	3	Upto K4	15

IV	Molecular Biology: Central dogma of molecular biology- DNA replication (prokaryotes and eukaryotes), enzymes involved in replication- Organization of Histones. RNA structures, Transcription, enzymes involved in transcription, post transcription changes (capping, polyadenylation and splicing), RNA editing and its transport- reverse transcription. Genetic code- Process of Translation. Post translational modifications of proteins.	4	Upto K4	20
V	Regulation of gene expression - Gene expression in Prokaryotic (<i>trp</i> operons) and Eukaryotic (<i>rbcl</i> gene) – Gene silencing- Molecular Chaperons. Signal transduction pathways – role of hormones and their receptors in signalling- Transposons and types- Gene mapping methods. Gene cloning methodologies: cloning vectors (pBR322, pUC18 and Blue scripts), Construction of cDNA library.	5	Upto K4	20

Books for Study

1. David Freifelder (2008). Essentials of Molecular Biology. Narosa Publishing house. New Delhi.
2. Karp, G. (1999). Cells and Molecular Biology: Concepts & Experiments. John Wiley and Sons, Inc., USA.
3. Alberts B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J. D (1989). Molecular biology of the Cell (2nd edition). Garland Pub. Inc., New York.

Books for References

1. Roy, S.C and Kumar, K.D.C (1977). Cell Biology, New Central Book Agency, Calcutta.
2. Aminul, I (2011). Text Book of Cell Biology. Books and Allied (P) Ltd, Kolkata, India.
3. Geoffrey M. Cooper (2019). The Cell: A Molecular Approach, Oxford University Press.
4. Turner, P.C., Mclennan, A.G., Bates, A.D. and White, M.R.H (2001). Instant notes on molecular biology.
5. Watson, J.D, Baker T.A., Bell S.P., Gann A., Levine M., Losick R (2014). Molecular Biology of the Gene (7th edition), Pearson Press.
6. Cooper G M and Hausman R E (2007). The Cell: Molecular Approach 4th Edn, Sinauer Associates, USA.

Web Resources

1. <https://www.pdfdrive.com/cell-biology-books.html>
2. <http://www.bio-nica.info/Biblioteca/Bolsover2004CellBiology.pdf>
3. <https://www.e-booksdirectory.com/listing.php?category=549>
4. <https://www.elsevier.com/books/molecular-biology/clark/978-0-12-813288-3>
5. <https://www.kobo.com/in/en/ebooks/molecular-biology>

Rationale for Nature of the Course

To acquire knowledge on cell inclusions, cell divisions and expose the students a fundamental of gene expressions and relations of molecular biology.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

This course enables the students to understand structure and functions of the cell and its molecular aspects and processing during gene expression.

Pedagogy

Chalk and Talk, Power Point, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Images, Google classroom & LMS (CANVAS).

Course Designer: Dr. P. Kannan, Associate Professor

Course Schedule

Unit	Description	Hours	Mode
I	Ultra structure and organization of Prokaryotic and Eukaryotic cells.	2	Chalk and Talk, Power Point, Group Discussion, Seminar, Tests Quiz, LMS (CANVAS).
	Plant cell structure, specialized plant cell types- Cell wall: chemistry and functions. Plasma membrane- structural model (Fluid Mosaic Model) and functions.	4	
	Plasmodesmata and its role in movement of molecules.	2	
	Molecular basis for cell wall mediated signalling mechanisms. Cell to cell communication mechanisms in plants.	4	
	Endocytosis and Exocytosis.	2	
	Cell divisions and regulations-	2	
	Mitosis	2	
	Meiosis	2	
II	Chloroplast-structure and function, genome organization	4	Chalk and Talk, Power Point, Quiz Group Discussion, Seminar, Assignment Google classroom & LMS (CANVAS).
	Mitochondria; structure, genome organization, biogenesis.	3	
	Plant Vacuole - Tonoplast membrane, ATPases transporters as a storage organelle.	2	
	Structure and function of other cell organelles- Golgi apparatus, lysosomes.	3	
	endoplasmic reticulum, Ribosomes and microbodies	3	
III	Nucleus: Structure and function, Nucleosome organization, euchromatin and heterochromatin.	4	Chalk and Talk, Power Point, Seminar, Quiz Group Discussion, Test Google classroom & LMS (CANVAS).
		2	
	DNA Structure. A, B and Z forms. DNA damage and repair (Thymine dimerization, photo-reactivation, excision repair).	3	
	Cell cycle and Apoptosis and its Control mechanisms.	3	
	Cytokinesis and cell plate formation.	3	

IV	Central dogma of molecular biology	2	Chalk and Talk, Power Point, Quiz, Seminar, Group discussion & Interactions Tests
	DNA replication (prokaryotes and eukaryotes), enzymes involved in replication	3	
	Organization of Histones.	3	
	RNA structures, Transcription, enzymes involved in transcription, post transcription changes (capping, polyadenylation and splicing),	4	
	RNA editing and its transport- reverse transcription.	2	
	Genetic code- Process of Translation	3	
	Post translational modifications of proteins.	3	
V	Gene expression in Prokaryotic (<i>trp</i> operons) and Eukaryotic (<i>rbcl</i> gene) – Gene silencing.	5	Chalk and Talk, Power Point, Quiz, Seminar
	Molecular Chaperons. Signal transduction pathways- role of hormones and their receptors in signalling-	4	
	Transposons and types- Gene mapping methods.	4	
	Gene cloning methodologies: cloning vectors (pBR322, pUC18 and Blue scripts)	5	
	Construction of cDNA library.	2	

Course Learning Outcomes: On successful completion of the course, the students will be able to

CLOs	CLO Statement	Knowledge Level
CLO 1	Recall a plant cell structure and explain its function.	Up to K4
CLO 2	know the structure of various cell organelles.	Up to K4
CLO 3	Understand the structural and functional significance of nucleic acid.	Up to K4
CLO 4	Compare and contrast the DNA replication (prokaryotes and eukaryotes), enzymes involved in replication, DNA repair mechanisms.	Up to K4
CLO 5	Discuss and develop skills for gene manipulation and Molecular cloning	Up to K4

Mapping Programme Specific Outcomes with Course Learning Outcomes:

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	1	2	2	2	1	2
CLO2	3	2	3	3	3	1
CLO3	3	2	3	1	2	1
CLO4	2	3	3	3	2	2
CLO5	3	3	3	2	3	2

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Mapping Programme Outcomes with Course Learning Outcomes:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	3	2	1
CLO2	3	3	2	2	3	2
CLO3	2	2	3	3	1	2
CLO4	3	3	3	3	3	3
CLO5	3	3	2	3	2	2

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Blue Print – Model for External Examination

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

Sl. No	CLOs	K- Level	Section – A		Section – B		Section C (Either/ Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K – Level		
1	CLO 1	Up to K 4	2	K1 or K2	1	K1	2(K1&K1)	1 (K2)
2	CLO 2	Up to K 4	2	K1 or K2	1	K1	2(K2&K2)	1 (K3)
3	CLO 3	Up to K 4	2	K1 or K2	1	K2	2(K3&K3)	1 (K3)
4	CLO 4	Up to K 4	2	K1 or K2	1	K2	2(K4&K4)	1 (K4)
5	CLO 5	Up to K 4	2	K1 or K2	1	K2	2(K3&K3)	1 (K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
-Mark 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 fact 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 BOTANY				CLASS: I M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
III	Core	23P3BCCT6	Genetics, Plant Breeding and Biostatistics	5	6	25	75	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented		

Objectives: The Course objectives are to,

1. introduce the principles and physical basis of inheritance and its role in major revelations like human genome project,
2. emphasize the chromosomal basis of inheritance and variations; to understand the influence of more than one gene on a character,
3. impart knowledge on conventional plant breeding methods for crop improvement,
4. acquaint with collection of data and its graphical representation and measuring central tendency and standard deviation and
5. hypothetically test data and attain possible predictions.

Unit	Description	Hours	K-level	CLO
I	Genetics: Brief account on Three great milestones of genetics: Mendelian laws, Watson and Crick DNA Structure, Rice genome project. Principles of inheritance: Law of segregation and Law of independent assortment. Deviations from allelic interactions: Incomplete dominance, Co-dominance and Multiple alleles. Sex linked inheritance: Colour blindness. Population Genetics: Hardy-Weinberg law and factors affecting it.	20	Upto K4	1
II	Linkage: Facts and significance; Complete and incomplete. Crossing over: Mechanisms and theories. Interaction of genes: Complementary genes and recessive epistasis. Polygenic inheritance: Kernel colour in wheat. Organelle inheritance: Chloroplast – iojap inheritance in corn. Chromosomal aberrations.	15	Upto K4	2
III	Plant Breeding: Objectives, Selection: Mass, Pureline and Clonal. Hybridization: Principles and Methods. Heterosis theories. Plant introduction and acclimatization. Polyploidy: Principles, types, Pros and cons. Mutation breeding: Procedure (Choice of material, choice of mutagen, part of the plant to be treated, dose of mutagen, handling of segregating generations); Role of genetic markers in mutation breeding (RAPD and AFLP). QTL analysis.	20	Upto K4	3

IV	Biostatistics: Data collection: Types of data and methods. Frequency distribution: Discrete, continuous and cumulative. Graphical and diagrammatic representation of data. Measures of central tendency: Mean, mode and median. Standard deviation. Probability distribution: Binomial, Poisson and normal.	20	Upto K4	4
V	Test of hypothesis: Chi-square test and student t test, Z test. ANOVA: one and two way. Correlation and regression. Multivariate analysis.	15	Upto K4	5

Books for study:

1. Verma P. S. and Agarwal P.K 9th edition Genetics. S.Chand Publications. ISBN 8121931142.
2. Singh B D (2015). *Plant Breeding: Principles and methods*. Kalyani Publications.
3. Gurumani, Biostatistics

Books for References:

1. Gardener, E.J. (1). 8th Ed. Principles of Genetics, John Wiley, New York.
2. Allard R W (2010). Principles of Plant Breeding (2nd Edn.). John Wiley and Sons, Inc.
3. Khan and Khanum, Biostatistics.

Web Resources

1. <https://www.cdc.gov/genomics/about/basics.htm>
2. <https://www.plantbreeding.org/students/resources>
3. <https://www.csueastbay.edu/statistics/biostatistics-psm/biostatistics.html>



Rationale for Nature of the course

Employability in research and development institutes that aimed at crop improvement and disease control, human hereditary diseases can be attained through the gained knowledge on basis of inheritance, plant breeding techniques and biostatistical processing of data and interpretations.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Able to predict the inheritance of traits in the posterity.

Knowledge gained on Selection and hybridization methods.

Collection of data, processing and graphical representation of data; hypothetical testing of data.

Pedagogy

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System (CANVAS).

Course Designer(s):

1. **Prof. V. Meenakshi Sundaram**, Assistant Professor.

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction, Mendels law, DNA structure and human genome project	7	Chalk and talk PPT, LMS and Group discussion, Quiz, Seminar, Test
	Mendelian laws,	3	
	Deviation from Mendelian laws	5	
	Sex linked inheritance	3	
	Population genetics	2	
Unit II	Linkage: Facts and significance; Complete and incomplete	4	Chalk and talk PPT, LMS and Group discussion, Quiz, Seminar, Test
	Crossing over: Mechanisms and theories.	3	
	Interaction of genes: Complementary genes and recessive epistasis.	3	
	Polygenic inheritance: Kernel colour in wheat	2	
	Organell inheritance: Chloroplast. Chromosomal aberrations.	3	
Unit III	Plant Breeding: Objectives	2	Chalk and talk PPT, LMS and Group discussion, Quiz, Seminar, Test
	Selection: Mass, Pure line and Clonal.	3	
	Hybridization: Principles and Methods. Heterosis theories	3	
	Plant introduction and acclimatization. Polyploidy: Principles, types, Pros and cons.	2	
	Mutation breeding: Procedure (Choice of material, choice of mutagen, part of the plant to be treated, dose of mutagen, handling of segregating generations); Role of genetic markers in mutation breeding (RAPD and AFLP).	10	
Unit IV	Biostatistics: Data collection: Types of data and methods.	5	Chalk and talk PPT, LMS and Group discussion, Quiz, Seminar, Test
	Frequency distribution: Discrete, continuous and cumulative. Graphical and diagrammatic representation of data.	5	
	Measures of central tendency: Mean, mode and median.	3	
	Measures of dispersion: Standard deviation.	2	
	Probability distribution: Binomial, Poisson and normal.	5	
Unit V	Test of hypothesis: Chi-square test and student t test, Z test.	6	Chalk and talk PPT, LMS and Group discussion, Quiz, Seminar, Assignment
	ANOVA: one and two way.	4	
	Correlation and regression. Multivariate analysis.	5	

Course Learning Outcomes: On successful completion of the course, the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
Students will be able to know, understand, apply and analyse		
CLO-1	Know the principles of autosomal and allosomal inheritance, some deviation interactions and allelic frequency in a population	Up to K4
CLO-2	Understand the linkage and crossing over, gene interactions, quantitative organelle inheritance,	Up to K4
CLO-3	Analyze crop improvement methods like selection, hybridization, polyploidy and mutation breeding	Up to K4
CLO-4	Predict the data collection methods, representation of data; measures of central tendency and measures of dispersion, probability distributions	Up to K4
CLO-5	Apply the testing of hypothesis, correlation and regression	Up to K4

Mapping Programme Specific Outcomes with Course Learning Outcomes:

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	1	2	2	2	1	2
CLO2	3	2	3	3	3	1
CLO3	3	2	3	1	2	1
CLO4	2	3	3	3	2	2
CLO5	3	3	3	2	3	2

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Mapping Programme Outcomes with Course Learning Outcomes:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	3	2	2
CLO2	3	3	2	2	3	2
CLO3	2	2	3	3	1	1
CLO4	3	3	3	3	3	2
CLO5	3	3	2	3	2	1

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Blue Print – Model for External Examination
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section – A		Section – B		Section C (Either/ Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K – Level		
1	CLO 1	Up to K 4	2	K1 or K2	1	K1	2(K1&K1)	1 (K2)
2	CLO 2	Up to K 4	2	K1 or K2	1	K1	2(K2&K2)	1 (K3)
3	CLO 3	Up to K 4	2	K1 or K2	1	K2	2(K3&K3)	1 (K3)
4	CLO 4	Up to K 4	2	K1 or K2	1	K2	2(K4&K4)	1 (K4)
5	CLO 5	Up to K 4	2	K1 or K2	1	K2	2(K3&K3)	1 (K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark 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 fact 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 BOTANY				CLASS: I M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
III	Core Practical	23P3BMP3	Practical - III	4	6	25	75	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented		

Course Objectives: This course will enable the students to,

1. observe chromosomes and different stages of cell divisions
2. demonstrate the methods of isolation and quantification of DNA.
3. solve problems related to Genetics and Biostatistics.
4. apply plant breeding techniques for crop improvement.

Practical – Cell and Molecular Biology

1. Squash preparation of onion root tips to study mitosis
2. Smear preparation of maize or Onion flower buds to study mitosis
3. Identification of various Ergastic substances
4. Illustrations of various cell organelles
5. Karyotyping and Idiogram
6. Isolation of plant genomic DNA and its quantification by UV-spectrophotometer.

Practical – Genetics, Plant Breeding and Biostatistics

1. Solving the genetics problems of various inheritance patterns given in the syllabus.
2. Construction of gene map following crossing over methods.
3. Data collection from plant samples
4. Grouping of data
5. Representation of data in graphs and bar digrams using MS EXCEL\
6. Measures of central tendency
7. Measures of dispersion: standard deviation
8. Testing the mendelian ratio; chi square test
9. ANOVA
10. Correlation and regression using software

Rationale for Nature of the course:

The course focus on the practical skills in laboratory on observation of chromosomes, different stages of cell division in plants, genomic DNA isolation, problems related to Genetics, Biostatistics and various plant breeding techniques

Activities having direct bearing on Skill development / Employability / Entrepreneurship

This Knowledge and skills acquired by the students will enable them to understand the types of cell division in plants, Isolation of genetic material and solve the problems related to Mendelian concepts in Genetics. The various plant breeding methods for crop improvement and statistical problems and tools will help them to equip themselves on self-employability.

Pedagogy

Chalk and Talk, Power Point, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Images, You Tube Videos, Google classroom & LMS (CANVAS).

Course Designer: Dr. P. Kannan, Associate Professor,
Prof. V. Meenakshi Sundaram, Assistant Professor

Course Schedule

Practical	Description	Hours	Mode
1	Squash preparation of onion root tips to study mitosis	3	Individual Experiments
2	Smear preparation of maize or Onion flower buds to study mitosis	3	Individual Experiments
3	Identification of various Ergastic substances	3	Hand Sectioning
4	Illustrations of various cell organells	3	Photographs and Videos
5	Karyotyping and Idiogram	3	Virtual Images and Group discussion
6	Isolation of plant genomic DNA and its quantification by UV-spectrophotometer	3	Group experiments
7	Isolation of plasmid DNA	2	Group experiments
8	Restriction digestion of DNA and its analysis by agarose gel electrophoresis	2	Group experiments
9	Isolation of RNA and quantifications- Demonstrations	2	Group experiments
10	SDS-PAGE analysis of seed storage proteins from legumes	2	Group experiments
11	Southern & Western Blotting Techniques.	2	Group experiments
12	Thermocycler (PCR) and DNA amplifications techniques. Measures of central tendency Correlation and regression using software	7	Group experiments LMS (CANVAS) & Group discussions

Course Learning Outcomes: On successful completion of the course, the students will be able to

CLOs	CLO Statement	Knowledge Level
CLO 1	Know the techniques in observation of cell organells, cell divisions, karyotyping and idiogram.	Up to K4
CLO 2	Understand DNA isolation, quantifications and chromosomal mapping	Up to K4
CLO 3	Analyze the various molecular biological experiments and techniques	Up to K4
CLO 4	Solving the genetics problems of various inheritance patterns	Up to K4
CLO 5	Apply the correlation and regression models using software's	Up to K4

Mapping Programme Specific Outcomes with Course Learning Outcomes:

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	1	2	2	2	1	2
CLO2	3	2	3	3	3	1
CLO3	3	2	3	1	2	1
CLO4	2	3	3	3	2	2
CLO5	3	3	3	2	3	2

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Mapping Programme Outcomes with Course Learning Outcomes:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	3	2	2
CLO2	3	3	2	2	3	2
CLO3	2	2	3	3	1	1
CLO4	3	3	3	3	3	2
CLO5	3	3	2	3	2	1

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

DEPARTMENT OF BOTANY				CLASS: I M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
III	SEC	23P3BECT3	Industrial Botany	3	5	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives: The course objectives are to,

1. learn the applied aspects of wood industry,
2. acquire the skills for working in plant-based industries,
3. empower the knowledge on plant-based small-scale industries,
4. improve the skills on tissue-culture based industries and
5. know the opportunities in plant-based industrial organizations.

Unit	Description	Hours	K-level	CLO
I	Wood industry: Introduction. A brief account of timber yielding trees in India. Properties, quality testing, characterization and grading of teak wood, rose wood and bamboo wood. Plywood industry – processing methods of veneering and finishing of plywood. Pulp-wood trees in India – process of paper making.	15	Up to K3	1
II	Plant products-based industries: Harvesting, processing and grading of tea. Extraction methods of volatile oils from mint, clove, eucalyptus and lemon grass. Spices and condiments industries: Harvest, storage and packaging methods of cinnamon, cardamom and black pepper. Marketing strategies of spices and condiments in India.	15	Up to K4	2
III	Plant-based small-scale industries: A brief account of dye yielding plants – extraction methods of henna and indigo dyes. Starch-yielding plants – flour making technology of tapioca. Extraction and preparation methods of palm jaggery from Palmyra palm. Sources and preparation of agarpathi and match sticks	15	Up to K4	3
IV	Tissue culture industries: Micropropagation of crop plants – protocol for mass production of banana clones. Callus culture, cell suspension culture and hairy root culture for production of withaferin, camptothecin and paclitaxel. Isolation and <i>in vitro</i> culture of endophytes for extraction of secondary metabolites. Biotransformation techniques for enhancement of secondary metabolite production.	15	Up to K4	4

V	Preparation of the project proposal for the establishment of plant product industries. Opportunities in herbal marketing and herbal trading companies in India. Grants and funds providing organization in India – National Medicinal Plant Board, Spice Board, Rubber Board, ICAR, NBPGR and CDRI.	15	Up to K4	5

Books for study:

1. Divya et al. 2022. Text book on wood products and utilization. Scientific Publishers, Jodhpur. ISBN: 9789392590795
2. Swamy, M.K. et al., 2021. Paclitaxel – sources, chemistry, anticancer actions, and current biotechnology. Academic Press, USA. ISBN: 9780323909518
3. Basu, S.K. et al., 2012. Industrial organization and management. Prentice Hall India Pvt. Ltd., New Delhi. ISBN: 9788120344211.

Books for References:

1. Bajpai, P. 2015. Pulp and paper making: microbiological issues in paper making. Elsevier, e-Book. eBook ISBN: [9780128034095](#)
2. Shahid Ul Islam 2017. Plant-based natural products: derivatives and applications. John Wiley & Sons, Inc. ISBN: 9781111942386
3. Pullaiah et al., 2020. Camptothecin and camptothecin producing plants. Elsevier, Inc. ISBN: 9780128204993
4. Ajeet Singh, 2022. Advanced phytochemicals and plant based drug discovery. IGI Global publisher, New Delhi. ISBN: 9781668451298.
5. Ushakumari, R. and Thamodharan, G. 2022. Commercial plant tissue culture and industrial applications. Narendra Publishing House, New Delhi. ASIN: BO9RGJT9KZ.

Web Resources

1. <https://www.sips.org.in>
2. <https://www.routledge.com>
3. <https://www.ibef.org/blogs/the-rising-plant-based-sector-in-india-insights-and-opportunities>
4. <https://nmpb.nic.in/>
5. <https://icar.org.in/>

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	A brief account of timber yielding trees in India. Properties, quality testing, characterization and grading of teak wood, rose wood and bamboo wood.	8	Power point presentation, Test, Seminar, quiz, Group discussion, Industrial visits
	Plywood industry – processing methods of veneering and finishing of plywood. Pulp-wood trees in India – process of paper making	7	
Unit II	Harvesting, processing and grading of tea leaves. Extraction methods of volatile oils from mint, clove, eucalyptus and lemon grass.	8	Seminar, Quiz, Test, Laboratory demonstration, Group discussion, Industrial visits
	Spices and condiments industries: Harvest, storage and packaging methods of cinnamon, cardamom and black pepper. Marketing strategies of spices and condiments in India.	7	
Unit III	brief account of dye yielding plants – extraction methods of henna and indigo dyes. Starch-yielding plants – flour making technology of tapioca.	8	Power point presentation, Test, Chalk and talk, Assignment, Seminar, Quiz, Industrial visits
	Extraction and preparation methods of palm jaggery from Palmyra palm. Sources and preparation of agarpathi and match sticks	7	
Unit IV	Micropropagation of crop plants – protocol for mass production of banana clones. Callus culture, cell suspension culture and hairy root culture for production of withaferin, camptothecin and paclitaxel.	8	Power point presentation, Test, Seminar, Quiz, Assignment, Group discussion, Industrial visits
	Isolation and <i>in vitro</i> culture of endophytes for extraction of secondary metabolites. Biotransformation techniques for enhancement of secondary metabolite production.	7	
Unit V	Project proposal for establishment of plant product industries. Opportunities in herbal marketing and herbal trading companies in India.	7	Power point presentation, Assignment of proposal writing, Group discussion, Industrial visits
	Grants and funds providing organization in India – National Medicinal Plant Board, National Spice Board, National Rubber Board, ICAR, NBPGR and CDRI.	8	

Rationale for Nature of the course

The course enhances the employable skills and getting opportunities in plant-based industries.

Activities having direct bearing on Skill development / Employability Entrepreneurship

The course will be provided the knowledge on plant products, analytical ability on opportunities, professional competency in nature-based industries, and transferable skill development on plant products.

Pedagogy

Chalk and talk, power point presentation, video shows, quiz, assignment, group discussion, protocol preparation, laboratory demonstration and industrial visits.

Course Designer:

Dr. S. KARUPPUSAMY, Associate Professor

Course Learning Outcomes: On successful completion of the course, the students will be able to,

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	On completion of this course, the students will be able to: Understand the applied knowledge on wood industries.	K1
CLO2	Would be competent to work in plant-products based industries.	K2
CLO3	Analyse the raw materials used in plant-based small-scale industries.	K3
CLO4	Evaluate the application of plant tissue culture for industrial production of valuable metabolites.	K4
CLO5	Synthesize the skills for establishment of plant-based industries.	K4

Mapping of CLOs with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	2	1	3	1	1	1
CLO2	1	2	2	1	3	1
CLO3	1	1	1	1	2	2
CLO4	3	2	2	1	1	1
CLO5	2	3	1	2	1	2

Advance application– 3;

Intermediate level–2;

Basic level–1

Mapping of CLOs with POs

Components of CIA

Component	Weight / Mark
Continuous Internal Assessment Test	10 Marks
Assignments / Seminars	5 Marks
Quiz / Product formulation	5 Marks
Field visit reports/Pilot project	5 Marks
Total	25 Marks

Blueprint for Semester Examination

Sl.No	Cos	K -Level	Section –A		Section –B		Section C (Either/Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K - Level		
1	CO1	Up to K2	2	K1or K2	1	K1	2(K2&K2)	1(K2)
2	CO2	Up to K3	2	K2or K3	1	K1	2(K3&K3)	1(K3)
3	CO3	Up to K3	2	K2or K3	1	K2	2(K3&K3)	1(K3)
4	CO4	Up to K4	2	K3or K4	1	K2	2(K4&K4)	1(K4)
5	CO5	Up to K4	2	K3or K4	1	K2	2(K4&K4)	1(K4)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark 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 fact 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 BOTANY				CLASS: I M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
III	SEC	23P3BECT4	Forestry	4	5	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives: The course objectives are to,

1. understand the various concepts and procedures of forestry
2. familiarize the functioning of the various types of forests
3. gain knowledge on forest dynamics and management
4. realize the importance of Tamil literature in relevance to forestry and
5. provide the comprehensive knowledge of English literature regarding the forestry.

Unit	Description	Hours	K-level	CLO
I	Forests: Introduction, definitions and classification of forest (Champion and Seth 1968). Afforestation and reforestation. Natural and artificial regeneration of forests. Silviculture: General principles, physical and ecological factors influencing vegetation. Silviculture of <i>Tectona grandis</i> .	15	Upto K4	1
II	Silvicultural practices: Clear felling, uniform shelter wood selection, coppices and conversion systems. Aerial seeding. Agroforestry: Scope, selection of species and utilization as food, fodder and fuel. Forest management: Forest protection against fire (Drone-spraying) pests and landslides. A brief account on participation of tribes on forestry programmes.	15	Upto K4	2
III	Forest utilization and Law: Direct and indirect benefits of forests. Timber and Non-Timber Forest Produces (NTFP): A brief account on Gums, resins, oil seeds, bamboos and medicinal plants. Forest Laws: Biodiversity act - 2002 and National biodiversity authority rules-2004.	15	Upto K4	3
IV	Poem: Gieve Patel – On killing a tree. Celestine Raj Monohar – Sonnet on Deforestation. Short Fiction: Ruskin Bond – Dust on the mountain. Alexis Snell – Bear in the Stars.	15	Upto K4	4
V	கபிலரின் குறிஞ்சிப்பாட்டு - 99 மலர்களின் அறிமுகம் - தேமா - கூவிளம் - செங்கொடி வேலி - வடவனம் - முல்லை - குறுக்கத்தி - நாகம் - வஞ்சி - குருந்து - வேங்கை	15	Upto K4	5

Books for Study:

1. Sagreiya, K. P. 1967. Forest and Forestry, 1967. National book trust India.
2. Snell and Alexix. 2024. Bear in the Stars. Penguin random house.
3. மரு.மு.அல்லிமுத்து. 2016. கபிலரின் குறிஞ்சிப்பாட்டும் சித்த மருத்துவமும். ஸ்ரீ இராஜேஸ்வரி பதிப்பகம். திருநெல்வேலி.

Books for References:

1. Indian Forestry: A breakthrough approach to forest service. 2023. K. Manikandan & S. Prabhu. Jain Brothers Publishers, New Delhi.
2. Introduction to Forestry, 2017. SR. Reddy & C. Nagamani. Kalyani Publishers, New Delhi.
3. Handbook of forestry, 2012. Bridger Blakeney, Agrotech Press, UK.
4. Handbook of Agroforestry, 2021. Agrotech Publishing Academy, New Delhi.
5. Forestry: Principles and applications. 2023. Antony Joseph Raj & S. B. Lal. Scientific Publishers, New Delhi.
6. Negi, S. S. 1988. Elements of general silviculture. International book distributors, New Delhi.

Web Resources:

1. <https://www.usaid.gov/india/forestry>
2. <https://www.clearias.com/forest/>
3. https://agritech.tnau.ac.in/forestry/agroforestry_index.html
4. https://ebook.icar.org.in/index.php/bookprocess/ugbscfcore_list
5. <https://www.insightsonindia.com/environment/environment-degradation-and-issues/forest-ecosystem/governmental-institutions-for-forest-conservation/agroforestry/>

Rationale for Nature of the Course:

Gaining theoretical knowledge and acquiring skills on silviculture, types of forests, agroforestry and social/urban forestry, forest management, forest utilization and legislation and forest laws will help students to get employment in forest department and Agro-based industries. Additionally, students will gain multidisciplinary understanding on departments related to forest studies in both Tamil and English.

Activities having direct bearing on Skill development / Employability / Entrepreneurship:

Analytical skills gained through discussions, relevant practices, study-trips, visit to timber and furniture shops.

Pedagogy:

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System.

Course Designer: Prof. S. CHELLA PANDIAN, Associate Professor, Department of Botany

Dr. S. SARAVANAN, Assistant Professor, Department of Botany

Dr. A. VIGNESH, Assistant Professor, Department of English

Dr. A. LAVANYA, Assistant Professor, Department of Tamil

Course Schedule:

Unit	Topics	Hrs	Mode
Unit I	Introduction, Definitions and forest types in India. Afforestation, reforestation. Natural and artificial regeneration of forests.	7	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz & Test
	Silviculture: General principles, physical and ecological factors influencing vegetation. Silviculture of <i>Tectona grandis</i> .	8	
Unit II	Sylvicultural systems: Clear felling, uniform shelter wood selection, coppices and conversion systems. Aerial seeding and thinning.	5	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Google classroom & Test
	Agroforestry: Scope, selection of species and utilization as food, fodder and fuel.	3	
	Forest management: Principles and techniques. Forest working plan. Impact of forest fires and human activities. Forest protection against fire, pests and landslides. A brief account on participation of tribes on forestry programmes.	7	
Unit III	Forest utilization: Direct and indirect benefits of forests.	3	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Test.
	Timper and Non-Timber Forest Produces (NTFP): Gums, resins, oil seeds, bamboos and medicinal plants.	5	
	Forest Laws: National forest policy-1988. Indian forest act-1927, Forest conservation act-1980, Biodiversity act-2002 and National biodiversity authority rules-2003.	7	
Unit IV	Poem: Gieve Patel – On killing a tree. Celestine Raj Monohar – Sonnet on Deforestation.	7	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz & Test.
	Short Fiction: Ruskin Bond – Dust on the mountain. Alexis Snell – Bear in the Stars.	8	
Unit V	கபிலரின் குறிஞ்சிப்பாட்டு - 99 மலர்களின் அறிமுகம் - தேமா - கூவிளம் - செங்கொடி	8	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Assignment.
	வேலி - வடவனம் - முல்லை - குறுக்கத்தி - நாகம் - வஞ்சி - குருந்து - வேங்கை	7	

Course Learning Outcomes: On successful completion of the course, the students will be able to,

CLOs	Course Learning Outcomes	Knowledge Level
CLO 1	Know the fundamentals, principles and significance of forests.	Up to K4
CLO 2	Understand the silviculture, agroforestry and forest management.	Up to K4
CLO 3	Evaluvate the forest utilization and laws.	Up to K4
CLO 4	Comprehend English-language literature on forests.	Up to K4
CLO 5	Recognize Tamil-language literature on forests.	Up to K4

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CLO 1	1	2	2	1	2	2
CLO 2	2	2	3	2	2	2
CLO 3	2	2	1	2	2	3
CLO 4	2	3	3	2	3	1
CLO 5	1	3	3	1	3	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PSO 6
CLO 1	3	3	2	3	2	3
CLO 2	3	3	3	2	3	2
CLO 3	2	2	3	3	1	2
CLO 4	3	3	3	3	3	1
CLO 5	3	3	2	2	2	2

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

Summative - Blue - Print - Model
(Mapping with Course 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 or K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO 2	Up to K3	2	K1 or K2	1	K1	2 (K2 & K2)	1 (K3)
3	CLO 3	Up to K3	2	K1 or K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO 4	Up to K4	2	K1 or K2	1	K2	2 (K4 & K4)	1 (K4)
5	CLO 5	Up to K5	2	K1 or 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			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 with 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 BOTANY				CLASS: I M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
III	SEC – NME II	23P3BSEN2	Mushroom Cultivation	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives: The Course objectives are to,

1. teach the identification of mushrooms.
2. differentiate the edible mushrooms with toxic and hallucinating fungi.
3. study the cultivation technique of mushrooms
4. learn the economic importance of mushroom in various fields.
5. study how to establish mushroom cultivation as business enterprise.

Unit	Description	Hours	K-level	CLO
I	Introduction: Morphological and microscopical identification of edible and poisonous mushrooms Medicinal, nutritional, nutraceuticals and dietary supplements of mushrooms.	6	Up to K4	1
II	Structure and keys for identification of edible mushrooms: <i>Agaricus bisporus</i> and <i>Pleurotus sajor-caju</i> , Key for identifying hallucinogenic mushroom - <i>Psilocybe</i> sps; Medicinal Mushroom – <i>Ganoderma lucidum</i> .	6	Up to K4	2
III	Cultivation: Substrate sterilization, bed preparation, cropping room and maintenance, raising of pure culture and spawn preparation, factors effecting button mushroom production.	6	Up to K4	3
IV	Post-harvest management: Harvest, storage, quality assurance of mushrooms. Pest management. Production of various mushroom-based foods for marketing - pickles, chips, soup and cutlet.	6	Up to K4	4
V	Entrepreneurship in mushroom cultivation - World production of edible mushroom. Legal and regulatory issues of introducing the medicinal mushrooms in different countries. Developing small scale industries and Government schemes. Mushroom Research Centers – International and National levels.	6	Up to K4	5

Books for study:

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Dept. of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. The Bangalore Printing and Publishing.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.

Books for References

1. Pandey B P (1996). A textbook of fungi. Chand and Company, New Delhi.
2. Nita Bhal (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
3. Mushrooms: Guide to Mushroom Culture. Pure Culture Spawn Co. Nabu Press. 2011. ISBN-10: 124596013X.

Web Resources

1. <http://www.agrimoon.com/mushroom-culture-horticulture-icar-pdf-book/>
2. [https://books.google.co.in/books/about/Mushroom Cultivation in India.html?id=6AJx99OGTKEC&redir_esc=y](https://books.google.co.in/books/about/Mushroom+Cultivation+in+India.html?id=6AJx99OGTKEC&redir_esc=y)
3. <https://www.amazon.in/Mushroom-Cultivation-India-B-C/dp/817035479X>

Rationale for Nature of the course

Gained theoretical knowledge on mushroom morphology, identification, principles, post-harvest technology and applications of mushrooms will help students to get employment in Agro-based industries.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Analytical skills gained through theoretical discussions on mushroom morphology, identification, principles of cultivation, develop the small-scale industry, marketing, research centres will help to students to attend issues in mushroom cultivation and agro based industries.

Pedagogy

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System (CANVAS).

Course Designer: DR. M. KARPAGA JOTHI, Assistant Professor

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction; Morphological and microscopical identification of edible and poisonous mushrooms	3	Chalk & Talk, Seminar, Quiz, & Test
	Medicinal, nutritional, nutraceuticals and dietary supplements of mushrooms	3	
Unit II	Structure and keys for identification of edible mushrooms: <i>Agaricus bisporus</i> and <i>Pleurotus sajor-caju</i> ,	3	Chalk & Talk, Seminar, Quiz, & Test
	hallucinogenic mushroom - <i>Psilocybe</i> sps; Medicinal Mushroom – <i>Ganoderma lucidum</i>	3	
Unit III	Cultivation: Substrate sterilization, bed preparation, cropping room and maintenance,	3	Assignment & Demonstrate method
	Raising of pure culture and spawn preparation, factors effecting button mushroom production	3	
Unit IV	Post-harvest management: Harvest, storage, quality assurance of mushrooms. Pest management.	3	Group Discussion, Seminar, Quiz & Test
	Production of various mushroom based foods for marketing - pickles, jams, chips, soup, cutlet, vegetable curry	3	
Unit V	Entrepreneurship in mushroom cultivation - World production edible mushroom. Legal and regulatory issues of introducing the medicinal mushrooms in different countries.	3	Seminar, Quiz Group Discussion, Test
	Developing small scale industry and Government schemes. Mushroom Research Centers – International and National levels.	3	

Course Learning Outcomes: On successful completion of the course, the students will be able to,

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Knowledge on identification of edible and toxic mushrooms belonging to Ascomycota and Basidiomycota	K1 TO K4
CLO-2	Outline the nutraceutical properties of edible mushrooms.	K1 TO K4
CLO-3	Knowledge on cultivation techniques of edible and medicinal mushrooms.	KQ TO K4
CLO-4	Understand the harvest and post-harvest techniques of mushroom crops.	K1 TO K4
CLO-5	Knowledge on the production and marketing strategies for Mushrooms	K1 TO SK4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6
CLO-1	1	2	2	2	2	2
CLO-2	3	2	3	2	3	2
CLO-3	3	1`	3	1	2	3
CLO-4	2	3	3	3	3	2
CLO-5	3	3	2	3	2	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	1	3	2	2
CLO2	3	3	2	2	3	3
CLO3	3	3	2	2	1	1
CLO4	3	3	3	3	3	3
CLO5	3	3	2	3	2	2

Advance application– 3;

Intermediate level–2;

Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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
2	CLO 2	Up to K3	2	K2&K3	1	K1	2(K2&K2)	1
3	CLO 3	Up to K4	2	K2&K3	1	K2	2(K3&K3)	1
4	CLO 4	Up to K4	2	K3&K4	1	K2	2(K4&K4)	1
5	CLO 5	Up to K4	2	K4&K4	1	K3	2(K4&K4)	1
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			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 with choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.66	
K3	4	2	10	20	36	30.00	30%
K4	2	-	20	20	42	35.00	35%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF BOTANY				CLASS: I M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
III	Internship		Internship	2	-	-	-	-

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives: The course objectives are to,

1. motivate students to take up internship in research institutions / industry
2. develop the employability of students and
3. promote entrepreneurial tendencies among students.

During the second semester vacation, students shall undertake internship for a minimum period of two weeks and submit a report and certificate from the company / industry / institution offering internship.

At the end of the internship, the students will be able to

CLOs	Course Learning Outcomes	K level
CLO 1	Work independently and as a team in mission critical projects in real-time	K4
CLO 2	Develop into a critical thinker and solve every day problems in the industry.	K5
CLO 3	Learn and analyze problems faced by the industry and workforce at large.	K4
CLO 4	Survey the job market / understand entrepreneurial opportunities / research opportunities available to them.	K2
CLO 5	Communicate precisely and accurately with team members and supervisors.	K3

Mapping of CLOs with 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

Advance application –3, Intermediate level –2, Basic level–1

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	3	3	3	3
CLO 2	3	3	3	3	3
CLO 3	3	3	3	3	3
CLO 4	3	3	3	3	3
CLO 5	3	3	3	3	3

Advance application –3, Intermediate level –2, Basic level–1

Valuation schema for Internship

The student will be graded on a seven-point scale with corresponding GPAs as mentioned below.

Grade	GPA
Outstanding	10
Excellent	9
Very Good	8
Good	7
Average	6
Below average	5
Reappearance	1-4

DEPARTMENT OF BOTANY				CLASS: II M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
IV	Core	23P4BCCT7	Plant Physiology	4	6	25	75	100

Nature of Course								
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented				

Objectives: The Course objectives are to,

1. understand the designating properties of water that privilege it as the chief constituent and mediating life-keeping processes,
2. acquaint with the role of mineral and organic solutes and its transport mechanisms,
3. familiarize with the fixation and metabolism of the major elements carbon and nitrogen,
4. narrate the energy exerting catabolic pathways and its significance and
5. unravel the role of hormones on plant growth and development.

Unit	Description	Hours	K-level	CLO
I	Water regime: Role and forms of water, ecology of water regime in plants. Water potential and its components. Mineral nutrition: Chemical composition of ash, Role of minerals, deficiency and toxicity symptoms. Mechanism of absorption of water by root (Short distance) – Apoplast, symplast, Ion channels – K ⁺ , Ca ²⁺ , Anion channels and aquaporins. P type and V type of pumps. Ascent of sap (long distance) – Root pressure, Cohesion-tension theory and transpiration pull. Transpiration ratio, mechanism of stomatal movements, anti-transpirants and factors affecting transpiration.	20	Up to K4	1
II	Physiology of nitrogen cycle – Soil forms, role of microbes, absorption mechanisms and metabolism. Photoassimilate translocation – Source to sink relationship, phloem loading and unloading. Elimination of substances in plants: Excretion and Secretion (Nectar and Terpenes), Ecological role of substance elimination.	15	Up to K4	2
III	Metabolism: Photosynthesis - Importance and Global role of green plants. Light phase: Properties of light, Absorption and action spectra, PSI and PS II, Non-cyclic and cyclic photophosphorylation. Dark phase: C ₃ , C ₂ , C ₄ cycles, and CAM pathway. Respiration: Glycolysis, Oxidative Pentose Phosphate Pathway, Pyruvate metabolism: (Fermentation and oxidative decarboxylation), Kreb's cycle. Electron Transport Chain. Energy budget.	20	Up to K4	3

IV	Growth and Development: Photobiology - Light parameters and plant responses, Structure and roles of photoreceptors: phytochrome, cryptochrome and phototropins. Structure and physiological roles of growth regulators: auxin, gibberellin, cytokinin, ethylene, abscisic acid, brassinosteroids and jasmonic acid.	20	Up to K4	4
V	Plant responses to water, cold and heat stresses. Biological clock. Senescence, seed dormancy, Photoperiodism, Vernalization. Plant movements: Heliotropic and thigmonastic.	15	Up to K4	5

Books for study:

1. Jain. V.K, Fundamentals of Plant Physiology, (2009), S. Chand and company Ltd., New Delhi. ISBN 81-219-0462-5
2. Pandey S.N and Sinha, B.K. Plant Physiology, 4th Edition. Vikas Publications. ISBN: 9788125918790
3. Verma B.K and Mohit verma. A textbook of Plant Physiology, Biochemistry and Biotechnology, S. Chand and company Ltd., New Delhi. ISBN-10: 9788121906272

Books for References:

1. Raman, K. 1996. Transport phenomenon in plants. Narosa Publications. ISBN 978 81 319 128 2.
2. Frank B. Salisbury, Cleon W. Ross and Plant physiology edition 4 Wadsworth publishing company. ISBN 0534983901
3. Malcolm B. Wilkins, M.B. Advanced Plant Physiology. Pitman press. ISBN 0-273- 01853-1
4. William G. Hopkins, Norman Introduction to Plant Physiology John Wiley & Sons ISBN-13 978-0470247662
5. Lincoln Taiz and Eduardo Zeiger, Plant Physiology. Third edition (2003). Panima Publishing Corporation, New Delhi. ISBN 81-86535-41-1

Web Resources

1. www.plantphys.net
2. https://www.youtube.com/watch?v=RT-w2xHVI_E
3. <https://www.youtube.com/watch?v=MHu-A58ys4>

Rationale for Nature of the course

Gained theoretical knowledge on plant water relations, metabolism and applications of hormones will help students to get employment in agro-based industries.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Analytical skills gained through theoretical discussions on water potential, various metabolic pathways, physiological basis of plant growth and development will help students to attend issues in crop improvement and Agri based industries.

Pedagogy

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System (CANVAS).

Course Designer(s): Prof. V. Meenakshi Sundaram, Assistant Professor.

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Role and forms of water, ecology of water regime in plants. Water potential and its components.	4	Chalk and talk PPT, LMS and Group discussion, Quiz, Seminar & Test
	Mineral nutrition: Chemical composition of ash, Role of minerals, deficiency and toxicity symptoms.	4	
	Mechanism of absorption of water by root (Short distance) – Apoplast, symplast, Ion channels – K ⁺ , Ca ²⁺ , Anion channels and aquaporins. P type and V type of pumps.	4	
	Ascent of sap (long distance) – Root pressure, Cohesion-tension theory and transpiration pull.	2	
	Transpiration ratio, mechanism of stomatal movements, antitranspirants and factors affecting transpiration.	6	
Unit II	Biogeochemical cycles of nitrogen, sulfur and phosphorus – Soil forms, role of microbes, absorption mechanisms and metabolism.	5	Chalk and talk PPT, LMS and Group discussion, Quiz, Seminar & Test
	Photoassimilate translocation – Source to sink relationship, phloem loading and unloading.	4	
	Elimination of substances in plants: Excretion and Secretion (Nectar and Terpenes), Ecological role of substance elimination.	6	
Unit III	Photosynthesis: Importance and Global role of green plants.	2	Chalk and talk PPT, LMS and Group discussion, Quiz, Seminar & Test
	Light phase: Properties of light, Absorption and action spectra, PSI and PS II, Non-cyclic and cyclic photophosphorylation.	6	
	Dark phase: C ₃ , C ₂ , C ₄ cycles, and CAM pathway.	6	
	Respiration: Glycolysis, Oxidative Pentose Phosphate Pathway, Pyruvate metabolism: (Fermentation and oxidative decarboxylation), Krebs's cycle. Electron Transport Chain. Energy budget.	6	
Unit IV	Photobiology: Light parameters and plant responses, Structure and roles of photoreceptors: phytochrome, cryptochrome and phototropins.	8	Chalk and talk PPT, LMS and Group discussion, Quiz, Seminar & Test
	Structure and physiological roles of growth regulators: auxin, gibberellin, cytokinin, ethylene, abscisic acid, brassinosteroids and jasmonic acid.	12	
Unit V	Plant responses to water, cold and heat stresses.	7	Chalk and talk PPT, LMS and Group discussion Quiz, Seminar & Assignment
	Senescence, ripening of fruits, seed dormancy, Photoperiodism, Vernalization	8	

Course Learning Outcomes: On successful completion of the course, the students will be able to,

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Know the water regime in plants, mineral nutrition and mechanism of transpiration	Up to K4
CLO-2	Understand the biogeochemical cycles and translocation of photoassimilates	Up to K4
CLO-3	Analyze the photosynthetic and respiration pathways	Up to K4
CLO-4	Evaluate the physiological roles of photoreceptors and phytohormones	Up to K4
CLO-5	Analyze the stress and plant responses physiology	Up to K4

Mapping of CLOs with PSOs

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

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	3	1	3	2
CLO2	3	3	2	2	3
CLO3	3	3	2	2	1
CLO4	3	3	3	3	3
CLO5	3	3	2	3	2

Advance application- 3;

Intermediate level-2;

Basic level-1

Summative - Blue – Print – Model
(Mapping with Course 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
2	CLO 2	Up to K3	2	K2&K3	1	K1	2(K2&K2)	1
3	CLO 3	Up to K4	2	K2&K3	1	K2	2(K3&K3)	1
4	CLO 4	Up to K4	2	K3&K4	1	K2	2(K4&K4)	1
5	CLO 5	Up to K4	2	K4&K4	1	K3	2(K4&K4)	1
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			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 with choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.66	
K3	4	2	10	20	36	30.00	30%
K4	2	-	20	20	42	35.00	35%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF BOTANY				CLASS: II M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
IV	Core Practical	23P4BCCP4	Core Practical - IV	4	6	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives: This course will enable the students to,

1. Estimate the water potential of plant tissues and related processes,
2. Calculate the amount of pigment and the rate of photosynthesis,
3. Analyze various biomolecules through quantitative and qualitative methods and
4. Inculcate the techniques employed in plant tissue culture and applied aspects of biotechnology.

Plant Physiology Practical:

1. Demonstration of influence of seed coat thickness on the rate of imbibitions
2. Estimation of fresh weight and dry weight of a week-old seedlings.
3. Determination of water potential of potato tuber following Gravimetric method
4. Determination of water potential of potato tuber / Quiscalis leaf following Chardakov's method
5. Demonstration of plasmolysis (or) estimation of water potential following plasmolytic method
6. Enumeration stomatal index of various leaves
7. Determine the effect of various organic solvent on membrane permeability of various colourful petals and beet root
8. Demonstration of hydroponics
9. Determine the effect of various detergents on membrane permeability of beet root
10. Comparing the stress induced responses: estimation of proline accumulation, catalase activity/peroxidase activity
11. Estimation of photosynthetic pigment
12. Demonstration of starch accumulation in leaves
13. Estimation of NR activity
14. Separation of photosynthetic pigments following paper chromatographic technique.
15. Separation of photosynthetic pigments following Column chromatographic technique.
16. Separation of photosynthetic pigments following TLC technique.
17. Demonstration of etiolation
18. Seed viability test
19. Effect of fertilizers (or) monochromatic light (or) hormones in seed germination
20. Physiological setups and spotters' discussion

Biochemistry and Applied Biotechnology Practical:

1. Estimation of Glucose.
2. Estimation of Protein.
3. Estimation of Lipid.
4. Paper Chromatography.
5. Thin Layer Chromatography.
6. Nitrate reductase activity.
7. Amylase activity.
8. Plasmid DNA (Mini-preparation method) from *E. coli*.
9. Extraction of total genomic DNA from plant leaves (CTAB method).
10. Agarose gel electrophoresis, staining and visualization of DNA.
11. Media preparation, surface sterilization, explant preparation, inoculation and incubation.
12. Micropropagation, callus culture and somatic embryogenesis using carrot explants.
13. Demonstration of PCR and blotting techniques.

Rationale for Nature of the Course:

The students acquire profound technical skills in the laboratory with scientific novel observations in the field of Plant Physiology, Biochemistry and applied areas of Biotechnology thereby enriching thorough experimental hands-on-training on various experiments.

Activities having direct bearing on Skill development / Employability / Entrepreneurship:

The knowledge explored from the practical skills in the nuances of physiological experiments, biochemical experiments and plant tissue culture techniques will enable the students to get a position in industries and research institutes.

Pedagogy

Chalk and Talk, Demonstration, Group Experiments, Hands-on-training, Interaction, Problem Solving, Quiz, Virtual Labs, You Tube Videos etc.

Course Designers:

Prof. V. Meenakshi Sundaram, Assistant Professor &

Dr. N. Janakiraman, Assistant Professor

Course Schedule:

S. No	Topics	Hrs	Mode
I	Demonstration of influence of seed coat thickness on the rate of imbibitions, Estimation of fresh weight and dry weight of a week-old seedlings.	8	Individual hands-on-training, Test, group experiments, demonstration and video clippings
	Determination of water potential of potato tuber following Gravimetric method, Determination of water potential of potato tuber / Quisqualis leaf following Chardakov's method	8	
	Demonstration of plasmolysis (or) estimation of water potential following plasmolytic method, Enumeration of stomatal index of various leaves, Determine the effect of various organic solvent on membrane permeability of various colourful petals and beet root	8	
	Comparing the stress induced responses: estimation of proline accumulation, catalase activity/peroxidase activity	8	
	Estimation of photosynthetic pigment, Demonstration of starch accumulation in leaves, Estimation of NR activity	8	
	Separation of photosynthetic pigments following paper chromatographic technique, Separation of photosynthetic pigments following Column chromatographic technique, Separation of photosynthetic pigments following TLC technique.	8	
	Demonstration of etiolation, Seed viability test, Effect of fertilizers (or) monochromatic light (or) hormones in seed germination, Physiological setups and spotters discussion	12	
II	Estimation of glucose, protein and lipids	6	Individual hands-on-training, Test, group experiments, demonstration and video clippings
	Separation of compounds using paper and thin layer chromatography	4	
	Nitrate reductase and amylase activity	4	
	Plasmid DNA (Mini-preparation method) from <i>E. coli</i> , Extraction of total genomic DNA from plant leaves (CTAB method), Agarose gel electrophoresis, staining and visualization of DNA	6	
	Media preparation, surface sterilization, explant preparation, inoculation and incubation. Micropropagation, callus culture and somatic embryogenesis using carrot explants	8	
	Demonstration of PCR and blotting techniques	2	

Course Learning Outcomes: On successful completion of the course, the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO 1	Perform quantitative tests for all major macromolecules and file a report of chemical profile of a plant cell.	Up to K4
CLO 2	Understand the fundamentals of water and its relation to plants.	Up to K4
CLO 3	Evaluate the role of pigment in photosynthetic mechanism and related events of plants.	Up to K4
CLO 4	Estimate and separate plant biomolecules	Up to K4
CLO 5	Analyse the basic techniques in plant tissue culture	Up to K4

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CLO 1	1	2	2	3	1	1
CLO 2	3	2	3	2	3	2
CLO 3	2	1	3	3	1	2
CLO 4	2	3	1	3	3	3
CLO 5	3	3	1	3	2	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	3	3	1	3	2	1
CLO 2	3	3	2	2	3	2
CLO 3	3	2	3	3	1	2
CLO 4	3	3	3	3	3	3
CLO 5	3	3	2	3	2	2

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

DEPARTMENT OF BOTANY				CLASS: II M.Sc., BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext	Total
IV	Project	23P4BECT5	Project & Viva-voce	8	8	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives: The course objectives are to,

1. motivate students to take up research projects in their field of interest.
2. promote scientific temper and systematic approach to problem solving and research methodology.
3. promote research writing aptitude among students.

During the fourth semester, students shall undertake a project work and submit the project report.

CLOs	Course Learning Outcomes	K level
CLO 1	Survey scientific literature available and identify gaps in existing studies	K4
CLO 2	Design a scientific study taking practical constraints into account	K5
CLO 3	Perform the scientific study taking practical constraints into account.	K3
CLO 4	Analyze the results.	K4
CLO 5	Communicate the findings based on ethical standards of reporting.	K3

Mapping of CLOs with 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

Advance application –3, Intermediate level –2, Basic level–1

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	3	3	3	3
CLO 2	3	3	3	3	3
CLO 3	3	3	3	3	3
CLO 4	3	3	3	3	3
CLO 5	3	3	3	3	3

Advance application –3, Intermediate level –2, Basic level–1

Internal& External Valuation for Project

Internal	External
25 marks	75 Mark
Guide Evaluation: ● 10 Marks for Students ability and interest ● 10 Marks for Regularity and Punctuality ● 5 Marks for Quality of the work and Presentation	Dept Evaluation: 25 (Min (No.) 50 % of faculty must be present) ● 15 Marks for Presentation using ICT tools. ● 10 Marks for Quality and Publications / Presentation in Seminar/ conferences External Evaluation: 50 ● 20 Marks for the Report ● 30 Marks for Presentation, Quality of work and Viva voce.

DEPARTMENT OF BOTANY				CLASS: II M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ Week	CIA	Ext	Total
IV	SEC	23P4BECT6	Biochemistry and Applied Biotechnology	4	6	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives: This course will enable the students to

1. Know the fundamentals and significance of biochemistry.
2. Study the structure and properties of biomolecules.
3. Learn the applied and industrial aspects of plant biotechnology.

Unit	Description	Hours	K-level	CLO
I	Biochemistry: Structure of atom, chemical bonds (ionic, covalent and hydrogen bonds), functional groups of biological importance, biological significance of pH, buffers (bicarbonate and phosphate) and their actions, principles and laws of thermodynamics, Gibbs free energy concept and redox potential.	15	Upto K4	1
II	Biomolecules: Carbohydrates: Classification, structure and properties of monosaccharides (glucose and fructose), disaccharides (sucrose and maltose) and polysaccharides (starch and cellulose). Carbohydrate metabolism: Gluconeogenesis. Lipids: Structure, fatty acids (saturated and unsaturated), properties and classification of lipids (simple, compound and derived). Lipid metabolism: β -oxidation of palmitic acid. Uses of cellulose and omega - 3 fatty acid.	20	Upto K4	2
III	Proteins: Amino acids - Structure, properties and classification based on R chain. Classification, properties and structure (primary, secondary, tertiary & quaternary) of proteins. Ramachandran plot. Enzymes: Nomenclature, properties, classification, mechanism of enzyme action, enzyme kinetics (Michaelis-Menton constant and Lineweaver Burk plot) and factors affecting enzyme action. Secondary Metabolites: Sources, chemical nature and role of alkaloids, terpenoids and flavonoids.	20	Upto K4	3

IV	Applied Biotechnology: Transgenic plants - pest resistance (Bt cotton), herbicide resistance (glyphosate), disease resistance (chitinase), biofortification (golden rice), virus and bacteria based transient gene expression systems. Virus induced gene complementation and gene silencing. Terminator seed technology, antisense technology for delayed fruit ripening, plants as factories for useful products and pharmaceuticals.	20	Upto K4	4
V	Fermentation techniques and types. Industrial production of enzymes (amylase), enzyme immobilization, citric acid production, antibiotic (penicillin production), amino acid (glutamic acid production) and production of ethanol. Bioreactors for culturing plant cells and production of secondary metabolites, super bug and its role in biodegradation. Bioremediation - <i>In situ</i> and <i>Ex situ</i> .	15	Upto K4	5

Books for Study:

1. Satyanarayana, U and Chakrapani, U. 2005. Biochemistry, Books and Allied (P) Ltd. Calcutta.
2. Jain, J.L. 2005. Fundamentals of Biochemistry. S. Chand & Co. New Delhi.
3. Lehninger, A.L. 1982. Principles of Biochemistry, CBS Publication.

Books for References:

1. Bonner, J. and Warner, W.H. 1961. Plant Biochemistry. Academic Press. Inv. New York.
2. Gupta, S.N. 2016. Biochemistry, Rastogi Publications, Meerut.
3. Zubay, G. 1988. Biochemistry. 1988 Macmillan Publishing Co, New York.
4. Heldt, H-W. 2005. Plant Biochemistry, 3rd Edition. Elsevier Academic Press.
5. Harold, F.M. 1986. The vital force: A study of Bioenergetics. Freeman & Co, New York.
6. Buchanan, B.B., Griseem, W. and Jones, R.L. 2000. Biochemistry and molecular biology of plants. 5th Edition. Wiley-Blackwell.

Web Resources:

1. http://www.brainkart.com/subject/Plant-Biochemistry_257/
2. https://swayam.gov.in/nd2_cec20_bt12/preview
3. <https://www.scribd.com/document/378882955/>
4. <https://manavrachna.edu.in/blog/scope-of-biotechnology/>
5. <https://archive.nptel.ac.in/courses/102/103/102103016/>
6. <https://archive.nptel.ac.in/courses/102/105/102105058/>

Rationale for Nature of the Course:

This course enables the students to understand the basic concept, structure and functions of various biomolecules. It also helps to imbibe the knowledge on the applied aspects of biotechnology.

Activities having direct bearing on Skill development / Employability / Entrepreneurship:

The skills learned by the students will help them to effectively understand the importance of various biomolecules and their metabolism. The knowledge on transgenic plant production and

industrial aspects of biotechnology will train the students to learn technical skills and promotes employment in industry.

Pedagogy:

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System.

Course Designer: Dr. N. JANAKIRAMAN, Assistant Professor

Course Schedule:

Unit	Topics	Hrs	Mode
Unit I	Structure of atom, chemical bonds (ionic, covalent and hydrogen bonds), functional groups of biological importance,	5	Chalk and Talk, Power Point, Discussion, Seminar, Test, Quiz, Video Clippings & Google classroom.
	Biological significance of pH, buffers (bicarbonate and phosphate) and their actions,	5	
	Principles and laws of thermodynamics, Gibbs free energy concept and redox potential.	5	
Unit II	Biomolecules: Carbohydrates: Classification, structure and properties of monosaccharides (glucose and fructose), disaccharides (sucrose and maltose) and polysaccharides (starch and cellulose).	8	Chalk and Talk, Power Point, Test, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Carbohydrate metabolism: Gluconeogenesis.	2	
	Lipids: Structure, fatty acids (saturated and unsaturated), properties and classification of lipids (simple, compound and derived).	7	
	Lipid metabolism: β -oxidation of palmitic acid.	3	
Unit III	Amino acids - Structure, properties and classification based on R chain.	5	Chalk and Talk, Test, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Classification, properties and structure (primary, secondary, tertiary & quaternary) of proteins.	5	
	Enzymes: Nomenclature, properties, classification, mechanism of enzyme action, enzyme kinetics (Michaelis-Menton constant and Lineweaver Burk plot) and factors affecting enzyme action.	5	
	Secondary Metabolites: Sources, chemical nature and role of alkaloids, terpenoids and flavonoids.	5	

Unit IV	Transgenic plants - pest resistance (Bt-cotton), herbicide resistance (glyphosate), disease resistance (chitinase), biofortification (golden rice).	5	Chalk and Talk, Power Point, Test, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Virus and bacteria based transient gene expression systems, virus induced gene complementation and gene silencing. Terminator seed technology,	5	
	Antisense technology for delayed fruit ripening, plants as factories for useful products and pharmaceuticals.	5	
Unit V	Fermentation techniques and types. Industrial production of enzymes (amylase), enzyme immobilization, citric acid production,	5	Chalk and Talk, Power Point, Assignment, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	antibiotic (penicillin production), amino acid (glutamic acid production) and production of ethanol.	5	
	Bioreactors for culturing plant cells and production of secondary metabolites, super bug and its role in biodegradation. Bioremediation - <i>In situ</i> and <i>Ex situ</i> .	5	

Course Learning Outcomes: On successful completion of the course, the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO 1	Know the fundamentals and significance of Biochemistry	Up to K4
CLO 2	Understand the structure and properties of plant biomolecules	Up to K4
CLO 3	Analyse the role of proteins and secondary metabolites in plants	Up to K4
CLO 4	Evaluate the methods of transgenic plant production	Up to K4
CLO 5	Apply the effective utilization of industrial products	Up to K4

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CLO 1	1	2	2	3	1	2
CLO 2	3	2	3	2	3	2
CLO 3	2	1	3	3	1	3
CLO 4	2	3	1	3	3	1
CLO 5	3	3	1	3	2	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	3	3	1	3	2	3
CLO 2	3	3	2	2	3	2
CLO 3	3	2	3	3	1	2
CLO 4	3	3	3	3	3	1
CLO 5	3	3	2	3	2	2

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

Summative - Blue - Print - Model

(Mapping with Course 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 or K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO 2	Up to K3	2	K1 or K2	1	K1	2 (K2 & K2)	1 (K3)
3	CLO 3	Up to K3	2	K1 or K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO 4	Up to K4	2	K1 or K2	1	K2	2 (K4 & K4)	1 (K4)
5	CLO 5	Up to K5	2	K1 or 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			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 with 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 BOTANY				CLASS: II M.Sc., BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext	Total
IV	SEC	23P4BSEN1	Tackling of Competitive Examinations	2	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives: The course objectives are to,

1. understand the various concepts of test of reasoning,
2. familiarize the functioning of the constitution of India,
3. gain knowledge on general awareness,
4. provide the comprehensive knowledge of NET/SET.

Unit	Description	Hours	K-level	CLO
I	Test of Reasoning: Concepts, explanations and illustrations for the following topics: Coding – decoding, classification/analogy series and data analysis.	12	Upto K4	1
II	Constitution of India and History: Total number of articles, schedules and annexures. Fundamental rights, Fundamental duties and Composition of parliament.	12	Upto K4	2
III	General awareness: A brief account on: Physical and biological sciences, Economy and Geography.	12	Upto K4	3
IV	National Eligibility Test for Junior research Fellow and Lectureship. General aptitude: Mathematical problems, Venn diagrams, Calculation of age and Seating arrangements.	12	Upto K4	4
V	Series completion, direction sense, number tests, blood relation tests.	12	Upto K4	5

Books for Study:

1. A Modern Approach to Verbal & Non-Verbal Reasoning. 2022. R.S. Aggarwal. S. Chand Publishers. New Delhi.
2. Multi-Dimensional Reasoning. 2010. Mishra & Kumar Dr. Lal. Upkar Prakashan Publishers. India.
3. Indian Constitution Text Book- For Civil Services/State Services. 2020. A.P Avasthi. Lakshmi Narain Agarwal Publishers. New Delhi.

Books for References:

1. Test of Reasoning for All Competitive Examination 7th Edition. 2020. Edgar Thorpe. McGraw Hill Publishers. USA.
2. Life Science Books of Theory Practice Study Material for CSIR NET, GATE, SET, TIFR & DBT Module. 2022. Kailash Choudhary. IFAS Publications. India.

Web Resources:

1. https://apply.tnpscexams.in/secure?app_id=UElZMDAwMDAwMQ==
2. <https://www.getmyuni.com/articles/list-of-competitive-exams-in-india>
3. <https://testbook.com/csir-net/life-science-cut-off>

Rationale for Nature of the Course:

This course enables the students to understand the basic concept, structure and functions of various competitive and NET/SET exams.

Activities having direct bearing on Skill development / Employability / Entrepreneurship:

Analytical skills gained through discussions, relevant practices and solve the mathematical problems.

Pedagogy:

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System.

Course Designer: Prof. S. CHELLA PANDIAN, Associate Professor and
Dr. S. SARAVANAN, Assistant Professor

Course Schedule:

Unit	Topics	Hrs	Mode
Unit I	Test of Reasoning: Concepts, explanations	4	Chalk and Talk, Discussion, Seminar, Interaction, Video Clippings Quiz, Seminar & Test
	Coding – decoding, classification/analogy series and data analysis.	8	
Unit II	Constitution of India and History - Preamble.	4	Chalk and Talk, Discussion, Interaction, Video Clippings, Quiz, Seminar & Test
	Fundamental rights, Fundamental duties and Constitution of parliament.	8	
Unit III	General awareness	3	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Test.
	Physical and biological sciences, Economy and Geography.	9	
Unit IV	General aptitude: Mathematical problems,	5	Chalk and Talk, Power Point, Quiz Discussion, Seminar, Interaction, test
	Venn diagrams, Calculation of age and Seating arrangements.	7	
Unit V	Series completion, direction sense,	6	Chalk and Talk, Discussion, Seminar, Interaction, Quiz & Assignment.
	number tests, blood relation tests.	6	

Course Learning Outcomes: On successful completion of the course, the students will be able to,

CLOs	Course Learning Outcomes	Knowledge Level
CLO 1	Know the test of Reasoning	Up to K4
CLO 2	Understand the constitution of India and History	Up to K4
CLO 3	Evaluate the general awareness	Up to K4
CLO 4	Analyse the General aptitude	Up to K4
CLO 5	Apply the mathematical problems	Up to K4

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CLO 1	1	2	2	1	2	2
CLO 2	2	2	3	2	2	2
CLO 3	2	2	1	2	2	3
CLO 4	2	3	3	2	3	1
CLO 5	1	3	3	1	3	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PSO 6
CLO 1	3	3	2	3	2	3
CLO 2	3	3	3	2	3	2
CLO 3	2	2	3	3	1	2
CLO 4	3	3	3	3	3	1
CLO 5	3	3	2	2	2	2

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

Summative - Blue – Print – Model
(Mapping with Course Learning Outcomes (CLOs))

Units	CLOs	K-Level	Section A		Section B		Section C (10 Marks)
			MCQs		Short answers (5)		
			No. of Questions	K-Level	No. of Questions	K-Level	
1	CLO1	Upto K4	6	K3/ K4	1	K1/ K2	1 (K2/ K3)
2	CLO2	Upto K4	6	K3/ K4	1	K1/ K2	1 (K2/ K3)
3	CLO3	Upto K4	6	K3/ K4	1	K1/ K2	1 (K2/ K3)
4	CLO4	Upto K4	6	K3/ K4	1	K1/ K2	1 (K2/ K3)
5	CLO5	Upto K4	6	K3/ K4	1	K1/ K2	1 (K2/ K3)
No. of Questions to be asked			30		5		5
No. of Questions to be answered			30		3		3
Marks for each question			1		5		10
Total marks for each			30		15		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	Section C	Total Marks	% of Marks with choice	Consolidated
K1		10		10	9.52	43%
K2		15	20	35	33.33	
K3	15		30	45	42.85	43%
K4	15			15	14.28	14%
Total Marks	30	25	50	105	100	100

DEPARTMENT OF BOTANY				CLASS: II M.Sc. BOTANY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
IV	Extension		Extension Activity	1	-	-	-	-

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Course Objectives:

1. To motivate students to take up community driven activities and projects.
2. To develop the societal awareness of students.
3. To promote environmental, sustainability and G20 High-Level Principles on Lifestyles for Sustainable Development (LIFE) among students.

During the duration of the programme, students shall undertake extension activities for a minimum duration of 15 hours including preparation and submit a work diary and report of activities along with certificates (if any) from trusts/ NGOs/ public offices / schools.

At the end of the programme, the students will be able to

CLOs	Course Learning Outcomes	K level
CLO 1	Work independently and as a team in extension activities and community projects	K4
CLO 2	Develop into dutiful and morally upright citizens of the country with an understanding of the problems of the society	K5
CLO 3	Suggest and implement out of the box solutions to the problems of the society from their domain knowledge and through their learning.	K4
CLO 4	Survey and understand the problems of the society and humanity as a whole.	K2
CLO 5	Communicate the problems of the society to civil administration/government forums for finding solutions to the problems of the locality.	K3

Mapping of CLOs with 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

Advance application –3, Intermediate level –2, Basic level–1

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	3	3	3	3
CLO 2	3	3	3	3	3
CLO 3	3	3	3	3	3
CLO 4	3	3	3	3	3
CLO 5	3	3	3	3	3

Advance application –3, Intermediate level –2 , Basic level–1

Valuation Schema for Extension Activity

The student will be graded on a seven-point scale with corresponding GPAs as mentioned below.

Grade	GPA
Outstanding	10
Excellent	9
Very Good	8
Good	7
Average	6
Below average	5
Reappearance	1-4



THE MADURA COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
DEPARTMENT OF BOTANY

CERTIFICATE COURSE
in
FLOWER ARRANGEMENT

Course Designer and Coordinator
Dr. S. GNAANA SARASWATHI,

Assistant Professor,
Department of Botany,
The Madura College,
Madurai - 625 011.

Course Description

The certificate course in Flower Arrangement is a creative journey where the students will delve into the timeless art of crafting exquisite floral compositions. This comprehensive program spans 30 hours, covering the historical evolution, principles, and practical techniques of flower arrangement. From mastering the steps of selection and preparation to creating various arrangements, including bouquets, centerpieces, and wreaths, the students will gain hands-on skills guided by industry experts. Through the course, the students will also explore diverse floral styles, from traditional to contemporary, and delve into the entrepreneurial aspects of floristry, including business planning, sustainability practices, and e-commerce integration. Whether they aspire to enhance their artistic skills or dream of starting their own floral venture, this course offers a blend of creativity and practical knowledge, making "Flower Arrangement" an apt and engaging title for the student's enriching journey into the world of floristry.

DEPARTMENT OF BOTANY			CERTIFICATE COURSE				
Course Type	Course Code	Course Title	Credits	Contact Hours	CIA	Ext	Total
Certificate	24BC07	Flower Arrangement	2	30	50	50	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives: The course objectives are to,

1. impart comprehensive knowledge on the history, scope, principles and various floral arrangement styles,
2. familiarize students with the step-by-step process, covering from selection to finishing touches,
3. equip students with practical skills in creating diverse types of flower arrangements, from bouquets to wreaths and
4. foster entrepreneurial skills by providing insights into startup ideas.

Unit 1 (6 Hr): Introduction to Flower Arrangement - history, scope and importance. Principles - balance, proportion, harmony, emphasis, rhythm and unity.

Unit 2 (6 Hr): Popular styles - Traditional, Contemporary, Ikebana, Formal, Minimalist, Monochromatic, Tropical, Cascade, Bohemian, Season and Occasion based.

Unit 3 (6 Hr): Steps - Selection and preparation of flowers, containers and materials, structure creation, foliage placement, addition of flowers, filling gaps and finishing touches (**Demonstration**).

Unit 4 (6 Hr): Types - Bouquets and boutonnières, vase arrangements, centerpieces, corsages and wreaths (**Hands-on activity**).

Unit 5 (6 Hr): Entrepreneurship - Start up ideas - business planning, necessary permits, source suppliers, eco-friendly floral practices, e-commerce in floristry, challenges and solutions (**Guest Lectures by Florists**).

References:

1. Fiona, B and Moore, T. 2012. The Ultimate Book of Fresh and Dried Flowers - A complete Guide to Floral Arranging. Hermes Publishing House, Wigston, United Kingdom.
2. Barnett, F. 2013. Flower Arranging: A Complete Guide to Creative Floral Arrangements. Southwater Publisher, An Imprint of Anness Publishing Ltd., Leicestershire, UK.
3. Welford, M and Wicks, S. 2014. Simple Flower Arranging. Dorling Kindersley Publishing House, London, SW11 7BW.

Web References:

1. https://agritech.tnau.ac.in/horticulture/horti_Landscaping_freshflower.html
2. <https://www.bfloral.com/bfloral-blog/types-of-flower-arrangements>
3. <https://www.bhg.com/decorating/home-accessories/flower-arranging/classic-flower-arrangements/>

Course Outcomes:

By successfully completing this course, the students will be able to

1. apply the principles in creating aesthetically pleasing floral designs,
2. acquire proficiency to execute various types of arrangements and confidently engage and showcase the step-by-step process from selection to finishing touches and
3. develop entrepreneurial insights and skills, empowering students to conceptualize and plan a floristry business, integrate eco-friendly practices and leverage e-commerce strategies.

Rationale of the nature of the course:

The flower arrangement course rationale revolves around fostering cultural appreciation, developing practical skills and artistic expression, exploring entrepreneurial opportunities, promoting environmental consciousness and staying relevant in the ever-evolving floral industry.

Activities having direct bearing on Skill development:**1. Practical Application Sessions:**

Regular hands-on sessions for creating various arrangements based on principles like balance, proportion, and harmony.

2. Workshops with Professional(s):

Exposing students to advanced techniques and real-world practices through workshops with experienced/professional floral designers.

3. Seasonal and Theme-based Projects:

Assigning small assignments that challenge students to adapt their skills to different seasons or specific themes, fostering creativity.

4. Entrepreneurial Simulation:

Giving tasks to the students to create a mock business plan, integrating entrepreneurial skills development and market awareness.

Activities having direct bearing Employability and Entrepreneurship:

By learning the above-mentioned skills, the learners will

- develop entrepreneurial skills by creating a comprehensive business plan for a floristry venture,
- enhance employability through participation in industry networking events and
- gain practical knowledge in e-commerce integration and sustainability practices.

Pedagogy - Blended Learning using CANVAS (LMS) / Google Classroom.

1. Chalk and talk.
2. Demonstration.
3. Hands on training.
4. Power-point presentations.
4. Guest Lectures for Business Start-ups.

Evaluation:

CIA: 50 marks (20 marks from Theory - Multiple Choice Questions; 25 Marks for Practical - Assignment submission on Season-based Floral Arrangement. 5 Marks for Regularity and Punctuality).

External: 50 marks (30 marks – Occasion-based Floral Arrangement; and 20 marks for Business Planning Blueprint).

Target Audience and Enrolment Limits:

Open to all UG and PG students of any discipline. The program has a limited intake, ranging from 30 to 35 students.

Course Fee: Rs. 500 / per student.



DEPARTMENT OF ZOOLOGY

Revised Curriculum

**TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION (TANSCHE)
(Choice Based Credit system with Outcome Based Education)**

Academic Year 2023-2024 onwards

II semester & II year (B.Sc. Zoology)

Allied Courses



The Madura College (Autonomous), Madurai – 625 011
Department of Zoology

Credit Distribution for I B.Sc. Zoology

Semester – I				
Part	Course Code	Course description	Credits	Hours
I	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	Language - I Tamil / Hindi / Sanskrit	3	6
II	23U1NENG1	Language - II English	3	6
III	23U1ZCCT1	Core Course - 1 (Invertebrata) (CC1)	5	5
	23U1ZCCP1	Core Course - 2 (Invertebrata Lab Course) (CC2)	3	3
	23U1CGET1	Generic Elective - 1 (Allied Chemistry-I) (EC1)	4	4
	23U1CGEP1	Generic Elective - 1 (Allied Chemistry Lab Course-I) (EC1-P)	1	2
IV	23U1ZFCT1	Foundation course (FC)- Applied Zoology	2	2
	23U1ZSED1	Skill Enhancement Course SEC-1 – Medical Laboratory Techniques	2	2
Semester – II				
Part	Course Code	Course description	Credits	Hours
I	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	Language - I Tamil / Hindi / Sanskrit	3	6
II	23U2NENG2	Language - II English	3	6
III	23U2ZCCT2	Core Course - 4 (Chordata) (CC3)	5	5
	23U2ZCCP2	Core Course - 5 (Chordata Lab Course) (CC4)	3	3
	23U2CGET2	Generic Elective - 2 (Allied Chemistry -II) (EC2)	4	4
	23U2CGEP2	Generic Elective - 2 (Allied Chemistry Lab Course-II) (EC2-P)	1	2
IV	23U2ZSED2	Skill Enhancement Course SEC-2– Ornamental fish farming and management	2	2
	23U2ZSED3	Skill Enhancement Course SEC-3 –Biocomposting for Entrepreneurship	2	2

Credit Distribution for II B.Sc. Zoology

Semester – III				
Part	Course Code	Course description	Credits	Hours
I	23U3TLAN3/ 23U3HLAN3/ 23U3SLAN3	Language - I Tamil / Hindi / Sanskrit	3	6
II	23U3NENG3	Language - II English	3	6
III	23U3ZCCT3	Core Course 5–Cell Biology (CC5)	4	4
	23U3ZCCP3	Core Course - 6 (Cell Biology Lab Course) (CC6)	3	3
	23U3BGET1	Generic Elective - 1 (Allied Botany-I) (EC1)	4	4
	23U3BGEP1	Generic Elective - 1 (Allied Botany Lab Course-I) (EC1-P)	1	2
IV	23U3ZSED4	Skill Enhancement Course SEC-4 Economic Zoology	2	2
	23U3ZSED5	Skill Enhancement Course SEC-5 Basic Course in Ornithology	2	2
	23U3ZEVS1	Environmental studies	-	1
			22	30
Semester – IV				
Part	Course Code	Course description	Credits	Hours
I	23U4TLAN4/ 23U4HLAN4/ 23U4SLAN4	Language - I Tamil / Hindi / Sanskrit	3	6
II	23U4NENG4	Language - II English	3	6
III	23U4ZCCT4	Core Course - 7 (Developmental Biology) (CC7)	4	4
	23U4ZCCP4	Core Course - 8 (Developmental Biology Lab Course) (CC8)	3	3
	23U4BGET2	Generic Elective - 2 (Allied Botany-II) (EC2)	4	4
	23U4BGEP2	Generic Elective - 2 (Allied Botany Lab Course-II) (EC2-P)	1	2
IV	23U4ZSED6	Skill Enhancement Course SEC-6 Bioinstrumentation	2	2
	23U4ZSED7	Skill Enhancement Course SEC-7 Basics of Marine Biology	2	2
	23U4ZEVS2	Environmental studies	2	1
			24	30

Add-on Courses

Semester	Course Code	Course Title
III	23U3ZAD1	Health Education
IV	23U4ZAD2	Wildlife Conservation

Credit Distribution for Allied Zoology (I B.Sc. Botany)

Semester – I				
Part	Course Code	Course description	Credits	Hours
III	23U1ZGET1	Generic Elective - 1 (Allied Zoology-I) (EC1)	4	4
	23U1ZGEP1	Generic Elective - 1 (Allied Zoology Lab Course-I) (EC1-P)	1	2
Semester – II				
Part	Course Code	Course description	Credits	Hours
IV	23U2ZGET2	Generic Elective - 2 (Allied Zoology -II) (EC2)	4	4
	23U2ZGEP2	Generic Elective - 2 (Allied Zoology Lab Course-II) (EC2-P)	1	2

Credit Distribution for Allied Zoology (II B.Sc. Chemistry)

Semester – III				
Part	Course Code	Course description	Credits	Hours
III	23U3ZGET1	Generic Elective - 1 (Allied Zoology-I) (EC1)	4	4
	23U3ZGEP1	Generic Elective - 1 (Allied Zoology Lab Course-I) (EC1-P)	1	2
Semester – IV				
Part	Course Code	Course description	Credits	Hours
IV	23U4ZGET2	Generic Elective - 2 (Allied Zoology -II) (EC2)	4	4
	23U4ZGEP2	Generic Elective - 2 (Allied Zoology Lab Course-II) (EC2-P)	1	2

Title of the Course		CHORDATA					
TANSCHC Course type		CC3					
Course Category		Core					
Nature of Course		Skill Development					
Category	Core	Year	FIRST	Credits	5	Course Code	23U2ZCCT2
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5					5
Marks		CIA			Semester		Total
		25			75		100
Pre-requisite(s)		Biology / Zoology knowledge at Higher Secondary level					
Objectives of the Course		- To understand the systematic classification of Phylum Chordata. - To analyze various groups chordates based on their functional morphology, modes of life - To understand the unique adaptive features among chordates To examine the evolutionary history of chordates					
Course Outline		Unit I: Chordata and Prochordates: General characteristics and classification (upto class level) of Phylum Chordata. Origin of Chordata, General characters, classification (<i>upto class level</i>) and Affinities and classification of Hemichordata, Urochordata, Cephalochordata. Retrogressive metamorphosis in <i>Ascidian</i>. <i>Amphioxus</i> – Morphology and excretory system. “<i>Balanoglossus</i> is an intermediate between invertebrates and chordates”. Unit II: Agnatha and Pisces: Agnatha: General characteristics, classification, <i>Petromyzon</i>-Morphology, Ammocoetes larva, breeding and migration. Pisces: Characteristics, classification upto subclass level. <i>Scoliodon sorrah</i> – Morphology, placoid scales, Reproduction and development. Origin of fishes, Affinities of Dipnoi, scales and fins - Accessory respiratory organs - Air bladder - Parental care - Migration - Economic importance. Unit III: Amphibia : General characters and classification upto order level - Origin of Amphibia - Type study - <i>Rana hexadactyla</i> - Adaptive features of Anura, Urodela and Apoda-Neoteny in Amphibia - Parental care in Amphibia.					

	Unit IV: Reptilia : General characters and classification upto subclass level- Type study – <i>Calotes versicolor</i> - Origin of reptiles, Golden age of reptiles, Extinct reptiles (Dinosaurs), Poisonous snakes of south India, Poison apparatus and biting mechanism of poisonous snakes - Skull in reptiles as basis of classification (Temporal fossae and Arcades). Unit V: Aves and Mammalia : Aves: General characters and classification – Type study - <i>Columba livia</i> (Circulatory and respiratory system)- Origin of birds, Flight adaptations, Migration. Mammalia: General characters and classification - Type study - Rabbit (Digestive system, sensory organs and reproductive system) - Adaptive radiation in mammals - Egg laying mammals, Marsupials, True placental mammals-Flying mammals, Aquatic mammals, Dentition in mammals.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Visit to a marine ecosystem/museum/attend lectures.
Skills acquired from this course	Professional skills such as broader taxonomic identification of chordates, learn the morphology, physiology and evolution of chordates.
Justification for nature of course	Learn the systematic classification of animal kingdom. Understand the structural adaptation of chordates in the ecological and evolutionary perspectives. Unravel the adaptive radiation among chordates.
Text Book(s)	1. Ayyar, E.K. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p. 2. Jordan, E.L. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal Physiology, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp. 3. Nigam, H.C., 1983. Zoology of Chordates, Vishal Publications, Jalandhar - 144008, 942. 4. Sinha, A.K., Adhikari, S., Ganguly, B.B. and Bharati Goswami, B.C. 2004. Biology of Animals Vol. II - New central book Agency (P) Ltd. 5. Kotpal, R.L. 2009. Modern text book of Zoology Vertebrates- Rastogi publications.

Reference Book(s)	1. Hall, B.K. and Hallgrímsson, B. 2008. Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc. 2. Hickman, C.P. Jr., Hickman, F.M. and L.S. Roberts, 1984. Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065 pp. 3. Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra – 282 003, 477 pp. 4. Parker and Haswell, 1964. Text Book of Zoology, Vol II (Chordata), A.Z.T,B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp. 5. Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan & Co., New York, 587 pp. 6. Young, J. Z. 2004. The Life of Vertebrates. III Edition. Oxford university press.
Websites and e-Learning resources	1. https://courses.lumenlearning.com/suny-biology2xmaster/chapter/chordates/ 2. https://www.toppr.com/guides/biology/animal-kingdom/phylum-chordata/ 3. https://manoa.hawaii.edu/exploringourfluidearth/biological/invertebrates/phylum-chordata 4. https://www.britannica.com/animal/chordate/Internal-features

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CLO	CLO Statement	Knowledge level
CLO1	Explain the characters, origin and classification of Phylum Chordata	K2
CLO2	Understand the characteristics of vertebrates and unique features of Prochordates and Agnatha.	K3
CLO3	Analyze the general characters and adaptive features of Amphibians.	K3
CLO4	Apply the knowledge on general and adaptive features of reptiles to unravel the life strategies of Reptiles.	K4
CLO5	Examine the general characters and modes of life in Aves and Mammalia	K4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1).

CLO	Pos						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
CLO1	3	2	1				1		2		1
CLO2	3		2	1		1	1	2	2	1	1
CLO3			2	2		1	2		2		1
CLO4		3	3		2		1		3	1	2
CLO5	2			2	3	1	1		3	1	2

Blueprint for test component of CIA

Pattern	Part A (Short answer type)	Part B (Either-or)	Part C (Essay type - open choice)
CLO x	1*	1+1*	1*
CLO y	1*	1+1*	1*

*K-levels can be decided by the course teacher ensuring proper distribution across K- levels.

Blueprint for Semester Examination
BLUE PRINT

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 KLevels

K Levels	SectionA (No Choice)	SectionB (No Choice)	Section C(Either/or)	SectionD (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	--	19	15.83	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%

Title of the Course		CHORDATA LAB COURSE					
TANSICHE Course type		CC4					
Course Category		Core					
Nature of Course		Employability / Skill Development					
Category	Core	Year	FIRST	Credits	3	Course Code	23U2ZCCP2
		Semester	1				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
					3		3
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Biology / Zoology knowledge at Higher Secondary level					
Objectives of the Course		• To understand the structures and distinct features of phylum Chordata. • To understand and able to distinguish the characteristic features of each subphylum and class. • To understand and compare the structure of various internal organs in different classes of vertebrates. • To know about the classification, adaptations and affinities of chordate animals.					
Course Outline		Unit-I Dissections: Frog (Demo)/Fish: External features, Digestive system, Arterial system, Venous system, 5 th Cranial nerve, 9 th and 10 th cranial nerves, Male and female urinogenital system.					
		Unit-II Mounting: Fish: Placoid, Cycloid, Ctenoid scales, Frog: Hyoid apparatus and Brain (Demo).					
		Unit-III Osteology: Frog: Skull and lower jaw, Vertebral column, Pectoral girdle, Pelvic girdle, Forelimb, Hindlimb. Chelonia Anapsid skull, Pigeon - skull and lower jaw, synsacrum.					
		Unit-IV Specimen and Slides: (i) Hemichordata: Balanoglossus, Tornaria larva (ii). Protochordata: Amphioxus, Amphioxus T.S. through pharynx (iii). Cyclostomata: Petromyzon, Myxine, Ammocoete larva (iv). Pisces: Sphyrna, Pristis, Torpedo, Channa, Pleuronectes, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Auguilla, Protopterus.					
		Unit-V Specimen and Slides: (v). Amphibia: Ichthyophis, Amblystoma, Siren, Hyla, Rhacophorus, Bufo, Rana, Axolotl larva (vi). Reptilia: Draco, Chamaeleon, Gecko, Uromastix, Viperarusselli, Naja, Bungarus, Enhydrina, Typhlops, Testudo, Trionyx, Crocodilus, Ptyas. (vii). Aves: Archaeopteryx, Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo; Collection and study of different types of feathers: Quill, Contour, Filoplume and Down (viii). Mammalia: Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris, Hedgehog.					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Visit to terrestrial and aquatic ecosystem/museum/attend lectures.
Skills acquired from this course	Professional skills such as identification of Chordates, learn the physiology and evolution of Vertebrates.
Justification for nature of course	The students will be able to understand structural organization of animals and develop skill in identification of animals in their habitat by analyzing unique structures and functions.
Text Book(s)	1. Lal S. S., 2009. Practical Zoology Vertebrate, Rajpal and Sons Publishing, 48 4pp. 2. Verma P.S., 2000. A Manual of Practical Zoology: Chordates, S. Chand Limited, 627pp.
Reference Book(s)	1. Robert William Hegner, 2015. Practical Zoology, Biblio Life, 522pp. 2. Young, J.Z., 1972. The life of vertebrates. Oxford Uni. London.
Websites and e-Learning resources	1. https://www.youtube.com/watch?v=xSu7jeOuPDk 2. https://www.youtube.com/watch?v=sCWUZiRaBbA 3. https://www.youtube.com/watch?v=xuSckL-IPhg 4. https://www.youtube.com/watch?v=PKK_ExR2SkY

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	CLO Statement	K-level
CO1	Identify and label the external features of different groups of chordate animals.	K2
CO2	Illustrate and examine the digestive system, Arterial system, venous system, 5 th cranial nerve, 9 th and 10 th cranial nerves and urinogenital system of vertebrate animals.	K3
CO3	Differentiate and compare the structure, function and mode of life of various groups of animals.	K3
CO4	To compare and distinguish the dissected internal organs of higher animals.	K4
CO5	To develop the mounting skills of economically and ecologically important vertebrates.	K4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1).

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
CLO1	3		1				1		2		1
CLO2		2		1			1		2		1
CLO3			2			1	2		2		1
CLO4		3		2					3	1	2
CLO5				2	3		1		1	1	

Title of the Course		ORNAMENTAL FISH FARMING & MANAGEMENT					
TANSCHÉ Course type		SEC					
Course Category		Skill Enhancement Course					
Nature of Course		Skill Development					
Category	Core	Year	FIRST	Credits	2	Course Code	23U2ZSED2
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2	2				2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Biology / Zoology knowledge at Higher Secondary level					
Objectives of the Course		1. To understand the importance of ornamental fish culture in relation to entrepreneurship development. 2. To analyze the identification, culture and maintenance of commercially important ornamental fishes. 3. To understand the knowledge on the techniques of ornamental fish breeding, rearing, disease control and economics of ornamental fish farming.					
Course Outline		Unit I: Introduction to ornamental fish keeping; Scope and importance of ornamental fish culture; Domestic and global scenario of ornamental fish trade and export potential; Commercially important ornamental fishes - Indigenous (<i>Danio rerio</i> , <i>Bariliusgatensis</i> , <i>Puntius denisoni</i> , <i>Nemachilus</i>) and exotic varieties (Koi carp, Tiger barb, Aravana, Gold fish).					
		Unit II: Biology of egg layers and live bearers. Food and feeding in ornamental fishes. Formulated feed and Live feed; Live feed culture. Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg. Guppy).					
		Unit III Aquarium design and construction; Materials required for the construction of tanks - Accessories - aerators, filters and lighting. Aquarium plants and their propagation. Maintenance of aquarium and water quality management.					
		Unit IV Ornamental fish Parasites and Diseases: Fish louse, Ligula, Fin rot disease, Carp pox and Velvet disease their prevention, control and treatment methods.					

	Unit V Packaging and Management: Conditioning, packing, transport and quarantine methods. Economics, trade regulations, domestic and export marketing strategies.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Visit to an ornamental fishfarm/Breeding hatcheries/aquarium centers /attend lectures.
Skills acquired from this course	• The students will be able to identify, culture, maintain and market the commercially important ornamental fishes. • The knowledge and skills gained on the different aspects of ornamental fish keeping will enable the students to develop entrepreneurship potential and help in self employment.
Justification for nature of course	This course will enable the student to grasp the theoretical knowledge and basic techniques of Ornamental Fish Culture, Aquarium setting, breeding, life history, food and feeding, diseases, transportation and packing.
Text Book(s)	1. Swain SK., Sarangi N. and Ayyappan S. 2010. Ornamental fish farming. ICAR, New Delhi. 2. Tharadevi, C.S. and K.V. Jayashree. 2009. Home Aquarium, Saras Publications, Nagercoil. 3. Arumugam, N. 2010. Aquaculture. Saras Publications, Nagercoil.
Reference Book(s)	1. Shukla, J.P. 2012. Fish and Fisheries. Rastogi Publications. New Delhi. 2. Zade, S.B., C.J. Khune, S.R. Sitre and R.V. Tijare. 2011. Principles of Aquaculture. Himalaya Publishing House. Mumbai. 3. Srivastava, C.B.L. 2006. Aquarium-Fish Keeping. Kitab Mahal, Allahabad. 4. Living Jewels – A handbook on freshwater ornamental fish, MPEDA, Kochi. 5. Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi. 6. Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquaculture. Daya Publishing House, New Delhi.
Websites and e-Learning resources	1. http://ecoursesonline.iasri.res.in/course/view.php?id=297 2. https://www.ofish.org/ 3. https://krishijagran.com/agripedia/income-generation-by-ornamental-fish-culture/ 4. https://99businessideas.com/ornamental-fish-farming

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CLO	CLO Statement	Knowledge level
CLO1	Understand the basic principles and knowledge of aquarium and varieties of ornamental fishes.	K2
CLO2	Apply the knowledge on Breeding techniques of ornamental fishes and fish feed formulation.	K3
CLO3	Examine the techniques of Ornamental fish culture.	K3
CLO4	Explain the causative organism of various diseases on aquarium fishes.	K4
CLO5	Analyze the Transportation methods and packing methods of ornamental fishes.	K4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1).

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
CLO1	3	2	1				1		2		1
CLO2	3		2	1		1	1	2	2	1	1
CLO3			2	2		1	2		2		1
CLO4		3	3		2		1		3	1	2
CLO5	2			2	3	1	1		3	1	2

Blueprint for test component of CIA

Pattern	Part A (Short answer type)	Part B (Either-or)	Part C (Essay type - open choice)
CLO x	1*	1+1*	1*
CLO y	1*	1+1*	1*

*K-levels can be decided by the course teacher ensuring proper distribution across K- levels.

BLUE PRINT FOR EXTERNAL**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 K3	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%

Title of the Course		BIOCOMPOSTING FOR ENTREPRENEURSHIP						
TANSCHE Course type		SEC-3						
Course Category		Elective						
Nature of Course		Skill Development						
Category	Elective	Year	FIRST	Credits	2	Course Code	23U2ZSED3	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		2						2
Marks		CIA			Semester		Total	
		25			75		100	
Pre-requisite(s)		Biology / Zoology knowledge at Higher Secondary level						
Objectives of the Course		- To highlight the importance of Biocomposting and Entrepreneurship in waste management. - To enable the students for setting up Biocompost units and bins for waste reduction.						
Course Outline		Unit I: Biocomposting – Definition, types-Backyard or onsite composting, Vermicomposting, Aerated (Turned) window composting, In-vessel composting, Bokashi composting;Ecological importance–environmental benefit, soil erosion, storm water management, plant growth, water conservation, waste reduction, combats climate change, soil health and wetland reclamation.						
		Unit II: Types of composting technology-Field pits, ground heaps, tank, large scale, batch and continuous methods.						
		Unit III: Preparation of Biocompost pit and bed using different amendments – characteristics of materials for bedding-absorbency, bulking potential, content of protein and nitrogen, selection of material for biocompost bed.						
		Unit IV: Applications of Biocompost in soil fertility maintenance, promotion of plant growth, value added products, waste reduction, solid wastes, biomedical wastes, domestic wastes, industrial wastes.						

	Unit V: Economics of establishment of a small biocompost unit- components of a biocomposting unit, process of composting expenditure, income, profit;Project report proposal-project description, harvesting, expenditure, income and profit.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Visit to a Biocomposting unit/ Vermiculture unit.
Skills acquired from this course	Professional skills such as establishment of biocomposting units and beds using different materials for waste reduction.
Justification for nature of course	Learn the economic importance of biocomposting. Understand the role of biocompost in soil fertility, promotion of plant growth, value added products and waste reduction. Enable to set a biocomposting unit as a cottage industry.
Text Book(s)	1. Bhatnagar, R.K. and R.K. Palta, 1996. Vermiculture and Vermi Composting, Kalyani Publishers, New Delhi, 103p. 2. Mary Violet Christy, A. 2008. Vermitechnology, MJP Publishers, Chennai, 118p
Reference Book(s)	1. Bikas R.Pati and Sati M. Mandal (2016). Recent trends in composting technology. 2. Van der Wurff, A.W, G., Fuchs, J.G., Raviv, M., Termorshuizen, A.J (Editors) 2016.Handbook for Composting and Compost use in Organic Horticulture. Biogreenhouse COST Action FA 1105.
Websites and e-Learning resources	1. https://agritech.tnau.ac.in/org_farm/orgfarm_composting.html 2. https://encyclopedia.pub/entry/27283 3. https://marinmg.ucanr.edu/basics/compost - other soil amendments/ 4. https://wikifarmer.com/bio-composting-by-using-agricultural-by-products/ 5. https://www.ramauniversity.ac.in/online-study-aterial/fet/biotechnology/m.sc/ii-semester/environmentalbiotechnology/lecture-7.pdf 6. https://mohua.gov.in/upload/uploadfiles/files/chap14(1).pdf 7. https://www.saraspublication.com/wp-content/uploads/2023/07/9789394196490-f.webp

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CLO	CLO Statement	Knowledge level
CLO1	Explain the types and ecological importance of Biocomposting.	K2
CLO2	Understand the types of Biocomposting technology.	K3
CLO3	Analyze different amendments used in the preparation of biocompost pit and bed.	K3
CLO4	Apply the knowledge in maintaining soil fertility, promoting plant growth and waste reduction.	K4
CLO5	Examine the role of biocomposting in income and employment generation.	K4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1).

CLO	Pos						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
CLO1	3	3	3	2	3	3	2	3	2	3	3
CLO2	3	3	3	2	3	3	2	3	3	3	3
CLO3	3	3	3	2	3	3	2	3	3	3	3
CLO4	2	3	3	2	3	3	2	3	3	3	3
CLO5	2	3	3	2	1	3	2	3	3	3	3

Blueprint for test component of CIA

Pattern	Part A (Short answer type)	Part B (Either-or)	Part C (Essay type - open choice)
CLO x	1*	1+1*	1*
CLO y	1*	1+1*	1*

*K-levels can be decided by the course teacher ensuring proper distribution across K- levels.

Blueprint for Semester Examination

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%

Title of the Course		ALLIED ZOOLOGY – II						
TANSCHÉ Course type		EC2						
Course Category		Elective (Generic / Discipline Specific)						
Nature of Course		Skill Development						
Category	Elective	Year	FIRST	Credits	4	Course Code	23U2ZGET2	
		Semester	II					
Instructional Hours per week		Lecture	Tutorial	Practical		Total		
		4				4		
Marks		CIA		Semester		Total		
		25		75		100		
Pre-requisite(s)		Biology / Zoology knowledge at Higher Secondary level.						
Objectives of the Course		• To learn basic concepts relating to aspects of respiratory, circulatory, excretory nervous and sensory physiology. • To comprehend the processes involved during development. • To learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccination schedule. • To comprehend the basic concepts of human genetics and patterns of inheritance. • To learn about aspects of animal behaviour such as foraging, courtship, nest construction, parental care and learning.						
Course Outline		Unit I: Physiology Respiration - Respiratory pigments and transport of gases. Mechanism of blood clotting. Types of excretory products and Ornithine cycle. Structure of neuron, Conduction of nerve impulse; Mechanism of vision and hearing.						
		Unit II: Developmental Biology Fertilization, Cleavage, Gastrulation and Organogenesis of Frog- Brain; Placentation in mammals.						
		Unit III: Immunology Innate and Acquired - Active and Passive; Antigens – Epitopes and Paratopes, Essential factors for Antigenicity; Antibodies-classes, properties and functions ofImmunoglobulins; Immunological organs - primary lymphoidorgans (Thymus and Bone marrow), secondary lymphoid organs (spleen and lymph nodes); Vaccination schedule.						
		Unit IV: Human Genetics Human Chromosomes – Sex Determination in Humans; Patterns of Inheritance: Autosomal dominant-Huntington’s disease; Autosomal Recessive – sickle cell disease; X-linked - Haemophilia, Y-linked - Hypertrichosis, Multiple allele – ABO blood group; Genetic Counselling.						
		Unit V: Animal Behaviour: Foraging – honey bee, Courtship Behaviour - birds, Shelter and Nest Construction - birds, Parental Care - fish, Learning Behaviour – classical conditioning.						

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Understand the human physiology, developmental biology, immunology, genetics and animal behaviour through videos/attend lectures.
Skills acquired from this course	The students will learn the mechanism of blood clotting, conduction of nerve impulse, mechanism of vision and hearing, structure and functions of immune system, identification of blood groups and antigen and antibody reactions.
Justification for nature of course	The students will be able to understand the human physiology, genetics, structure and functions of immune system, developmental biology of frog and animal behaviour.
Text Book(s)	1. Verma P.S. & Agarwal Developmental Biology, Chordata, embryology S.Chand & Co Klug, W. S., Cummings, M. R. & Spencer, C - Concepts of Genetics. (12th ed.). New Jersey: Pearson Education. 2. Harjindra Singh, 1990. A Text Book of Animal Behaviour, Anomol Publication, 293pp. 3. Verma P.S., Tyagi B.S & Agarwal V.K., 2010. Animal Physiology, S. Chand & Co. Ltd., New Delhi Publishing., 417 pp.
Reference Book(s)	1. Owen, J. A., Punt, J. & Stranford, S. A. - Kuby Immunology. New York: W.H. Freeman & Company. 2. Klug, W. S., Cummings, M. R. & Spencer, C - Concepts of Genetics. (12th ed.). New Jersey: Pearson Education. 3. Mathur, R.- Animal Behaviour. Meerut: Rastogi.
Websites and e-Learning resources	1. https://www.britannica.com/science/genetic-counseling 2. https://www.youtube.com/watch?v=BFxJlxIldAI 3. https://courses.lumenlearning.com/suny-ap2/chapter/transport-of-gasesno-content/ 4. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Biology_(Kimball)/14%3A_Embryonic_Development_and_its_Regulation/14.02%3A_Frog_Embryology 5. https://biomates.wordpress.com/2019/02/18/courtship-and-nesting-behaviour/

COURSE OUTCOMES:

At the end of the course, the student will be able to:

COs	Course Outcomes	K-level
CO1	Recall the structure and functions of human body parts and organs.	K2
CO2	Describe the various developmental stages of an organism.	K3
CO3	Analyse the working of body and immune systems.	K3
CO4	Examine the different patterns of human genetic inheritance.	K4
CO5	Evaluate the behaviour of animals to physiology and analyse the different types of behaviour.	K4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1).

CLO	Pos						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
CLO1	3	3	2	2	3	2	3	2	3	3	1
CLO2	3	2	1	1	2	1	1	1	2	3	1
CLO3	3	3	1	2	3	3	3	3	2	3	2
CLO4	3	2	1	2	3	2	2	2	3	3	2
CLO5	3	3	2	1	2	2	1	1	2	3	1

Blueprint for test component of CIA

Pattern	Part A (Short answer type)	Part B (Either-or)	Part C (Essay type - open choice)
CLO x	1*	1+1*	1*
CLO y	1*	1+1*	1*

*K-levels can be decided by the course teacher ensuring proper distribution across K- levels.

BLUE PRINT FOR EXTERNAL**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 (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	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Title of the Course		ALLIED ZOOLOGY LAB COURSE					
TANSCHÉ Course type		EC1-P					
Course Category		Skill Enhancement Course					
Nature of Course		Skill Development					
Category	Core	Year	FIRST	Credits	1	Course Code	23U2ZGEP2
		Semester	2				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
				2		2	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Biology / Zoology knowledge at Higher Secondary level					
Objectives of the Course		- Acquire the basic knowledge of diversity and organisation of Phylum Protozoa, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Chordata. - Gain knowledge in the taxonomic position of the Phylum. - Comparing the structural and functional organisations of lower organisms with human systems enables them to invent medicines for a particular disease. - Get placements in pharma companies to invent new ointments, antibiotics and interferons for endemic epidemic and pandemic diseases. - Paves the path for DNA recombinant technology.					
Course Outline		Unit I: Estimation of oxygen consumption of fish with reference to the body weight and learning the basic concepts relating to the aspects of respiration.					
		Unit II: Qualitative estimation of Nitrogenous waste products in the given sample and learning about the type of excretory products.					
		Unit III: Identifying the blood group of individuals and acquiring knowledge on Rh factor and antigen antibody reaction.					
		Unit IV: Identifying the different types of eggs by mounting in lower organism.					
		Unit V: - Identifying the chromosomal aberrations. - Updated vaccination schedule. - Courtship behaviour - Parental behaviour - Learning behaviour - Immunoglobulins - Autosomal dominant - Autosomal recessive - Multiple alleles - Monozygotic & dizygotic twins					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Visit to terrestrial and aquatic ecosystem/museum/attend lectures.
Skills acquired from this course	Analyse, compare and distinguish the features of lower organisms with chordates.
Justification for nature of course	Preparing the students for placements by inculcating valuable knowledge and providing trainings.
Text Book(s)	1. Ekambaranathalyar and T. N. Ananthakrishnan, (1995). <i>A manual of Zoology</i>, Vol. I (Part 1, 2), S. Viswanathan, Chennai. 2. Lal, S.S, (2016). <i>Practical Zoology Invertebrate</i>, Rastogi Publications. 3. Verma, P.S, (2000). <i>A Manual of Practical Zoology: Chordates</i>, S. Chand Limited, 627pp.
Reference Book(s)	1. Lal, S.S. (2005). <i>A text Book of Practical Zoology: Invertebrate</i>, Rastogi, Meerut. 2. Robert William Hegner, 2015. <i>Practical Zoology</i>, Biblio Life, 522 pp. 3. Verma, P.S. (2010). <i>A Manual of Practical Zoology: Invertebrates</i>, S Chand, 497pp. 4. Young, J.Z. (1972). <i>The life of vertebrates</i>. Oxford Uni. London.
Websites and e-Learning resources	1. https://www.youtube.com/watch?v=b04hc_kOY10 2. https://bit.ly/3CzTEy8 3. http://tolweb.org/Chordata/2499 4. http://www.agshoney.com/training.htm 5. https://www.nationalgeographic.com/animals/invertebrate 6. http://www.csrtimys.res.in/

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO	CO Statements	K-level
CO1	Identify and label the external features of different groups of invertebrate and vertebrate animals.	K2
CO2	Illustrate and examine the circulatory system, digestive system and reproductive system of Invertebrate animals.	K3
CO3	Observation of visceral organs and their functions. Creating and maintaining a record without its function and noticing and comparing its complications.	K3
CO4	Analyzing the enzymatic substances promotes knowledge in metabolism.	K4
CO5	Preparing antibacterial agents promotes practical knowledge in industrial field.	K4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) in the 3-point scale of STRONG (3), MEDIUM (2) and LOW (1).

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
CLO1	3	1	1				1	1	2	1	1
CLO2	3	2		1			1	2	2		1
CLO3	3	1	2			1	2	1	2		1
CLO4	2	3		2			2	3	3	1	2
CLO5	2	1		2	3		3	3	1	3	

DEPARTMENT OF ZOOLOGY				CLASS: II B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
III	Core	23U3ZCCT3	CELL BIOLOGY	4	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented		Entrepreneurship Oriented	

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

- To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells.
- To understand the metabolic activity, energy production and utilization of cells.
- To appraise the process of cell division and cell cycle.
- To describe the types and role of RNA and protein synthesis.
- To apply the knowledge of cell biology to identify their major role in the entire metabolic activity.

Unit	Description	Hours	K-level	CLO
I	History of Cell biology - Cell theory - Prokaryotic and Eukaryotic cells, Cell fractionation -Homogenization and centrifugation. Techniques to isolate subcellular components, Histological techniques-Staining procedures, Microscopes - Light, Phase contrast, SEM and TEM-Units of measurement.	12	Upto K2	1
II	The Cell – Cell theory –Viruses-Types (DNA & RNA) and Structures -Bacteria-Bacterial membrane, Ultra structure of plant and Animal cell, Cytoplasm-Structure, Composition and function. Plasmids. Plasmamembrane – types-Fluid mosaic type, Endoplasmic reticulum, Golgi complex, Lysosomes, Centrioles, Microfilaments–Ultrastructure, composition and functions.	12	Upto K3	2
III	Cell components&Nucleus- Mitochondria – Structure and functions. Nucleus –Ultrastructure, composition and functions. DNA types, patterns, denaturation and replication. Nucleosomes, Chromosomes – Heterochromatin, Euchromatin and histones. Hydrolysis and sequencing.	12	Upto K3	3
IV	Cell division& Cell cycle- Mitosis, Meiosis and their significance. Cancer Biology-Cancer cells, types and carcinogenesis, Aging of cells-Apoptosis and Stem cell studies.	12	Upto K4	4
V	Protein synthesis: Types and role of RNA, structure of t-RNA, properties of genetic code, polysomes, Transcription and Translation and its regulation, short outline of post transcriptional modifications. Mechanism of Enzyme action and inhibition.	12	Upto K4	5

Books for study:

1. Arumugam, N.2020.Cell Biology and Molecular Biology,Saras Publications,Nagercoil.
2. Arumugam, N.2014.Cell biology, Saras Publications, Nagercoil.
3. Fatima, D., Narayanan, LM., Meyyan.RP., Nallasingam,K.,Prasannakumar,S.& Arumugam, N 2014, Biochemistry, Saras Publications. Nagercoil.
4. Verma, P. S.& Aggarwal.VK, 2016. Cell Biology (Cytology, Biomolecules and Molecular Biology), S. Chand Publishers, New Delhi.

Books for References:

1. Albert B., Hopkin K., Johnson A. D., Morgan D., Raff M., Roberts K. and Walter P. (2018) Essential Cell Biology 5thEdn., (paperback) W.W. Norton & Company p.864.
2. Burke, Jack. D., 1970. Cell Biology, Scientific Book Agency, Calcutta.
3. DeRobertis, E.D.P. and E.M.F. DeRobertis, 1988.Cell and Molecular Biology, 8th Edition, International Edition, Infomed, HongKong,734pp.
4. Hardin J. and Bertoni G. (2017) Becker's World of the Cell.9thEdn (Global Edition). Pearson Education Ltd., p.923
5. Loewy, A.G. and P. Sickevitz, 1969. Cell Structure and Function, Amerind Publishing Co., New Delhi-110020, 516pp.
6. Mason K.A., Losos J.B. and Singer S.R. (2011) Raven and Johnson's Biology. 9thEdn. McGraw Hill publications. p.1406.

Web Resources

1. <http://www.microscopemaster.com/organelles.html>
2. <https://bit.ly/3tXwDSB>
3. <https://bit.ly/3tWNpRX>
4. <https://bit.ly/3AuYR9M>
5. <https://rsscience.com/cell-organelles-and-their-functions/>

Rationale for Nature of the course

This course will enable the learner to comprehend the knowledge on concepts of cell theory, ultrastructure and types of cells, advanced techniques used in cell biology, role of cell organelles, phases of cell cycle, biochemistry of metabolism in cells, types and role of RNA, protein synthesis, enzymes and their role in metabolism of the cell.

Activities having direct bearing on Skill development / Employability Entrepreneurship

The working principles of the acquired knowledge of advanced instruments which is used in cytology will enable the learner for developing their skills in cytological techniques and also paves the path for their employability.

Pedagogy

Audiovisual lectures, PPT, seminars, group discussions, quiz, OHP presentations etc.

Course Designer:Dr. B. Latha

Course Schedule (60 hours)

Unit	Topics	Hrs	Mode
Unit I	History of Cell biology - Cell theory.	2	Audiovisual lectures, PPT, group discussions, quiz, seminars & test.
	Prokaryotic and Eukaryotic cells.	2	
	Cell fractionation -Homogenization and centrifugation.	2	
	Techniques to isolate subcellular components.	2	
	Histological techniques - Staining procedures.	2	
	Microscopes-Light, Phase contrast, SEM and TEM-Units of measurement.	2	
Unit II	The Cell –Cell theory -Viruses-Types (DNA & RNA) and Structures	2	Brainstorming activities, Audiovisual lectures, PPT, group discussions, quiz, seminars & test.
	Bacteria-Bacterial membrane, Ultra structure of plant and Animal cell.	2	
	Cytoplasm-Structure. Composition and function. Plasmids.	2	
	Plasma membrane-types-Fluid mosaic type, Endoplasmic reticulum.	2	
	Ultrastructure composition and functions of Golgi complex and Lysosomes.	2	
	Ultrastructure composition and functions of Centrioles and Microfilaments.	2	
Unit III	Mitochondria – Structure and functions.	2	Icebreaking sessions Audiovisual lectures, PPT, group discussions, quiz, seminars & test.
	Nucleus – Ultrastructure, composition and functions	2	
	DNA – types, patterns.	2	
	DNA denaturation and replication.	2	
	Nucleosomes, Chromosomes – Heterochromatin, Euchromatin and histones.	2	
	Hydrolysis and sequencing.	2	
Unit IV	Cell division - Mitosis and their significance.	2	Audiovisual lectures, PPT, group discussions, quiz, seminars & test.
	Meiosis in animal cells and their significance.	2	
	Cancer Biology - Cancer cells, types and carcinogenesis.	2	
	Aging of cells	2	
	Apoptosis	2	
	Stem cell studies.	2	
Unit V	Types and role of RNA, structure of t-RNA.	2	Chalk and talk, Audiovisual lectures, PPT, seminars, group discussions, quiz & Assignment.
	Properties of genetic code, polysomes.	2	
	Protein synthesis (Transcription and Translation) and its regulation.	2	
	Short outline of post transcriptional modifications.	2	
	Mechanism of Enzyme action and factors affecting enzyme activities.	2	
	Enzyme inhibition-reversible, irreversible and allosteric.	2	

Course Learning Outcomes:

At the end of the course, the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Explaining Cell theory, cytological techniques, cell fractionation ultrastructure and functions of plasma membrane.	Up to K2
CLO-2	Discussing the ultrastructure and functions of cell organelles.	Up to K3
CLO-3	Exploring the stages of cell cycle and metabolic activities in mitochondria.	Up to K3
CLO-4	Investigating the mechanism of protein synthesis and analyzing their roles.	Up to K4
CLO-5	Analyzing the role of cellular components and exploring role of enzymes in the entire system.	Up to K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	3	1	1
CLO-2	2	2	3	1	2
CLO-3	1	2	3	2	2
CLO-4	2	1	3	3	1
CLO-5	2	2	3	1	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	1	2	2	1
CLO2	2	2	2	3	2	1
CLO3	3	3	2	2	2	1
CLO4	3	3	2	3	3	1
CLO5	2	2	3	3	2	1

Advance application– 3;

Intermediate level–2;

Basic level–1

BLUE PRINT FOR EXTERNAL

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: II B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
III	Core	23U3ZCCP3	CELL BIOLOGY LAB COURSE	3	3	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Course Objectives

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

1. To understand the techniques of cell biology and biochemistry.
2. To operate the instruments using in cell biology and biochemistry experiments.
3. To explore and observe the stages of celldivision in plant and animal tissues
4. To estimate and qualitative analysis of the macromolecules.
5. To describe the types and role of RNA and protein synthesis.

Unit	Description	Hours	K-level	CLO
I	Operational methods and uses of microscope, camera lucida, stage and ocular micrometers. Cell measurements.	9	Up toK2	1
II	Preparation and Identification of slides of Mitotic divisions with onion root tips. Preparation and Identification of different stages of Meiosis in Grasshopper Testes.	9	Up to K3	2
III	Buccal epithelium (Barr body) preparation. Preparations of cells and tissues – Squmousepithelium, striated muscle, smooth muscle,cardiac muscle.	9	Up toK3	3
IV	Cell Counts - Total count RBC & WBC of Human, Differential Count. Qualitative analysis of carbohydrates, protein and lipid. Quantitative estimation of carbohydrates, proteins and lipid.	9	Up toK4	4
V	SPOTTERS pH meter, Centrifuge, Spectrophotometer, Paper Chromatography, Agarose Gel Electrophoresis, Polyacrylamide Gel Electrophoresis, Structure of DNA & RNA.	9	Upto K4	5

Books for References

1. David L. Nelson & Michael M. Cox, 2017. Lehninger Principles of Biochemistry, Macmillan.
2. De Robertis, EDP. & De Robertis, EMF. 2010. *Cell and Molecular Biology*, Lippincott Williams & Wilkins.
3. Gupta, PK. 2018. Cell Biology, Rastogi Publications, Meerut.
4. Jain, J.L., Jain, N. & Jain, S. 2016. Fundamentals of Biochemistry, S. Chand Publications, New Delhi.
5. Pawar, CB. 2019. Cell Biology, Himalaya Publications.
6. Ramadevi, K. 2016. Ambika Shanmugam's Fundamentals of Biochemistry for Medical Students, Wolters Kluwer India Pvt Ltd.

Web Resources

1. <https://www2.samford.edu/~djohnso2/44962w/334/mitosis.html>
2. [Meiosis in Grasshopper Testis \(Poecilocus Pictus\) | Cell Biology and Genetics | Biotechnology Methods | Botany Laboratory Experiments \(biocyclopedia.com\)](#)
3. <https://mgscience.ac.in/wp-content/uploads/2021/02/protocol-blood-cell-count.pdf>
4. <https://byjus.com/chemistry/tests-of-carbohydrates-fats-and-proteins-in-given-food-stuffs/>

Rationale for Nature of the course

The students can develop their skills in operating microscopes, camera lucid and micrometers. They could develop their skills to study cell division, cell counts, preparation of cells and tissues, estimation and qualitative analysis of macromolecules and techniques used in biochemistry can be learned.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

Acquiring of skills on operating advanced instruments in the field of cytology and biochemistry, and knowledge on qualitative and quantitative estimation of macromolecules will ensure their career in higher studies, research institutes and industries.

Pedagogy

Audiovisual lectures, PPT, seminars, group discussions, quiz. OHP presentations etc.

Course designers:

Dr. B. Latha

Dr. C. Selvakumar

Course Schedule (Total hours:45)

Cycle	Description	Staff Name	Hrs	Mode
Experiments				
1	Operational methods and uses of microscopes		3	Live demo with instruments
2	Operational methods and uses of camera lucida, stage and ocular micrometers		3	Live demo with instruments
3	Cell measurements.		3	Procedure with slides
4	Preparation and Identification of slides of Mitotic divisions with onion root tips.		3	Live demonstration
5	Preparation and Identification of different stages of Meiosis in Grasshopper Testes.		3	Live demonstration
6	Preparations of cells and tissues – Squamous epithelium, striated muscle, smooth muscle, cardiac muscle.		3	Live demo experiments
7	Cell Counts - Total count RBC & WBC of Human, Differential Count.		3	Live demonstration
8	Qualitative analysis of carbohydrates, protein and lipid.		3	Live demonstration
9	Quantitative analysis of carbohydrates, protein and lipid.		3	Live demonstration
Spotters				
10	pH meter, Centrifuge,		3	Live demo with instruments
11	Spectrophotometer, Paper Chromatography,		3	Live demo with instruments
12	Agarose Gel Electrophoresis Polyacrylamide Gel Electrophoresis		3	Live demo with instruments
13	Structure of DNA and RNA.		3	Comments with Image
14	Internal Practical Test			
15	Summative Practical Examination			

Course Learning Outcomes:

At the end of the course, the students will be able to

	CLO Statements	Knowledge level
CLO-1	Recall the operational methods and uses of microscopes, camera lucida, stage and ocular micrometers.	K2
CLO-2	Understand the cytological and biochemical techniques.	K3
CLO-3	Apply the knowledge to explore and observe the stages of cell division in plant and animal tissues	K3
CLO-4	Analyse the preparation of cells and tissues, cell division and cell counts.	K4
CLO-5	Examine the quantitative and qualitative analysis of carbohydrate, proteins and lipids.	K4

Mapping with Programme Specific Outcomes

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	3	2	2
CLO-2	3	2	3	2	3
CLO-3	3	1	3	1	3
CLO-4	3	2	3	2	2
CLO-5	3	2	3	2	2

Mapping with Programme Outcomes

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	3	1	1	2	3	1
CLO-2	3	2	1	3	3	2
CLO-3	3	3	1	3	3	1
CLO-4	3	3	1	3	3	2
CLO-5	3	2	1	3	3	1

3- Advance application;

2- Intermediate level;

1- Basic level

DEPARTMENT OF ZOOLOGY				CLASS: IIB.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	SEC	23U3ZSED4	ECONOMIC ZOOLOGY	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented		Entrepreneurship Oriented	✓

Course Objectives

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

1. To understand the economic importance of animals.
2. To create awareness among the students about the applied aspects of Zoology.
3. To gain knowledge on various techniques employed in different culture systems.
4. To apply efficiently and execute the methodology for field practice.
5. To motivate the students for the self-employment.

Unit	Description	Hours	K-Level	CLO
I	Unit I: Economic Entomology Introduction to Economic Entomology. Lac Culture: Introduction – Life history of Lac Insects – Host plants – cultivation of Lac – Enemies of lac cultivation – Economic importance of Lac.	6	Up to K2	1
II	Unit II: Vermiculture Introduction – Types of earthworms – ecological classifications of earthworms. Vermicomposting: vermicomposting methods – factors affecting vermicomposting – Vermiculture unit. Harvesting of vermicompost – vermicast – advantages of vermicompost – vermiwash and its applications.	6	Up to K3	2
III	Unit III: Aquaculture Fresh water aquaculture: Carp culture, types of ponds, preparation maintenance, harvesting and management. Integrated and composite culture. Prawn culture. Marine Aquaculture: Edible – pearl oyster culture.	6	Up to K3	3
IV	Unit IV: Poultry Farming Commercial poultry farming – Nutritive value of egg and meat. Broiler management (Definition; Housing and equipment; Brooding, feeding and health cover of broilers; Record keeping; Broiler integration) – Layer management (Brooder; Grower and layer management; Culling of layers; Marketing of eggs and meat).	6	Up to K4	4

V	Unit V: Dairy Farming Dairy farming, classification of breeds of cattle – Indigenous and exotic breeds, Selection of dairy cattle. Breeding – artificial insemination, Dairy cattle management – housing – water supply – cattle nutrition feeding standards, Milk - Composition of milk – milk spoilage – pasteurization – Role of milk and milk products in human nutrition.	6	Upto K4	5

Books for Study

1. Awasthi, V.B., 2012. Introduction to General and Applied Entomology, third edition, Scientific publishers, India.
2. Shukla & Upadhyay, 2014. Economic Zoology, 5th edn. Rastogi Publication, Meerut New Delhi.
3. David, B and Ananthakrishnan, T. N., 2006. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India.
4. Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3rd Ed. Kalyani Publishers, Ludhiana.

Books for References

1. Glenn Munroe, 2017. Manual of on-Farm vermicomposting and vermiculture, Holdanca Farms Ltd, Wallace, Nova Scotia.
2. Gupta, P.K., 2008. Vermicomposting for sustainable agriculture, 2nd Edition, Agrobios, India.
3. Abishek Shukla, D., 2009. A Hand Book of Economic Entomology, Vedamse Books, New Delhi.
4. Banerjee, G.C., 2006. Text book of Animal Husbandry 8th Ed. Oxford and IBH Publishing Company Ltd., New Delhi.
5. Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.
6. Dunham, R.A., 2004. Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.

Web resources

1. https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html
2. <http://caa.gov.in/farms.html>
3. https://agritech.tnau.ac.in/animal_husbandry/animhus_index.html
4. https://agritech.tnau.ac.in/farm_enterprises/Farm%20enterprises_%20poultry%20unit.html
5. https://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 methodologies, field practice employed in rearing of economically important animals.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge and skill of Economic Zoology will help the students to augment 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. S. Dinakaran

Course Schedule (Total hours: 30)

Unit	Description	Staff Name	Hrs	Mode
I	Introduction to Economic Entomology.		1	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Seminar, Quiz, Test
	Lac Culture: Introduction – Life history of Lac Insects		2	
	Host plants – cultivation of Lac – Enemies of lac cultivation		2	
	Economic importance of Lac.		1	
			6	
II	Introduction – Types of earthworms – ecological classifications of earthworms.		2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Seminar, Quiz, Test
	Vermicomposting: vermicomposting methods – factors affecting vermicomposting – Vermiculture unit.		2	
	Harvesting of vermicompost – vermicast – advantages of vermicompost – vermiwash and its applications.		2	
			6	
III	Carp culture – types of ponds – preparation – maintenance – harvesting and management.		2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Seminar, Quiz, Test
	Integrated and composite culture.		1	
	Prawn culture.		1	
	Marine Aquaculture: Edible – pearl oyster culture.		2	
			6	
IV	Commercial poultry farming – Nutritive value of egg and meat.		2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Seminar, Quiz, Test
	Broiler management (Definition; Housing and equipment; Brooding, feeding and health care of broilers; Record keeping; Broiler integration)		2	
	Layer management (Brooder; Grower and layer management; Culling of layers; Marketing of eggs and meat).		2	
			6	

V	Dairy farming,classification of breeds of cattle – Indigenous and exotic breeds – Selection of dairy cattle.		2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Seminar, Quiz, Assignment
	Breeding – artificial insemination – Dairy cattle management – housing – water supply – cattle nutrition feeding standards.		2	
	Milk - Composition of milk – milk spoilage – pasteurization – Role of milk and milk products in human nutrition		2	
			6	

Course Learning Outcomes:

At the end of the course, the students will be able to

	CLO Statements	Knowledge level
CLO 1	Identify the breeds and varieties of poultry, fish, and cattle and understand the basic aspects of farming.	Up to K2
CLO 2	Design new methods to improve farm animals with increased productivity and disease resistance and to construct new methods in vermicomposting.	Up to K3
CLO 3	Analyse the pros and cons of different methods of farming and marketing strategies of products.	Up to K3
CLO 4	Evaluate the use of available resources in improving the breeds, vermicomposting, farm products etc..	Up to K4
CLO 5	Assess and integrate the available tools and techniques to increase the productivity in farms.	Up to K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	3	1
CLO-2	1	3	2	3	2
CLO-3	3	3	2	3	2
CLO-4	2	3	3	3	2
CLO-5	1	3	2	3	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	1	2	1	2
CLO2	3	3	3	2	2	1
CLO3	3	2	2	2	2	1
CLO4	3	3	3	2	3	2
CLO5	3	2	2	2	2	1

Advance application– 3;

Intermediate level–2;

Basic level–1

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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: IIB.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	SEC	23U3ZSED5	BASIC COURSE IN ORNITHOLOGY	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Course Objectives

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

1. To equip students with the required knowledge to understand the taxonomic position and role played by birds in the ecosystem, their importance to humans and their evolution
2. To enable students to comprehend the biological evolution of birds and their structural adaptations
3. To enable students to understand and learn aspects of bird behaviour
4. To enable students to learn about the breeding biology of birds
5. To equip students with a knowledge of macroecology of birds, bird populations and communities, bird diseases, bird conservation and on the role of citizen science in ornithology.

Unit	Description	Hours	K-Level	CLO
I	Introduction to Ornithology: Bird Lore; Birds and Humans; Classification of Birds, Bird Evolution and Speciation; Endemism	6	Up to K2	1
II	Morphology of Birds : External Morphology of the Bird; Structure of bird feather, Internal Structure of the Bird; Adaptations to Flight	6	Up to K3	2
III	Bird Behaviour: Foraging, Roosting, Vocalization, Imprinting, Feather care, Bird Intelligence, Social Behaviour, Mixed Species Flocks, Migration	6	Up to K3	3
IV	Breeding Biology: Differential investment of sexes; territoriality, courtship and display behaviour, nesting, eggs, incubation and care of young, brood parasitism	6	Up to K4	4
V	Bird community and Conservation Studying bird populations and communities, sampling methods; Macro ecology; Molecular Techniques in Ornithology; Avian Disease; Citizen Science and Ornithology; Threats faced by birds; Bird Conservation with case studies	12	Upto K4	5

Book for study

1. Scot, G. 2010. Essential Ornithology, Oxford University Press. Oxford. Pp185
2. Ali, S. and Ripley, S.D. Handbook of the Birds of India and Pakistan, Vol 1-10. Oxford University Press, Oxford
3. Grimmet, R., C. Inskipp and T. Inskipp. 2014. Birds of the Indian Subcontinent, Cristopher Helm. London. Pp55.

Book for References

1. Lovette, I.J and Fitzpatrick, J.W. (2016). Handbook of Bird Biology, 3rd ed. Wiley.
2. Birkhead, T. (2013). Bird Sense: What it's like to be a bird? Bloomsbury, NY.
3. Birkhead, T., Wimpenny, J., and Montgomerie, B. (2014). Ten Thousand Birds: Ornithology since Darwin. Princeton University Press, Princeton, NJ.
4. Gill, F.B, and Prum, R.O. (2019). Ornithology, 4th ed. Macmillan.

Webresources

1. <https://en.wikipedia.org/wiki/Ornithology>
2. <https://ornithology.com/ornithology-lectures/avian-ecology/>
3. https://onlinecourses.nptel.ac.in/noc22_ge10/preview
4. <https://www.ornithology.in/lectures/>
5. <https://unacademy.com/content/neet-ug/study-material/biology/ornithology/>

Rationale for Nature of the course

This course will enable the students to learn the basic concepts of ornithology. The knowledge acquired through the course will help the students to learn basic science of ornithology and equip them to find the research and entrepreneurial opportunities.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The course enriches students about overall understanding of ornithology, which may boost their likeliness towards nature conservation and research temperament.

Pedagogy

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

Course Designer: Dr.R.Eswaran

Course Schedule (Totalhours: 30)

Unit	Description	StaffName	Hrs	Mode
I	Introduction to Ornithology; Bird Lore; Birds and Humans;		2	Lecture,ChalkandTalk, Interaction,PPT, GroupDiscussion, Quiz, Seminar & Test
	Classification of Birds,		2	
	Bird Evolution and Speciation; Endemism		2	
			6	
II	External Morphology of the Bird; Structure of bird feather,		2	Lecture,Chalkand Talk, Interaction,PPT, Group Discussion, Quiz, Seminar & Test
	Internal Structure of the Bird;		2	
	Adaptations to Flight		2	
			6	
III	Bird Behaviour: Foraging, Roosting, Vocalization,		2	Lecture,ChalkandTalk, Interaction,PPT, GroupDiscussion, Quiz, Seminar & Test
	Imprinting, Feather care, Bird Intelligence,		2	
	Social Behaviour, Mixed Species Flocks, Migration		2	
			6	
IV	Breeding Biology: Differential investment of sexes; territoriality,		2	Lecture,ChalkandTalk, Interaction,PPT, GroupDiscussion, Quiz, Seminar & Test
	courtship and display behaviour, nesting,		2	
	eggs, incubation and care of young, brood parasitism		2	
			6	
V	Studying bird populations and communities, sampling methods; Macro ecology;		2	Lecture,ChalkandTalk, Interaction,PPT, GroupDiscussion, Quiz, Seminar & Assignment
	Molecular Techniques in Ornithology; Avian Disease; Citizen Science and Ornithology;		2	
	Threats faced by birds; Bird Conservation with case studies		2	
			6	

Course Learning Outcomes:

At the end of the course, the students will be able to

CLOs	CLO Statements	Knowledge level
CLO 1	Demonstrate the interaction between the birds and Man, and describe the evolution speciation and endemism of birds	Up to K2
CLO 2	Identify the morphological features that help the birds for flight	Up to K3
CLO 3	Organize the various behaviours of birds and their importance	Up to K3
CLO 4	Analyze the breeding behavior of birds	Up to K4
CLO 5	Examine the sampling methods for birds, threats to bird community and conservation.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CLO 1	3	2	3	2	1
CLO 2	3	2	3	1	2
CLO 3	2	2	3	2	2
CLO 4	3	2	3	3	2
CLO 5	3	2	3	2	2

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CLO 1	3	2	2	2	2	1
CLO 2	3	2	2	2	2	2
CLO 3	3	2	2	2	2	2
CLO 4	3	2	1	1	2	2
CLO 5	3	2	2	2	2	3

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

BLUEPRINTFOR SUMMATIVE EXAMINATION

ArticulationMapping-KLevels withCourseLearningOutcomes(CLOs)

Sl.No	CLOs	K- Level	SectionA		SectionB		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 toK2	2	K1&K2	1	K1	2 (K1&K1)	1(K2)
2	CLO2	Up toK3	2	K1&K2	1	K1	2 (K2&K2)	1(K3)
3	CLO3	Upto K3	2	K1&K2	1	K2	2 (K3&K3)	1(K3)
4	CLO4	Upto K4	2	K1&K2	1	K2	2 (K4&K4)	1(K4)
5	CLO5	Upto 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-Rememberingand recallingfactswithspecificanswers

K2-Basic understandingoffactsand statingmain ideaswith generalanswers

K3-Applicationoriented-SolvingProblems

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

Distribution of Section-wise Marks with KLevels

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: IIB.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Core	23U4ZCCT4	DEVELOPMENTAL BIOLOGY	4	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Course Objectives

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

1. To create an awareness to the students about the theories, concepts and basics of Developmental Biology.
2. To provide students about the idea of sex cells, fertilization, cleavage, differentiation and development of organs.
3. To make an awareness of the induction, organizers and development of extra embryonic structures.
4. To provide adequate explanation to students about the late embryonic developments and post embryonic development and ageing
5. To give an idea about teratogenesis, *invitro* fertilization, stem cells and amniocentesis to the students

Unit	Description	Hours	K-Level	CLO
I	Gametogenesis & Fertilization Basic concepts of developmental biology. Structure & types of Spermatozoa, Mammalian egg - Egg membranes. Types of egg - Spermatogenesis – Oogenesis. Fertilization – mechanism, theories and significance – Parthenogenesis.	12	Up to K2	1
II	Blastulation & Gastrulation Cleavage - Planes and Patterns, Factors controlling cleavage - Fate map and its construction. Blastulation – types of blastula. Morphogenetic movements - Gastrulation of frog & chick.	12	Up to K3	2
III	Organogenesis Development of Brain, Eye and Heart in frog. Development of Nervous system in chick. Foetal membranes in chick. Development of Pro, Meso, Metanephric kidneys. Placentation in Mammals.	12	Up to K3	3
IV	Applied Embryology Organizer concept – Structure – mechanism of induction and competence. Nuclear transplantation - teratogenesis – Regeneration: types - events and factors. Embryonic stem cells & significance. Methods to culture embryo	12	Up to K4	4

V	Human embryology Reproductive organs, Menstrual cycle and menopause - Pregnancy – trimesters – development. Erythroblastosis foetalis -Twins – types. Infertility – causes - Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentesis.	12	Upto K4	5

Book for study

1. Lewis Wolpert 2007. Principles of development, 3rd edition, Oxford University Press, New Delhi, India.
2. Subramoniam, T. 2003. Developmental Biology, Narosa Publishing House, New Delhi, India.
3. Verma, P.S., Agarwal, V. K.2010.Chordate Embryology: Developmental Biology, S. Chand & Company, New Delhi., India.

Book for References

1. Gilbert S.F. 2010. Developmental Biology, Sinauer Associates, Massachusetts, USA.
2. Balinsky, B.I. 1970. Introduction to Embryology, Philadelphia & London, UK.
3. Berril, N.J.1971. Developmental Biology, McGraw Hill, New York, USA.
4. Russ Hodge 2010. Developmental Biology, Facts on File, Inc., New York, USA.
5. Carlson, Bruce, M. 2009. Human embryology and Developmental Biology, Elsevier, Philadelphia, USA

Webresources

1. <https://www.ncbi.nlm.nih.gov/books/NBK10052/>
2. <https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html>
3. <https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/>

RationaleforNatureofthecourse

Thiscoursewillenablethestudentstolearnthe basic concepts, gametogenesis organogenesis, applied embryology and human embryology. The knowledge acquired through the course equip the students to work in a genetic laboratory.

ActivitieshavingdirectbearingonSkilldevelopment/Employability/Entrepreneurship

The course enrichesstudents about overallunderstandingofbiology,which mayboosttheirresearchtemperament.

Pedagogy

ChalkandTalk,PPT,groupdiscussion,seminar,interaction,quiz,tutorialandvirtuallabs.

Course Designer :Dr.R.Eswaran

Course Schedule (Total hours: 60)

Unit	Description	Staff Name	Hrs	Mode
I	Gametogenesis & Fertilization, Basic concepts of developmental biology		2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Test
	Structure & types of Spermatozoa		2	
	Mammalian egg - Egg membranes, types of egg		2	
	Spermatogenesis – Oogenesis		3	
	Fertilization – mechanism, theories and significance – Parthenogenesis		3	
			12	
II	Blastulation & Gastrulation, Cleavage - Planes and Patterns, Factors controlling cleavage		3	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Test
	Fate map and its construction		2	
	Blastulation – types of blastula		3	
	Morphogenetic movements - Gastrulation of frog & chick		4	
			12	
III	Organogenesis, Development of Brain, Eye and Heart in frog		3	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Test
	Development of Nervous system in chick		2	
	Foetal membranes in chick		2	
	Development of Pro, Meso Metanephric kidneys		3	
	Placentation in Mammals		2	
			12	
IV	Applied Embryology, Organizer concept – Structure – mechanism of induction and competence		3	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Test
	Nuclear transplantation – teratogenesis		3	
	Regeneration: types - events and factors		2	
	Embryonic stem cells & significance		2	
	Methods to culture embryos		2	
			12	
V	Human embryology Reproductive organs, Menstrual cycle and menopause		3	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Assignment
	Pregnancy – trimesters – development. Erythroblastosis foetalis		3	
	Twins – types. Infertility – causes		2	
	Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentesis		4	
			12	

Course Learning Outcomes:

At the end of the course, the students will be able to

CLOs	CLO Statements	Knowledge level
CLO 1	Demonstrate the structure and types of gametes, and to understand the mechanism of fertilization.	Up to K2
CLO 2	Identify the mechanism of cleavage and blastulation.	Up to K3
CLO 3	Organize the development pattern of various organs in Frog and Chick.	Up to K3
CLO 4	Examine the role of organizer in development and Inspect the regeneration types	Up to K4
CLO 5	Analyze the different aspects of human embryology and Assisted Reproductive Technology.	Up to K4

Mapping with Programme Specific Outcomes

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	1	3	2	1
CLO 2	3	1	3	2	2
CLO 3	2	1	3	1	2
CLO 4	3	2	3	3	2
CLO 5	3	2	3	2	3

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

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CLO 1	3	2	2	2	1	1
CLO 2	3	2	1	2	2	1
CLO 3	3	2	1	2	2	2
CLO 4	3	2	1	2	2	2
CLO 5	3	2	2	2	3	3

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

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ArticulationMapping-KLevels withCourseLearningOutcomes(CLOs)

Sl.No	CLOs	K-Level	SectionA		SectionB		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		ShortAnswers			
			No.of Questions	K- Level	No.of Questions	K- Level		
1	CLO1	UptoK2	2	K1&K2	1	K1	2 (K1&K1)	1(K2)
2	CLO2	Up toK3	2	K1&K2	1	K1	2 (K2&K2)	1(K3)
3	CLO3	Upto K3	2	K1&K2	1	K2	2 (K3&K3)	1(K3)
4	CLO4	Upto K4	2	K1&K2	1	K2	2 (K4&K4)	1(K4)
5	CLO5	Upto K4	2	K1&K2	1	K2	2 (K3&K3)	1(K3)
No.ofQuestions to be Asked			10		5		10	5
No.ofQuestions to be Answered			10		5		5	3
Marksforeachquestion			1		2		5	10
TotalMarks foreach Section			10		10		25	30

K1-Rememberingand recallingfactswithspecificanswers

K2-Basic understandingoffactsand statingmain ideaswith generalanswers

K3-Applicationoriented-SolvingProblems

K4-Examining,analyzing,presentationandmakeinferenceswithevidences

DistributionofSection-wiseMarkswithKLevels

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: II B.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
IV	Core	23U4ZCCP4	DEVELOPMENTAL BIOLOGY LAB COURSE	3	3	25	75	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented		

Course Objectives

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

1. To describe the basic techniques used in Developmental Biology.
2. To understand the different stages of chick embryo and sperm and egg of an organisms.
3. To learn the mounting and sectioning of egg and sperm of an organism.
4. To analyze the fecundity of fish and developmental stages of invertebrates and vertebrates.
5. To evaluate the various techniques used in developmental biology.

Unit	Description	Hours	K-Level	CLO
I	Observation of different stages of chick embryo 24 hours, 48 hours, 72 hours and 96 hours	9	UptoK2	CLO 1
II	Mounting of egg and sperm of chosen animals. Transverse section of testis and ovary.	9	UptoK3	CLO 2
III	Observation of cleavage stages, blastula, gastrula and neurula of frog. Fecundity of fish	9	UptoK3	CLO 3
IV	Developmental stages of Invertebrates (Insects) Developmental stages of Vertebrates (Fish)	9	UptoK4	CLO 4
V	Spotters Sperm and Ovum of man Morula, Blastula Placenta in shark and mammals Test tube baby, Twins	9	UptoK4	CLO 5

Books for References

1. Balinsky, B.I. 1965. *An Introduction to Embryology*, W.B. Saunders and Co, Philadelphia.
2. Berril, N.J. & Kars, G. 1986. *Developmental biology*, McGraw Hills.
3. Gilbert, S.F., 2010. *Developmental Biology*, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
4. Majumdar, N.N. 1985. *Vetebrate Embryology*, Tata McGraw-Hill, New Delhi.
5. Sinha, J., Chatterjee, A.K. & Chattopadhyay, P. 2011. *Advanced Practical Zoology*, Books and Allied (P) Ltd.

Web Resources

1. <https://organismalbio.biosci.gatech.edu/growth-and-reproduction/animal-development-i/>
2. <https://www.youtube.com/watch?v=GciJ9X3tJtI>
3. <https://www.youtube.com/watch?v=vBGumRAWaa0>
4. <https://organismalbio.biosci.gatech.edu/growth-and-reproduction/animal-development-ii/>

Rationale for Nature of the course

The students will acquire skills on studying the different stages of embryo, cleavage stages, different stages of development of an organism and the techniques used in developmental biology. The students can develop skills to validate genetic laws through experiments. They could develop their skills to study polytene chromosome.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

Students could learn the skills in studying different stages developing embryo, mounting and sectioning of egg and sperm. It would help their overall understanding on true affinities existing between animals that enriches their research career.

Pedagogy

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

Course designer: Dr. C. Selvakumar

Course Schedule (Total hours: 45)

Cycle	Description	Staff Name	Hrs	Mode
Experiments				
1	Observation of different stages of chick embryo (24 hours and 48 hours)		3	Observation of slides and discussion
2	Observation of different stages of chick embryo (72 hours and 96 hours)		3	Observation of slides and discussion
3	Mounting of egg and sperm of chosen animals		3	Mounting
4	Transverse section of testis and ovary		3	Sectioning
5	Observation of cleavage stages, blastula, gastrula and neurula of frog.		3	Observation of slides and discussion
6	Fecundity of fish		3	Live demo with experiments
7	Developmental stages of Invertebrates (Insects)		3	Live demonstration
8	Developmental stages of Vertebrates (Fish)		3	Live demonstration
Spotters				
9	Sperm and ovum of man		3	Comments with Image
10	Morula and Blastula		3	
11	Placenta of shark and mammals		3	
12	Test tube baby, Twins		3	
14	Internal Practical Test		3	
15	Summative Practical Examination			

Course Learning Outcomes:

At the end of the course, the students will be able to

CLOs	CLO Statements	Knowledge level
CLO 1	Understand the different stages of chick embryo.	Up to K2
CLO 2	Apply the knowledge to mount the egg and sperm of chosen animals and transverse section of testis and ovary	Up to K3
CLO 3	Describe the process of cleavage, blastulation and gastrulation of frog.	Up to K3
CLO 4	Analyze the fecundity of fish and developmental stages of invertebrates and vertebrates.	Up to K4
CLO 5	Evaluate the various techniques used in developmental biology.	Up to K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	1	3	1	3
CLO-2	3	1	3	2	2
CLO-3	3	1	3	1	3
CLO-4	2	1	3	2	2
CLO-5	3	1	3	1	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	1	2	3	3
CLO2	3	3	1	3	3	2
CLO3	3	2	1	2	3	3
CLO4	3	1	1	3	3	2
CLO5	3	2	1	2	3	3

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

DEPARTMENT OF ZOOLOGY				CLASS: IIB.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	SEC	23U4ZSED6	BIOINSTRUMENTATION	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives

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

- To induce interest in the use of various biological instrumentation and employ for the study of cells, tissues and genetic material
- To help students to map the use of specific bioinstrumentation for specific biological
- To study the working principle of different bioinstrumentation and their applications
- To enable students to design experiments and justify them with the underlying principles of bioinstrumentation.

Unit	Description	Hours	K-level	CLO
I	Good Laboratory Practices: Guide lines, Laboratory symbols; Cleaning and sterilization of labware and reagents; handling and care of laboratory animals; Concepts of molecular weight, atomic weight, preparation of solutions of a particular molarity and percentage; Buffers: definition and preparation of buffers, pH meter; Safety and ethical issues in laboratory settings	6	K2	CLO1
II	Microscopy - Light microscope, SEM, TEM; Cryopreservation - principle and procedure; Fluorescence activated cell sorting; X-ray crystallography.	6	K3	CLO2
III	Centrifugation - working principle and types of centrifugation; Spectrophotometry (UV); Chromatography - principle and types of chromatography.	6	K3	CLO3
IV	Biomedical Instrumentation: Haemoglobinometer, sphygmomanometer, ECG, cardiac pacemakers; X-ray imaging, CT scan Ultrasound imaging; medical applications of laser; Biosensors - glucose biosensor, alcohol biosensor,	6	K4	CLO4
V	Molecular Techniques: Isolation of DNA and Proteins, Electrophoresis of DNA, Polymerase chain reaction; Southern and Western blotting.	6	K4	CLO5

Books for study:

1. SabariGhosal and Anupama Sharma Avasthi, 2018. Fundamentals of Bioanalytical Techniques and Instrumentation, 2nd Ed., Phi Learning Pvt. Ltd., New Delhi, India.
2. Veerakumari L., 2015. Bioinstrumentation, MJP Publishers, Chennai, India.
3. Prakash Singh Bisen, Anjana Sharma, 2012. Introduction to Instrumentation in Life Sciences, CRC Press, Taylor & Francis Group, New York, USA.
4. Gupta P.C., 2010. Biological Instrumentation and Methodology (Tools & Techniques), S. Chand & Company Limited, New Delhi, India.
5. Ghatak K. L., 2010. Techniques and Methods in Biology, Phi Learning Pvt. Ltd., New Delhi, India.

Books for References:

1. Sue Carson, Heather Miller, Melissa Srouji and Scott Witherow, 2019. Molecular Biology Techniques: A Classroom Laboratory Manual, Academic Press, New York, USA
2. Aysha Divan, Janice Royds, 2013. Tools and Techniques in Biomolecular Science, Oxford Univeristy Press, UK
3. Gordon M.H., Macrae R., 2012. Instrumental Analysis in the Biological Sciences, Blackie & Son Ltd., UK
4. Leonard Davis, Mark Dibner and James Battey, 2012. Basic Methods in Molecular Biology, Elsevier Science Publishing Co., New York, USA.
5. Wilson, K.M. and Walker, J.M., 2010. Principles and Techniques of Biochemistry and Molecular Biology, Cambridge Universiyu Press, UK.

Web Resources

1. <https://bit.ly/3i5flym>
2. <https://pbiol.rsb.org.uk>
3. <https://www.nature.com/subjects/biological-techniques>
4. <https://www.ibiology.org>

Rationale for Nature of the course

This course will enable the students to grasp the theoretical knowledge and basic techniques of various biological instrumentation and employ for the study of cells, tissues and genetic material

Activities having direct bearing on Skill development / Employability Entrepreneurship

The acquiring of knowledge on basic techniques of various biological instrumentation enriches students' overall understanding working principles of microscopy, chromatography, Centrifugation, Electrophoresis and Molecular techniques such as DNA isolation and PCR amplification which may boost their Bio medical laboratory interest, Molecular research temperament and Entrepreneurship

Pedagogy

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

Course Designer: Dr. P. Sivakumar

Course Schedule (30 hours)

Unit	Topics	Hrs	Mode
Unit I	Guide lines, Laboratory symbols; Cleaning and sterilization of lab ware and reagents; handling and care of laboratory animals;	2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Test
	Concepts of molecular weight, atomic weight, preparation of solutions of a particular molarity and percentage;	2	
	Buffers: definition and preparation of buffers, pH meter; Safety and ethical issues in laboratory settings	2	
		6	
Unit II	Microscopy- Light microscope, SEM, TEM	2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Test
	Cryopreservation - principle and procedure	2	
	Fluorescence activated cell sorting; X-ray crystallography.	2	
		6	
Unit III	Centrifugation- working principle and types of centrifugation.	2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Test
	Spectrophotometry (UV).	2	
	Chromatography - principle and types of chromatography.	2	
		6	
Unit IV	Haemoglobinometer, sphygmomanometer, ECG, cardiac pacemakers.	2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Test
	X-ray imaging, CT scan, Ultrasound imaging.	2	
	Medical applications of laser; Biosensors - glucose biosensor, alcohol biosensor.	2	
		6	
Unit V	Isolation of DNA and Proteins	2	Lecture, Chalk and Talk, Interaction, PPT, Group Discussion, Quiz, Seminar & Assignment
	Electrophoresis of DNA, Polymerase chain reaction;	2	
	Southern and Western blotting.	2	
		6	

Course Learning Outcomes:

At the end of the course, the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Understand explain the steps in the use of various biological instrumentation that are used in the study of different animal specimens.	K2
CLO-2	Analyse the applications of biological techniques and employ them for the study of cells, tissues and genetic material.	K3
CLO-3	Analyse, Correlate and appraise the use of specific bioinstrumentation for specific biological experiments and infer the results of such experiments	K3
CLO-4	Evaluate the working principle of different bioinstrumentation and to summarize their applications.	K4
CLO-5	Interpret the experiments and justify them with the understanding of the underlying principles of bioinstrumentation that are eco-friendly, ethical and have national and global relevance.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	1	1	3	1	1
CLO-2	2	2	3	2	1
CLO-3	2		2	2	1
CLO-4	2	1	2		2
CLO-5	1	1	3		2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	1		3	1	1	1
CLO2	1		3		1	1
CLO3	1	2	3	2		1
CLO4	1	2	3	2	2	1
CLO5	1	2	3	2	2	1

Advance application– 3;

Intermediate level–2;

Basic level–1

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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: IIB.Sc. Zoology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	SEC	23U4ZSED7	BASICS OF MARINE BIOLOGY	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Course Objectives

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

1. To understand and learn the physical, chemical and biological aspects of marine environment and to gain knowledge about the management of oceans.
2. To introduce students to the marine environment and its indigenous organisms.
3. To study the principles, concepts and facts through which the student can better understand and appreciate the nature of the sea and its inhabitants.
4. To acquaint the student with the characteristics used to identify and classify marine plants and animals and to develop an awareness of the career possibilities available to students in this area.

Unit	Description	Hours	K-level	CLO
I	Marine Ecology : Marine environment- ecological factors- light, temperature, salinity, pressure; Classification of marine environment; Pelagic environment – Planktonic and Nektonic adaptations; Benthic environment - intertidal, interstitial and deep sea adaptations; Distribution and ecological role of other coastal environments - coral reefs, estuaries, mangroves.	6	Up to K2	1
II	Physical and Chemical Oceanography : Physical Properties of Seawater- density, viscosity, surface tension; temperature distribution in the sea – heat budget; El Nino and La Nina, Dynamics of the ocean- Waves, Currents and Tides, Tsunami. Chemical composition of seawater- major and minor elements, trace elements- their importance.	6	Up to K3	2
III	Biological Oceanography : Sea as a biological environment- Plankton- classification based on size, mode of life and habitat. Phytoplankton and Zooplankton – methods of collection-standard plankton net and high speed plankton net.	6	Up to K3	3
IV	Marine Pollution : Ocean pollution- kinds and quantities of pollutants, toxic effects and control measures – oil spills, plastics, nuclear waste disposal in	6	Up to K4	4

	marine environment. Eutrophication.			
V	Ocean Management: Role of National and international agencies and organizations in ocean management-FAO, UNEP, DOD, IMO INMARSAT-IUCN and Marpol, Traffic.Ocean policy (India)-research and management.	6	Up to K4	5

Books for study:

1. Thurman, Harold., 2001 Introduction to Oceanography, Prentice Hall Inc. New Jersey. 506 pp.
2. Bertness, M.D, S. D. Gaines and M.K. Hay 2000. Marine Community Ecology Sinauer Associates.
3. Grant Gross, M., 1993 Oceanography: A view of the earth (sixth edition). Prentice Hall Inc. New Jersey.
4. Fincham A. A, 1984. Basic Marine Biology. Cambridge University Press, England. 157 pp.
5. John Resch Jr. 1979, Marine Biology. Reston Publishing Company, Virginia. 257 pp.

Books for References:

1. Barbara E. Curry, 2016. Advances in Marine Biology, Volume 74, 1st Edition. Academic Press ISBN: 9780128036075
2. Peter Castro, Michael E. Huber, 2015. Marine Biology; Series Botany, Zoology, Ecology and Evolution. McGraw-Hill Education.
3. Philip V. Mladenov, 2013 Marine Biology: A very short introduction, 1st Edition. Oxford University Press.
4. Venkataraman K, Raghunathan C, Raghuraman R, Sreeraj C. R, 2012. Marine diversity in India. Zoological Survey of India, Kolkata. 178 pp.
5. Amy Hill. 2002. Marine Biology: An Introduction to Ocean Ecosystems (Marine Biology Ser) Walch publishing.

Web Resources

1. <https://www.livescience.com>
2. <https://www.icriforum.org>
3. <https://www.cbd.int>
4. <https://oceanservice.noaa.gov/facts/ninonina.html>

Rationale for Nature of the course

This course will enable the students to comprehend the knowledge on basic concepts of marine biology. Students will learn the significance of marine ecosystem, physical, chemical and biological oceanography. Students will also acquire knowledge on marine pollution control methods and get enlightened on role of national and international agencies in ocean management.

Activities having direct bearing on Skill development / Employability Entrepreneurship

The acquired knowledge on marine ecosystem and ocean management will help the students for developing the skills in marine biology, which further paves the way for their employability.

Pedagogy

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

Course Schedule(30 hours)

Unit	Topics	Hrs	Mode
Unit I	Marine environment- ecological factors- light, temperature, salinity, pressure; Classification of marine environment	2	Chalk and talk, ppt, group discussion, quiz, seminar & Test
	Pelagic environment – Planktonic and Nektonic adaptations	2	
	Benthic environment - intertidal, interstitial and deepsea adaptations.	1	
	Distribution and ecological role of other coastal environments - coral reefs, estuaries, mangroves,	1	
Unit II	Physical Properties of Seawater- density, viscosity, surface tension and conductivity	1	Chalk and talk, ppt, group discussion, quiz, seminar & Test
	Temperature distribution in the sea - heat budget; El Nino and La Nina	1	
	Dynamics of the ocean- Waves and Currents, Tides and Tsunami	1	
	Chemical composition of seawater-major and minor major minor and trace elements- their importance	1	
	Sea as a biological environment- Plankton- classification based on size, mode of life and habitat.	1	
	Phytoplankton and Zooplankton - methods of collection	1	
Unit III	Sea as a biological environment- Plankton- classification based on size.	1	Chalk and talk, ppt, group discussion, quiz, seminar & Test
	Sea as a biological environment- Plankton- classification based on and habitat.	1	
	Sea as a biological environment- Plankton- classification based on habitat.	1	
	Phytoplankton and Zooplankton - methods of collection- Standard plankton net	1	
	Phytoplankton and Zooplankton - methods of collection- highspeed plankton net	1	
Unit IV	Ocean pollution- kinds and quantities of pollutants.	2	Chalk and talk, ppt, group discussion, quiz, seminar & Test
	Toxic effects and control measures – oil spills, plastics.	1	
	Nuclear waste disposal in marine environment.	2	
	Eutrophication	1	
Unit V	Role of National and international agencies and organizations in ocean management-FAO and UNEP	1	Chalk and talk, ppt, group discussion, quiz, seminar & Assignment
	Role of National and international agencies and organizations in ocean management- DOD	1	
	Role of National and international agencies and organizations in ocean management- IMO INMARSAT- IUCN	1	
	Role of National and international agencies and organizations in ocean management-Marpol andTrafic	1	
	Ocean policy (India)- research and development	2	

Course Learning Outcomes:

At the end of the course, the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Understand the marine ecosystem and its inhabitants	Up to K2
CLO-2	Describe the physical properties and chemical compositions of sea water	Up to K3
CLO-3	Demonstrate the methods of collections of planktons	Up to K3
CLO-4	Examine the marine pollutants, toxic effects and control measures	Up to K4
CLO-5	Discuss the role of national and international agencies in ocean management	Up to K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	1	2	2	2	1
CLO-2	1	1		2	
CLO-3	2	2	1	2	2
CLO-4	2	2		2	2
CLO-5	2	2	2	2	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	2	3	2		1
CLO2	2	1	2	2	1	
CLO3	2	2	2	2	2	1
CLO4	2	2	2	2	2	
CLO5	2	2	2	2	2	1

Advance application– 3;

Intermediate level–2;

Basic level–1

BLUE PRINT FOR EXTERNAL**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%



The Madura College (Autonomous), Madurai – 625 011
Department of Zoology
UG Programme Structure

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	23U1ZCCT1	Core Course - 1 (Invertebrata) (CC1)	5	5			✓			✓	38.23 %
	23U1ZCCP1	Core Course - 2 (Invertebrata Lab Course) (CC2)	3	3			✓			✓	67.03 %
	23U1ZFCT1	Foundation course (FC)- Applied Zoology	2	2	✓		✓		✓		NEW
	23U1ZSED1	Skill Enhancement Course SEC-1 – Medical Laboratory Techniques	2	2	✓		✓		✓		NEW
II	23U2ZCCT2	Core Course - 4 (Chordata) (CC3)	5	5			✓			✓	30 %

	23U2ZCCP2	Core Course - 5 (Chordata Lab Course) (CC4)	3	3			✓			✓	72 %
	23U2ZSED2	Skill Enhancement Course SEC-2 – Ornamental fish farming and management	2	2		✓	✓	✓			NEW
	23U2ZSED3	Skill Enhancement Course SEC-3 – Biocomposting for Entrepreneurship	2	2		✓		✓			NEW
III	23U3ZCCT3	Core Course 5– Cell Biology (CC5)	4	4			✓			✓	34.4 %
	23U3ZCCP3	Core Course - 6 (Cell Biology Lab Course) (CC6)	3	3	✓		✓			✓	15.38 %
	23U3ZSED4	Skill Enhancement Course SEC-4 Economic Zoology	2	2		✓	✓		✓		NEW
	23U3ZSED5	Skill Enhancement Course SEC-5 Basic Course in Ornithology	2	2	✓		✓		✓		NEW

IV	23U4ZCCT4	Core Course - 7 (Developmental Biology) (CC7)	4	4	✓		✓			✓	3.5 %
	23U4ZCCP4	Core Course - 8 (Developmental Biology Lab Course) (CC8)	3	3	✓		✓			✓	30.4 %
	23U4ZSED6	Skill Enhancement Course SEC-6 Bioinstrumentation	2	2	✓	✓	✓		✓		NEW
	23U4ZSED7	Skill Enhancement Course SEC-7 Basics of Marine Biology	2	2	✓		✓		✓		NEW
Total											

Empl- Employability; Ent- Entrepreneurship; Skill- Skill Development



DEPARTMENT OF COMPUTER SCIENCE

Revised Curriculum

**TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION (TANSCHE)
(Choice Based Credit system with Outcome Based Education)**

Academic Year 2023-2024 onwards

III and IV semesters (B.Sc. Computer Science)

THE MADURA COLLEGE (Autonomous)
Department of Computer Science
Curriculum Structure

Semester: III

Part	Course Code	Course description	Hours	Credits
I		Language - I Tamil / Hindi / Sanskrit	6	3
II		Language - II English	6	3
III	23U3DCCT3	Core Theory -3: Python Programming	5	4
	23U3DCCP3	Core Practical -3 Python Programming Lab	3	3
	23U3DDST1	Elective course -3 (Generic/Discipline specific) Digital Logic Fundamentals	5	5
IV	23U3DSED4	Skill Enhancement Course SEC-4 Web Designing	2	2
	23U3DSED5	Skill Enhancement Course SEC-5 Multimedia systems	2	2
	23U3EVST1	Environmental Studies EVS -1	1	1
		Total	30	23

Semester: IV

Part	Course Code	Course description	Hours	Credits
I		Language - I Tamil / Hindi / Sanskrit	6	3
II		Language - II English	6	3
III	23U3DCCT4	Core Theory -4 Computer Networks	5	4
	23U3DCCP4	Core Practical -4 Web Designing Lab.	3	3
	23U3DDST2	Elective course -4 (Generic/Discipline specific) Resource Management Techniques	5	5
IV	23U3DSED6	SEC-6 PHP Programming	2	2
	23U3DSED7	SEC-7 Software testing	2	2
	23U3EVST2	Environmental Studies EVS -2	1	1
		Total	30	23

Semester – III

DEPARTMENT OF COMPUTER SCIENCE				CLASS: II B.Sc. Computer Science				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext	Total
III	Core course theory	23U3DCCT3	Python Programming	4	5	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To make students understand the concepts of Python programming.
- To apply the OOPs concept in PYTHON programming.
- To impart knowledge on demand and supply concepts
- To make the students learn best practices in PYTHON programming
- To know the costs and profit maximization

UNIT	Contents	No. of Hours	K Level	CLO
I	Basics of Python Programming: History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Builtin Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. Python Arrays: Defining and Processing Arrays – Array methods.	15	Upto K2	CLO1
II	Control Statements: Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. Jump Statements: break, continue, and pass statements.	15	Upto K3	CLO2
III	Functions: Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. Function Arguments: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. Python Strings: String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. Modules: import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules.	15	Upto K3	CLO3

IV	Lists: Creating a list -Access values in List-Updating values in ListsNested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. Dictionaries: Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	15	Upto K4	CLO4
V	Python File Handling: Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods- append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files.	15	Upto K4	CLO5
TOTAL HOURS		75		

Textbooks

1. Reema Thareja, “Python Programming using problem solving approach”, First Edition, 2017, Oxford University Press.
2. Dr. R. Nageswara Rao, “Core Python Programming”, First Edition, 2017, Dream tech Publishers.

Reference Books

1. VamsiKurama, “Python Programming: A Modern Approach”, Pearson Education.
2. Mark Lutz, ”Learning Python”, Orielly.
3. Adam Stewarts, “Python Programming”, Online.
4. Fabio Nelli, “Python Data Analytics”, APress.
5. Kenneth A. Lambert, “Fundamentals of Python – First Programs”, CENGAGE Publication.

Web Resources

1. <https://www.programiz.com/python-programming>
2. <https://www.guru99.com/python-tutorials.html>
3. https://www.w3schools.com/python/python_intro.asp
4. <https://www.geeksforgeeks.org/python-programming-language/>
5. [https://en.wikipedia.org/wiki/Python_\(programming_language\)](https://en.wikipedia.org/wiki/Python_(programming_language))

Rationale for the Nature of the Course:

The course teaches the essential concepts of Python programming and gives an in-depth knowledge of functions, control statements, directories, and file handling. Learners can develop programs with the essential concepts of data types, lists, basic operators, and functions.

Activities having a 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.

Course Designer(s):

1. **Dr. Sree Ram Kumar T**
2. **Prof. P. Sridevi**

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Basics of Python Programming: History of Python-Features of Python-Literal-Constants-Variables -	5	Chalk and Talk, Power point presentation, Quiz, Test
	Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments –	5	
	Indentation- Operators-Expressions-Type conversions. Python Arrays: Defining and Processing Arrays – Array methods.	5	
Unit II	Control Statements: Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements.	5	Seminar, Test, Group Discussion
	Iterative Statements: while loop, for loop, else suite in loop and nested loops.	5	
	Jump Statements: break, continue and pass statements.	5	
Unit III	Functions: Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement.	5	Power point presentation. Demonstration, Test, Quiz
	Function Arguments: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. Python Strings: String operations-Immutable Strings -	5	
	Built-in String Methods and Functions - String Comparison. Modules: import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules.	5	
Unit IV	Lists: Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods.	5	Chalk and Talk, Seminar, Test
	Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples.	5	
	Dictionaries: Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	5	

Unit V	Python File Handling: Types of files in Python - Opening and Closing files	5	Power point presentation, Assignment, Quiz
	Reading and Writing files: write() and writelines() methods-append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files	5	
		5	

Course Learning Outcomes

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.	Upto K2
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.	Upto K3
CO3	Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules.	Upto K3
CO4	Work with List, tuples and dictionary, Write program using list, tuples and dictionary.	Upto K4
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs using files.	Upto K4

Mapping of CLOs with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3

S-Strong-3 M-Medium-2 L-Low-1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	1	3
CLO5	3	2	2	1	2

Advance application– 3;

Intermediate level–2;

Basic level–1

(Mapping with Course 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	K1 & K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO2	K1 & K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K3)
3	CLO3	Upto K3	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO4	Upto K4	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K4)
5	CLO5	Upto 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			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 with choice	Consolidated
K1	5	1	2	-	17	14.20	42%
K2	5	4	2	1	33	27.50	
K3	-	-	4	2	40	33.30	33%
K4	-	-	2	2	30	25.00	25%
Total Marks	10	10	50	50	120	100	100%

DEPARTMENT OF Computer Science					CLASS: II B.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
III	Core-Practical	23U3DCCP3	Python Programming Lab	3	3	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives:

- Be able to design and program Python applications.
- Be able to create loops and decision statements in Python.
- Be able to work with functions and pass arguments in Python.
- Be able to build and package Python modules for reusability.
- Be able to read and write files in Python.

List of Programs

1. Program using variables, constants, I/O statements in Python.
2. Program using Operators in Python.
3. Program using Conditional Statements.
4. Program using Loops.
5. Program using Jump Statements.
6. Program using Functions.
7. Program using Recursion.
8. Program using Arrays.
9. Program using Strings.
10. Program using Modules.
11. Program using Lists.
12. Program using Tuples.
13. Program using Dictionaries.
14. Program for File Handling

Rationale for Nature of the course

Programming with Python has become an essential part of mastering machine learning which has become a necessity for survival in the fourth industrial revolution

Activities having direct bearing on Skill development / Employability/Entrepreneurship

Live Demonstrations, Hands-on with debugging and executing python programs

Pedagogy

Live Demonstrations, Test, Quiz, Seminar

Course Designer(s):

1. Dr. Sree Ram Kumar T
2. Prof. P. Sridevi

Course Learning Outcomes

Course Outcomes		Knowledge Level
On completion of this course, students will		
CO1	Demonstrate an understanding of the syntax and semantics of the PYTHON language	Upto K2
CO2	Identify the problem and solve using PYTHON programming techniques.	Upto K3
CO3	Identify suitable programming constructs for problem-solving.	Upto K3
CO4	Analyze various concepts of the PYTHON language to solve the problem in an efficient way.	Upto K4
CO5	Develop a PYTHON program for a given problem and test for its correctness.	Upto K4

Mapping with PSOs:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3

S-Strong-3 M-Medium-2 L-Low-1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	3	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	3	1
CLO5	3	2	2	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

DEPARTMENT OF Computer Science					CLASS: II B.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ex t	Total
III	DST-1	23U4DDST-1	Digital Logic Fundamentals	5	5	25	75	100

Nature of Course	Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Units	Contents	Required Hours	K Level	CLO
I	Number Systems and Codes: Number System – Base Conversion – Binary Codes – Code Conversion. Digital Logic: Logic Gates – Truth Tables – Universal Gates.	15	Upto K2	CLO1
II	Boolean Algebra: Laws and Theorems – SOP, POS Methods – Simplification of Boolean Functions – Using Theorems, K-Map, Prime – Implicant Method – Binary Arithmetic: Binary Addition – Subtraction – Various Representations of Binary Numbers – Arithmetic Building Blocks – Adder – Subtractor.	15	Upto K3	CLO2
III	Combinational Logic: Multiplexers – Demultiplexers – Decoders – Encoders – Code Converters – Parity Generators and Checkers.	15	Upto K3	CLO3
IV	Sequential Logic: RS, JK, D, and T Flip-Flops – MasterSlave Flip-Flops. Registers: Shift Registers – Types of Shift Registers.	15	Up to K4	CLO4
V	Counters: Asynchronous and Synchronous Counters - Ripple, Mod, Up-Down Counters– Ring Counters. Memory: Basic Terms and Ideas –Types of ROMs – Types of RAMs.	15	Upto K4	CLO5

Rationale for Nature of the course

Thorough testing is essential to ensure software systems function correctly, are secure, meet stakeholders' needs, and ultimately provide value to end users. Software testing is a crucial activity in the software development life cycle that aims to evaluate and improve the quality of software products.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Live Demonstrations illustrating the application of testing to software projects, Hands-on with common software testing tools

Pedagogy

Chalk and Talk, Quiz, Seminar, Group Discussion, Assignment

Course Designer(s):

1. Er. J. Rajendran
2. Dr. Sree Ram Kumar T

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Number Systems and Codes: Number System – Base Conversion – Binary Codes – Code Conversion.	7	Group discussion, presentation, Test, Quiz
	Digital Logic: Logic Gates – Truth Tables – Universal Gates.	8	
Unit II	Boolean Algebra: Laws and Theorems – SOP, POS Methods – Simplification of Boolean Functions	7	Chalk and talk, demonstration, Seminar, Test
	Using Theorems, K-Map, Prime – Implicant Method – Binary Arithmetic: Binary Addition – Subtraction – Various Representations of Binary Numbers – Arithmetic Building Blocks – Adder – Subtractor.	8	
Unit III	Combinational Logic: Multiplexers – Demultiplexers – Decoders	7	Quiz, presentation, Test
	Encoders – Code Converters – Parity Generators and Checkers	8	
Unit IV	Sequential Logic: RS, JK, D, and T Flip-Flops – Master-Slave Flip-Flops.	8	Chalk and talk, quiz, Test
	Registers: Shift Registers – Types of Shift Registers	7	
Unit V	Counters: Asynchronous and Synchronous Counters - Ripple, Mod, Up-Down Counters– Ring Counters	7	Presentation, group discussion, Assignment, Seminar
	Memory: Basic Terms and Ideas –Types of ROMs – Types of RAMs.	8	

Course Learning Outcomes

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
CO1	Identify the logic gates and their functionality.	Upto K2
CO2	Perform number conversions from one system to another system	Upto K3
CO3	Understand the functions of combinational circuits	Upto K3
CO4	Perform number conversions.	Upto K4
CO5	Perform Counter design and learn its operations	Upto K4

Mapping with PSOs:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage of course contributed to each PSO	15	12	10	11	12	13

S-Strong-3 M-Medium-2 L-Low-1

Mapping with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	3	2
CLO5	3	2	3	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

(Mapping with Course 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	K1 & K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO2	K1 & K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K3)
3	CLO3	Upto K3	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO4	Upto K4	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K4)
5	CLO5	Upto 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			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 with choice	Consolidated
K1	5	1	2	1	17	14.20	42%
K2	5	4	2	1	33	27.50	
K3	-	-	4	1	40	33.30	33%
K4	-	-	2	2	30	25.00	25%
Total Marks	10	10	50	50	120	100	100%

DEPARTMENT OF Computer Science					CLASS: II B.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
III	SEC-4	24U3DSED4	Web Designing	2	2	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- Understand the basics of HTML and its components
- To study about the Graphics in HTML
- Understand and apply the concepts of XML and DHTML
- Understand the concept of JavaScript
- To identify and understand the goals and objectives of the Ajax

UNIT	Details	No. of Hours	K Level	CLO
I	HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size, face and color alignment links-tables-frames.	6	Upto K2	CLO1
II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page.	6	Upto K3	CLO2
III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).	6	Upto K3	CLO3
IV	Dynamic HTML: Document object model (DCOM)Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding. JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition,	6	Upto K4	CLO4
V	Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.	6	Upto K4	CLO5
	Total	30		

Text Books

1. Pankaj Sharma, “Web Technology”, SkKataria& Sons Bangalore 2011.
2. Mike Mcgrath, “Java Script”, Dream Tech Press 2006, 1st Edition.
3. Achyut S Godbole&AtulKahate, “Web Technologies”, 2002, 2nd Edition.

Reference Books

1. Laura Lemay, RafeColburn , Jennifer Kyrnin, “Mastering HTML, CSS &Javascript Web Publishing”, 2016.
2. DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Paperback 2016, 2nd Edition.

Web Resources

1. NPTEL & MOOC courses titled Web Design and Development.
2. <https://www.geeksforgeeks.org>

Rationale for the Nature of the Course

This course is designed to equip students with the skills and knowledge needed to create web programs with good appeal, responsive, and user-friendliness. It covers a range of topics such as HTML, CSS javascript, and XML.

Activities having a 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.

Course Designer(s):

1. **Prof. R. Umasankari**
2. **Prof. P. Sridevi**

Course Schedule

Unit	Topics	Hrs.	Mode
Unit I	HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break.	3	Presentation, group discussion, Quiz, Test
	Emphasizing test- heading and horizontal rules-list-font size, face and color alignment links-tables-frames.	3	
Unit II	Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia,	3	Demonstration, chalk and talk, Test, Seminar
	data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page	3	
Unit III	Cascading style sheet (CSS)-what is CSS-Why we use CSS-	3	Presentation, demonstration, Quiz, test
	CSS-adding CSS to your web pages-Grouping stylesextensible markup language (XML).	3	
Unit IV	Document object model (DCOM)Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding.	3	Chalk and talk, group discussion, Quiz, Test
	Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition	3	
Unit V	Advance script, JavaScript and objects, JavaScript own objects	3	Presentation, demonstration, Seminar, Assignment
	the DOM and web browser environments, forms and validations	3	

Course Learning Outcomes

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
CO1	Develop working knowledge of HTML	Upto K2
CO2	Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).	Upto K3
CO3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).	Upto K3
CO4	Ability to develop a java script	Upto K4
CO5	An ability to develop web application using Ajax.	Upto K4

Mapping with PSOs:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage of course contributed to each PSO	15	12	10	11	12	13

S-Strong-3 M-Medium-2 L-Low-1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	3	2
CLO5	3	2	3	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

(Mapping with Course 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	K1 & K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO2	K1 & K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K3)
3	CLO3	Upto K3	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO4	Upto K4	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K4)
5	CLO5	Upto 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			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 with choice	Consolidated
K1	5	1	2	1	17	14.20	42%
K2	5	4	2	1	33	27.50	
K3	-	-	4	1	40	33.30	33%
K4	-	-	2	2	30	25.00	25%
Total Marks	10	10	50	50	120	100	100%

DEPARTMENT OF Computer Science					CLASS: II B.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
III	SEC-5	24U3DSED5	Multimedia Systems	2	2	25	75	100

Nature of course	Skill oriented		Employability oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- Understand the definition of Multimedia
- To study about the Image File Formats, Sounds Audio File Formats
- Understand the concepts of Animation and Digital Video Containers
- To study about the Stage of the Multimedia Project
- Understand the concept of Ownership of Content Created for Project Acquiring Talent

UNIT	Contents	No. of Hours	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.	6	Upto K2	CLO 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. DigitalAudio-multimedia System Sounds Audio File Formats Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project	6	Upto K3	CLO 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	6	Upto K3	CLO 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.	6	Upto K4	CLO4

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	6	Upto K4	CLO5
	Total	30		

Text Book

Tay Vaughan, "Multimedia: Making It Work", 8th Edition, Osborne/McGraw Hill, 2001.

Reference Books

Ralf Steinmetz & Klara Nahrstedt "Multimedia Computing, Communication & Applications", Pearson Education, 2012.

Web Resources

<https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/>

Rationale for the Nature of the Course

Multimedia systems is to introduce the various aspects of multimedia components like Images, audio, sound, and computer graphics and to provide hands-on training. The learners can create, import, store, retrieve, edit, and delete different types of multimedia elements in digital form. Also, the students can understand how to design multimedia environments.

Activities having a direct bearing on Skill development / Employability / Entrepreneurship

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

Pedagogy:

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

Course Designer(s):

1. **Prof. J. Mayajothi**
2. **Prof. P. Sridevi**

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Multimedia Definition-Use Of Multimedia Delivering Multimedia- Text: About Fonts and Faces	3	Chalk and talk, quiz, test
	Using Text in Multimedia -Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.	3	
Unit 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	3	PowerPoint presentation, demonstration, Test, Quiz
	Midi vs. DigitalAudio-multimedia System Sounds Audio File Formats Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project	3	
Unit III	Animation: The Power of Motion-Principles of Animation-Animation by Computer - Ma	3	Chalk and talk, group discussion, Test, Quiz
	Animations that Work. Video: Using Video - Working with Video and Displays-Digital Video Containers-Obtaining Video Clips -Shooting and Editing Video	3	
Unit IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs	3	PowerPoint presentation, quiz, Test
	An Authoring Systems Needs-Multimedia Production Team	3	
Unit V	Planning and Costing: The Process of Making Multimedia-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing	3	Group discussion, chalk and talk, Assignment, Seminar
	Content andTalent: Acquiring Content-Ownership of Content Created for Project-Acquiring Talent	3	

Course Learning Outcomes

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
CO1	understand the concepts, importance, application and the process of developing multimedia	Upto K2
CO2	to have basic knowledge and understanding about image related processings	Upto K3
CO3	To understand the framework of frames and bit images to animations	Upto K3
CO4	Speaks about the multimedia projects and stages of requirement in phases of project.	Upto K4
CO5	Understanding the concept of cost involved in multimedia planning, designing, and producing	Upto K4

Mapping with PSOs:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	3	3	3	2
CO2	2	3	2	3	2	1
CO3	1	2	3	3	3	2
CO4	3	2	2	2	1	2
CO5	2	3	1	3	3	3
Weightage of course contributed to each PSO	10	12	11	14	12	10

Strong-3 M-Medium-2 L-Low-1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	3	2
CLO5	3	2	3	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

(Mapping with Course 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	K1 & K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO2	K1 & K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K3)
3	CLO3	Upto K3	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO4	Upto K4	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K4)
5	CLO5	Upto 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			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 with choice	Consolidated
K1	5	1	2	1	17	14.20	42%
K2	5	4	2	1	33	27.50	
K3	-	-	4	1	40	33.30	33%
K4	-	-	2	2	30	25.00	25%
Total Marks	10	10	50	50	120	100	100%

SEMESTER: IV

DEPARTMENT OF Computer Science					CLASS: II B.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	Corecourse-4	23U4DCCT4	Computer Networks	4	5	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives:

- **To learn the basic concepts of Data communication and Computer network**
- **To learn about wireless Transmission**
- **To learn about networking and data link layer.**
- **To study Network communication.**
- **To learn the concept of the Transport layer**

UNIT	Contents	No. of Hours	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	Upto K2	CLO1
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	Upto K3	CLO2
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	Upto K3	CLO3
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	15	Upto K4	CLO4
V	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography	15	Upto K4	CLO5
	Total	75		

Text Book

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

Reference Books

1. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition, 2017
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://en.wikipedia.org/wiki/Computer_network
2. <https://citationsy.com/styles/computer-networks>

Rationale for the Nature of the Course

Computer networks refers to interconnected computing devices that can exchange data and share resources with each other. The course includes basics about computer network organization and a theoretical understanding of data communication and computer networks. It describes the idea of the Open Systems Interconnection (OSI) communication model, error detection and recovery, local area networks, and more.

Activities having a 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.

Course Designer(s):

1. **Er. J. Rajendran**
2. **Prof. P. Sridevi**

Course Schedule

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

Course Learning Outcomes

	Course Outcomes	Knowledge Level
CO	On completion of this course, students will	
CO1	To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models	Upto K2
CO2	To gain knowledge on Telephone systems using wireless network	Upto K3
CO3	To understand the concept of MAC	Upto K3
CO4	To analyze the characteristics of Routing and Congestion control algorithms	Upto K4
CO5	To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS	Upto K4

Mapping with PSOs:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	3	3	3	2
CO2	2	3	2	3	2	1
CO3	1	2	3	3	3	2
CO4	3	2	2	2	1	2
CO5	2	3	1	3	3	3

Strong-3 M-Medium-2 L-Low-1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	3	2
CLO5	3	2	3	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

(Mapping with Course 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	K1 & K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO2	K1 & K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K3)
3	CLO3	Upto K3	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO4	Upto K4	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K4)
5	CLO5	Upto 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			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 with choice	Consolidated
K1	5	1	2	1	17	14.20	42%
K2	5	4	2	1	33	27.50	
K3	-	-	4	1	40	33.30	33%
K4	-	-	2	2	30	25.00	25%
Total Marks	10	10	50	50	120	100	100%

DEPARTMENT OF Computer Science					CLASS: II B.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	CORE-PRACTICAL	23U4DCCP4	Web Designing Lab	3	3	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	✓

List of Programs:

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

Web designing insists the web developers to learn coding and a good logical skills to develop websites with an appealing view. Web designing is the term to design the interface of any website , web page looking, and the how website is so impressive.

Activities having a 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.

Course Designer(s):

1. Prof. R. Umasankari
2. Prof. P. Sridevi

COURSE OUTCOMES:

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

CLOs	COURSE OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CO-1	Understand the concepts of identifiers, variables, arrays, control structures, functions and objects in JavaScript.	Up to K2
CO-2	Develop hands on experience using HTML	Up to K3
CO-3	Identify the creation of basic animation techniques	Up to K3
CO-4	Understand the concepts of creating web pages for the customized applications.	Up to K4
CO-5	Describe the concepts of creating the forms and integrating the database with forms.	Up to K4

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	3	3	3	2
CO2	2	3	2	3	2	1
CO3	1	2	3	3	3	2
CO4	3	2	2	2	1	2
CO5	2	3	1	3	3	3

Strong-3 M-Medium-2 L-Low-1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	3	2
CLO5	3	2	3	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

DEPARTMENT OF Computer Science					CLASS: II B.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	Discipline - specific	23U4DDST2	Resource Management Techniques	5	5	25	75	100

Nature of course	Skill oriented		Employability oriented	✓	Entrepreneurship Oriented	✓

COURSE OBJECTIVES :

- To impart the knowledge of Linear programming, integer programs and queueing models.
- Learning the various problems and methods to solve mathematical models that represents realworld problems.

Units	Topics	Total Hours: 75 hrs.	K-Levels	CLO
Unit -I	Linear Programming Problem – I Mathematical Formulation of the problem – Graphical Solution – Introduction- Graphical Solution Method – Some exceptional cases- General L.P.P. – Canonical and Standard forms of L.P.P.	15 hours	Up to K2	CLO1
Unit-2	Linear Programming Problem – II Simplex Method – Introduction – Fundamental Properties of Solutions – The computational procedure – Use of Artificial Variable.	15 hours	Up to K3	CLO2
Unit-3	Transportation and Assignment problem Transportation Problem – Introduction – General Transportation Problem – The transportation table – Solution of a Transportation problem – Finding an initial basic feasible solution – Test for optimality – Transportation Algorithm (MODI method). Assignment Problem – Introduction – Mathematical formulation of the problem – The assignment method – Special cases in assignment problems – A typical assignment problem – The traveling salesman problem.	15 hours	Upto K3	CLO3

Unit-4	Game Theory Introduction – Two-person zero-sum games – Some basic terms – The Maxmin-Minimax principle – Games without Saddle points mixed strategies – Graphic solution of 2 x n and m x 2 games – Dominance property.	15 hours	Upto K4	CLO4
Unit-5	Network Scheduling Introduction – Network and basic components – Logical sequencing – Rules of network Construction – Critical path analysis – Distinction between PERT and CPM.	15 hours	Upto K4	CLO5

Text Book

Kanti Swarup, P.K. Gupta, Man Mohan – “Operations Research” – 18th edition, Sultan Chand & Sons Educational Publishers, New Delhi.

Chapters:

Unit – I : 2.1 – 2.3, 3.1-3.5

Unit – II : 4.1-4.4

Unit – III: 10.1, 10.2, 10.5, 10.8-10.10, 10.13, 11.1-11.5, 11.7.

Unit – IV : 7.1-7.7.

Unit – V : 25.1-25.4, 25.6, 25.8.

Books for Reference :

1. Hamdy A. Taha – “Operations Research an Introduction” – PHI, 8th edition.
2. S.D. Sharma – “Operations Research” – 12th edition, Kedar Nath Ram Nath & Co Publishers, Meerut.

Web resources:

1. https://drive.google.com/file/d/13l4Cd61gbhx_fWpyizZfDHI9mEEQ-Btd/view
2. <https://web.itu.edu.tr/topcuil/ya/OR.pdf>

Rationale for Nature of the course:

Resource management techniques is the science of rational decision-making along with the study of the synthesis of intricate problematic situations. Thus, the nature of operations research is purely scientific as it aims at determining the systematic behavior and optimizing the results. Resource management technique is the process of planning, scheduling, and allocating organizational and project resources in the best possible way.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Assignment preparation
- Thinking and analysis on theoretical concepts

Pedagogy:

The teaching methods includes Chalk and talk, PowerPoint, demonstrations, assignments and group discussions on the theoretical topics.

Course schedule

Unit	Topics	Hrs	Mode
Unit I	Mathematical Formulation of the problem – Graphical Solution – Introduction	3	Chalk and talk, Quiz , test
	Graphical Solution Method – Some exceptional cases	5	
	General L.P.P.	5	
	Canonical and Standard forms of L.P.P.	2	
Unit II	Simplex Method – Introduction	3	Chalk and talk, Group discussion, Test, Seminar
	Fundamental Properties of Solutions – The computational procedure	3	
	Use of Artificial Variable.	3	
	The assignment method – Special cases in assignment problems	3	
	A typical assignment problem – The traveling salesman problem.	3	
Unit III	Transportation Problem – Introduction – General Transportation Problem – The transportation table	3	Chalk and talk, Quiz, Test assignment
	Solution of a Transportation problem – Finding an initial basic feasible solution – Test for optimality	3	
	Transportation Algorithm (MODI method). Assignment Problem – Introduction – Mathematical formulation of the problem	3	
	The assignment method – Special cases in assignment problems	3	
	A typical assignment problem – The traveling salesman problem.	3	
Unit IV	Introduction – Two-person zero-sum games	3	PPT, Chalk and talk, Quiz, Test
	Some basic terms – The Maxmin-Minimax principle	3	
	Games without Saddle points-mixed strategies	3	
	Graphic solution of 2 x n and m x 2 games – Dominance property.	6	
Unit V	Introduction – Network and basic components	5	PPT, Chalk and talk, Quiz and assignment
	Logical sequencing – Rules of network Construction	5	
	Critical path analysis – Distinction between PERT and CPM.	5	

COURSE OUTCOMES:

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

	COURSE OUTCOME	Knowledge Level (basis of Bloom's Taxonomy)
CO-1	Understand the theoretical workings of the simple method for linear programming	Up to K2
CO-2	Know the relationship between a linear program and its dual, including strong duality and complementary slackness	Up to K3
CO-3	Solve specialized linear programming problems like the transportation and assignment problems	Up to K3
CO-4	Solve network models like the shortest path, minimum spanning tree, and maximum flow problems	Up to K4
CO-5	Understand the applications of, basic methods for, and challenges in integer programming	Up to K4

MAPPING OF COs 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)
CO-1	3	1	1	2	1	1
CO-2	2	3	2	1	1	1
CO-3	2	3	1	1	1	2
CO-4	3	2	2	1	2	1
CO-5	2	2	2	3	2	1

3- Advanced Application

2- Intermediate

1- Introductory

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	3	2
CLO5	3	2	3	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

(Mapping with Course 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	K1 & K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO2	K1 & K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K3)
3	CLO3	Upto K3	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO4	Upto K4	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K4)
5	CLO5	Upto 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			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 with choice	Consolidated
K1	5	1	2	1	17	14.20	42%
K2	5	4	2	1	33	27.50	
K3	-	-	4	1	40	33.30	33%
K4	-	-	2	2	30	25.00	25%
Total Marks	10	10	50	50	120	100	100%

DEPARTMENT OF Computer Science					CLASS: II B.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	SEC-6	23U4DSED6	PHP Programming	2	2	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- To provide the necessary knowledge on basics of PHP.
- To design and develop dynamic, database-driven web applications using PHP version.
- To get an experience on various web application development techniques.
- To learn the necessary concepts for working with the files using PHP.
- To get a knowledge on OOPS with PHP.

UNIT	Contents	No. of Hours	K Level	CLO
I	Introduction to PHP -Basic Knowledge of websites - Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation	6	Upto K2	CLO1
II	PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML -Embedding HTML in PHP. Introduction to PHP Variable -Understanding Data Types Using Operators -Using Conditional Statements - If(), else if() and else if condition Statement.	6	Upto K3	CLO2
III	Switch() Statements -Using the while() Loop -Using the for() Loop PHP Functions. PHP Functions -Creating an Array -Modifying Array Elements Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions.	6	Upto K3	CLO3
IV	PHP Advanced Concepts -Reading and Writing Files - Reading Data from a File.	6	Upto K4	CLO4
V	Managing Sessions and Using Session Variables - Destroying a Session -Storing Data in Cookies -Setting Cookies.	6	Upto K4	CLO5
	Total	30		

Text Book

1. Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison.
2. The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes

Reference Books

1. PHP: The Complete Reference-Steven Holzner.
2. DT Editorial Services (Author), "HTML 5 Black Book (Covers CSS3,
3. JavaScript, XML, XHTML, AJAX, PHP, jQuery)", Paperback 2016, 2ndEdition.

Web Resources

1. Opensource digital libraries: PHP Programming
2. <https://www.w3schools.com/php/default.asp>

Rationale for Nature of the course

PHP is an open-source, server-side programming language that can be used to create websites, applications, customer relationship management systems and more. It is a widely-used general-purpose language that can be embedded into html.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Hands-on with debugging and interpreting PHP Scripts

Pedagogy

Live Demonstrations, Quiz, Test, Seminar, Chalk and Talk

Course Designer(s):

1. **Prof. P. Sridevi**
2. **Prof. J. Mayajothi**

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction to PHP -Basic Knowledge of websites - Introduction of Dynamic Website	3	Group discussion, presentation, Test, Quiz
	Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation	3	
Unit II	PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML -Embedding HTML in PHP.	3	Chalk and talk, demonstration, Seminar, Test
	Introduction to PHP Variable -Understanding Data Types Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement	3	
Unit III	Switch() Statements -Using the while() Loop -Using the for() Loop PHP Functions - Creating an Array	3	Quiz, presentation, Test
	Modifying Array Elements Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions.	3	
Unit IV	PHP Advanced Concepts -Reading and Writing Files	3	Chalk and talk, quiz, Test
	Reading Data from a File.	3	
Unit V	Managing Sessions and Using Session Variables - Destroying a Session	3	Presentation, group discussion, Seminar, Assignment
	Storing Data in Cookies -Setting Cookies.	3	

Course Learning Outcomes

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
CO1	Write PHP scripts to handle HTML forms	Upto K2
CO2	Write regular expressions including modifiers, operators, and metacharacters.	Upto K3
CO3	Create PHP Program using the concept of array.	Upto K3
CO4	Create PHP programs that use various PHP library functions	Upto K4
CO5	Manipulate files and directories.	Upto K4

Mapping with PSOs:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage of course contributed to each PSO	15	12	10	11	12	13

S-Strong-3

M-Medium-2

L-Low-1

Mapping of CLOs with POs

Mapping with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	3	2
CLO5	3	2	3	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

(Mapping with Course 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	K1 & K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO2	K1 & K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K3)
3	CLO3	Upto K3	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO4	Upto K4	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K4)
5	CLO5	Upto 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			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 with choice	Consolidated
K1	5	1	2	1	17	14.20	42%
K2	5	4	2	1	33	27.50	
K3	-	-	4	1	40	33.30	33%
K4	-	-	2	2	30	25.00	25%
Total Marks	10	10	50	50	120	100	100%

DEPARTMENT OF Computer Science					CLASS: II B.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	SEC-7	23U4DSED7	Software Testing	2	2	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- **To study fundamental concepts in software testing**
- **To discuss various software testing issues and solutions in software unit test, integration, and system testing.**
- **To study the basic concept of Data flow testing and Domain testing.**
- **To Acquire knowledge on path products and path expressions.**
- **To learn about Logic-based testing and decision tables**

UNIT	Contents	No. of Hours	K Level	CLO
I	Introduction: Purpose–Productivity and Quality in Software– Testing Vs Debugging–Model for Testing– Bugs– Types of Bugs – Testing and Design Style.	6	Upto K2	CLO1
II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction Flow Testing Techniques.	6	Upto K3	CLO2
III	Data Flow Testing Strategies - Testing: Domains and Paths – Domains and Interface Testing.	6	Upto K3	CLO3
IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions. Syntax Testing– Formats– Test Cases	6	Upto K4	CLO4
V	Logic-Based Testing–Decision Tables–Transition Testing– States, State Graph, State Testing.	6	Upto K4	CLO5
	Total	30		

Text Book

1. B.Beizer,“SoftwareTestingTechniques”,IIEdn.,DreamTechIndia,NewD elhi,2003.
2. K.V.K.Prasad, “Software Testing Tools”, DreamTech.India, NewDelhi,2005

Reference Books

1. I.Burnstein,2003,“PracticalSoftwareTesting”,Springer International Edn.
2. E. Kit, 1995, “Software Testing in the Real World: Improving the Process”, Pearson Education, Delhi.
3. R. Rajani,andP.P.Oak,2004,“SoftwareTesting”, Tata Mcgraw Hill, New Delhi.

Web Resources

1. <https://www.javatpoint.com/software-testing-tutorial>
2. <https://www.guru99.com/software-testing.html>

Rationale for Nature of the course

Thorough testing is essential to ensure software systems function correctly, are secure, meet stakeholders' needs, and ultimately provide value to end users. Software testing is a crucial activity in the software development life cycle that aims to evaluate and improve the quality of software products.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Live Demonstrations illustrating the application of testing to software projects, Hands-on with common software testing tools

Pedagogy

Chalk and Talk, Quiz, Seminar, Group Discussion, Assignment

Course Designer(s):

1. **Er. J. Rajendran**
2. **Dr. Sree Ram Kumar T**

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction: Purpose–Productivity and Quality in Software– Testing Vs Debugging	3	Group discussion, presentation, Test, Quiz
	Model for Testing–Bugs–Types of Bugs – Testing and Design Style	3	
Unit II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation	3	Chalk and talk, demonstration, Seminar, Test
	Application Transaction Flow Testing Techniques.	3	
Unit III	Data Flow Testing Strategies, domain testing	3	Quiz, presentation, Test
	Domains and Paths – Domains and Interface Testing	3	
Unit IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions	3	Chalk and talk, quiz, Test
	Syntax Testing– Formats–Test Cases	3	
Unit V	Logic-Based Testing–Decision Tables	3	Presentation, group discussion, Quiz, Assignment
	Transition Testing–States, State Graph, State Testing.	3	

Course Learning Outcomes:

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
CO1	Students learn to apply software testing knowledge and engineering methods	Upto K2
CO2	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.	Upto K3
CO3	Have an ability to understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	Upto K3
CO4	Have a basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems	Upto K4
CO5	Have the ability to use software testing methods and modern software testing tools for their testing projects.	Upto K4

Mapping with PSOs:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage of course contributed to each PSO	15	12	10	11	12	13

S-Strong-3 M-Medium-2 L-Low-1

Mapping with POs

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	2	2	2	1
CLO2	2	2	1	3	2
CLO3	3	2	2	1	2
CLO4	2	3	2	3	2
CLO5	3	2	3	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

(Mapping with Course 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	K1 & K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
2	CLO2	K1 & K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K3)
3	CLO3	Upto K3	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K3)
4	CLO4	Upto K4	2	K1 & K2	1	K2	2 (K3 & K3)	1 (K4)
5	CLO5	Upto 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			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, presenting, and make inferences with evidence

Distribution of Section-wise Marks with K Levels

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K2	5	4	2	1	33	27.50	
K3	-	-	4	1	40	33.30	33%
K4	-	-	2	2	30	25.00	25%
Total Marks	10	10	50	50	120	100	100%



THE MADURA COLLEGE (AUTONOMOUS), MADURAI-11
DEPARTMENT OF COMPUTER SCIENCE
UG Programme Structure Academic Year 2023-2024 onwards
B.Sc. (Computer Science)

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		Language - I Tamil / Hindi / Sanskrit	6	3							
		Language - II English	6	3							
	23U3DCCT3	Core Theory -3 Python Programming	5	4	✓		✓			✓	70%
	23U3DCCP3	Core Practical -3 Python Programming Lab	3	3	✓		✓			✓	New
	23U3DSST1	Elective course -3 (Generic/Discipline specific) Digital Logic Fundamentals	5	5	✓		✓			✓	30%
	23U3DSED4	Skill Enhancement Course SEC-4 Web Designing	2	2	✓	✓	✓			✓	32%
	23U3DSED5	Skill Enhancement Course SEC-5 Multimedia systems	2	2	✓	✓			✓		No Change
		Environmental Studies EVS -1	1	1			✓		✓		
IV		Language - I Tamil / Hindi / Sanskrit	6	3							
		Language - II English	6	3							
	23U4DCCT4	Core Theory -4 Computer Networks	5	4	✓		✓			✓	No change
	23U4DCCP4	Core Practical -4 Web Designing Lab.	3	3	✓	✓	✓			✓	New
	23U4DSST2	Elective course -4 (Generic/Discipline specific) Resource Management Techniques	5	5	✓	✓				✓	No change
	23U4DSED6	SEC-6 PHP Programming	2	2	✓	✓	✓			✓	New
	23U4DSED7	SEC-7 Software testing	2	2	✓	✓	✓			✓	New
		Environmental Studies EVS -2	1	1		✓	✓		✓	✓	

***Empl- Employability;**

Ent- Entrepreneurship;

Skill- Skill Development



THE MADURA COLLEGE (AUTONOMOUS)

DEPARTMENT OF INFORMATION TECHNOLOGY

**Revised Curriculum based on
TAMIL NADU STATE COUNCIL FOR HIGHER EDUCATION (TANSCHE)
(Choice Based Credit system with Outcome Based Education)**

Academic Year 2023-2024 onwards

III and IV semesters (B.Sc. Information Technology)

Allied Courses

III and IV semesters of (M.Sc. Computer Science)

Curriculum Structure for B.Sc. Information Technology

Part	Course Description	Course Type	Course Title	Contact hours/week	Credits
SEMESTER I					
I	Lang-I	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	Tamil-I/ Sanskrit-I/ Hindi-I	6	3
II	English –I	23U1NENG1	English –I	6	3
III	Core Course I	23U1FCCT1	Programming in C	5	5
	Core Course (Practical I)	23U1FCCP1	C Programming Lab	3	3
	Generic Elective Course I	23U1SGET1	Statistical Methods and its Application - I	6	5
IV	Foundation Course	23U1FFCT1	Fundamentals of Computers	2	2
	Skill Enhancement Course I	23U1FSED1	Office Automation	2	2
	Total			30	23
SEMESTER II					
I	Lang-II	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	Tamil-II/ Sanskrit-II/ Hindi-II	6	3
II	English-II	23U2NENG2	English-II	6	3
III	Core Course II	23U2FCCT2	JAVA Programming	5	5
	Core Course (Practical II)	23U2FCCP2	JAVA Programming Lab	3	3
	Generic Elective Course II	23U2SGET2	Statistical Methods and its Application - II	6	5
IV	Skill Enhancement Course II	23U2FSED2	Problem Solving Techniques	2	2
	Skill Enhancement Course III	23U2FSED3	Fundamentals of Information Technology	2	2
	Total			30	23
SEMESTER III					
I	Lang-III	23U3TLAN3/ 23U3HLAN3/ 23U3SLAN3	Tamil-III/ Sanskrit-III/ Hindi-III	6	3
II	English –III	23U3NENG3	English –III	6	3

III	Core Course III	23U3FCCT3	Relational Database Management System	4	4
	Core Course (Practical III)	23U3FCCP3	Relational Database Management System Lab	3	3
	Generic Elective Course III	23U3KGET1(F)	Financial Accounting	6	5
IV	Skill Enhancement Course IV	23U3FSED4	Multimedia Systems	2	2
	Skill Enhancement Course V	23U3FSED5	Digital Logic Fundamentals	2	2
	EVS I	23U3EVST1	Environmental Studies – I	1	-
	Total			30	22
SEMESTER IV					
I	Lang-IV	23U4TLAN4/ 23U4HLAN4/ 23U4SLAN4	Tamil-IV/ Sanskrit-IV/ Hindi-IV	6	3
II	English-IV	23U4NENG4	English-IV	6	3
III	Core Course IV	23U4FCCT4	Dot Net Programming	4	4
	Core Course (Practical IV)	23U4FCCP4	Dot Net Programming Lab	3	3
	Generic Elective Course IV	23U4KGET2(F)	Cost & Management Accounting	6	5
IV	Skill Enhancement Course VI	23U4FSED6	Advanced Excel	2	2
	Skill Enhancement Course VII	23U4FSED7	Introduction to HTML	2	2
	EVS II	23U4EVST2	Environmental Studies – II	1	2
	Total			30	24

VALUE ADDED COURSES

Course Description	Course Type	Course Title	Contact hours/week	Credits
Add-On I	23U3FAD1	Multimedia Tools	2	2
Add-On II	23U4FAD2	R Programming	2	2
Certificate Course I	23FC01	Web Designing Tools	2	2
Certificate Course II	23FC02	PC Hardware & Troubleshooting	2	2
Self Study Course		Quantitative Aptitude	-	2

DEPARTMENT OF INFORMATION TECHNOLOGY					CLASS: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Core Theory	23U3FCCT3	Relational Database Management System	4	4	25	75	100
Nature of Course								
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented				

Objectives:

- To understand the basic DBMS models and architecture.
- To practice the power of SQL Queries and PL/SQL Blocks.
- To learn about Relational Model and its operations on the database.
- To study the data base design using ER Model.
- To acquire knowledge on Normalization.

Unit	Description	Hours	K-level	CLO
I	Introduction to Databases: Introduction – Characteristics of the Database Approach – Actors on the Scene – Workers behind the scene – Advantages of using DBMS Approach. Overview of database and Architectures: Data Models, Schemas, and Instances – Three-schema Architecture and Data Independence – Database languages & Interfaces – Database System Environment– Centralized & Client Server Architecture for DBMS - Classification of DBMS.	12	K2	CLO 1
II	SQL: The Relational Database Standard: Data definition, Constraints, and schema changes in SQL – Basic Queries in SQL – More complex SQL Queries – Insert, delete and update statements in SQL – Views in SQL. PL/SQL: Introduction to PL/SQL – More on PL/SQL – Error Handling in PL/SQL – Oracle's Named Exception Handlers – Stored Procedures and Functions – Execution of Procedures and Functions – Advantages – Procedures Vs. Functions – Syntax for Creating Procedures and Functions – Deleting a Stored Procedure or Function – Oracle Packages – Database Triggers – Types Of Triggers – Deleting a Trigger – Raise-Application Error Procedure.	12	K4	CLO 5

III	Basic Relational Model: Relational Model Concepts – Relational Model Constraints and Relational Database Schemas – Update Operations, Tractions, Dealing with Constraint Violations – Formal Relational Languages: Unary Relational Operations: SELECT and PROJECT – Relational Algebra Operations from Set Theory – Binary Relational Operations: JOIN and DIVISION – Examples of Queries in Relational Algebra.	12	K4	CLO 2
IV	Conceptual Data Modelling using the ER Model: Using High-Level Conceptual Data Models for Database Design – An example DB application – Entity Types, Entity Sets, Attributes, and Keys – Relationship Types, Relationship sets, Roles, and Structural Constraints – Weak entity types – Example- Mapping a Conceptual Design into Logical Design: Relational Database Design using ER-Relational Mapping – Mapping EER Model Constructs to Relations.	12	K3	CLO 3
V	Functional Dependencies and Normalization for Relational Database: Functional Dependencies – Definition of Functional Dependency – Normal Forms based on Primary Keys – Normalization of Relations – First Normal Form – Second Normal Form – Third Normal Form – BCNF- Fourth Normal Form- Fifth Normal Form.	12	K3	CLO 4

Books for Study:

1. Fundamentals of Database Systems – Ramez Elmasri, Shamkant B. Navathe (2014), – Sixth edition – Pearson Education, New Delhi.
Unit I – 1.1, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6
Unit III – 3.1, 3.2, 3.3, 6.1, 6.2, 6.3, 6.5
Unit IV – 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7
Unit V – 15.2, 15.3, 15.4, 15.5, 15.6, 15.7
2. SQL, PL/SQL-The Programming Language of Oracle – Ivan Bayross (2003 Reprint) – Second Revised Edition – BPB Publications, New Delhi.
Unit II – 15, 17 (Page no 369 – 376), 18 (Page no 379 – 396 and 403 – 413)

Books for References:

1. Database System Concepts – Abraham Silberschatz, Henry F.Korth, S.Sudarshan – Tata McGraw Hill Publication, 4th Edition.
2. Database Systems – Thomas Connolly – Addison Wesley – New Print 2000.
3. Database Management Systems – Ragu Rama Krishnan, Johannes Gehrke – McGraw Hill Edition.

Web Resources:

1. <https://www.geeksforgeeks.org/dbms-architecture-2-level-3-level/>
2. <https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/>
3. <https://www.javatpoint.com/dbms-relational-algebra>
4. <https://www.tutorialspoint.com/normal-forms-in-dbms>

Rationale for Nature of the course:

- Facilitates Data Integrity, Accuracy, Consistency and reduce Redundancy.
- Illustrates Data Scalability and Flexibility.
- Redeem knowledge on Normalization Techniques, to get opportunity as back-end designer.

Activities having direct bearing on Skill development / Employability:

- Practice to write Queries & Blocks of codes.
- Practice to design a Database in a required Normalized Form.
- Exercising debugging routines.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Mrs. S. Sasikala

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction to Databases: Introduction – Characteristics of the Database Approach – Actors on the Scene – Workers behind the scene – Advantages of using DBMS Approach. Overview of database and Architectures: Data Models, Schemas, and Instances	6	Lecture, Quiz, PPT, Test, Seminar
	Three-schema Architecture and Data Independence. Database languages & Interfaces – Database System Environment– Centralized & Client Server Architecture for DBMS - Classification of DBMS.	6	
Unit II	SQL: The Relational Database Standard: Data definition, Constraints, and schema changes in SQL – Basic Queries in SQL – More complex SQL Queries – Insert, delete and update statements in SQL – Views in SQL - PL/SQL: Introduction to PL/SQL – More on PL/SQL – Error Handling in PL/SQL – Oracle's Named Exception Handlers – Stored Procedures and Functions.	6	Lecture, Quiz, Test, Seminar
	Execution of Procedures and Functions – Advantages – Procedures Vs. Functions – Syntax for Creating Procedures and Functions – Deleting a Stored Procedure or Function – Oracle Packages – Database Triggers – Types Of Triggers – Deleting a Trigger – Raise-Application Error Procedure.	6	

Unit III	Basic Relational Model: Relational Model Concepts – Relational Model Constraints and Relational Database Schemas – Update Operations, Tractions, Dealing with Constraint Violations.	6	Lecture, Quiz, Group Discussion, Test, Seminar
	Formal Relational Languages: Unary Relational Operations: SELECT and PROJECT – Relational Algebra Operations from Set Theory – Binary Relational Operations: JOIN and DIVISION – Examples of Queries in Relational Algebra.	6	
Unit IV	Conceptual Data Modelling using the ER Model: Using High-Level Conceptual Data Models for Database Design – An example DB application – Entity Types, Entity Sets, Attributes, and Keys – Relationship Types, Relationship sets, Roles, and Structural Constraints.	6	Lecture, Quiz, Assignment, Test, Seminar
	Weak entity types – Example- Mapping a Conceptual Design into Logical Design: Relational Database Design using ER- Relational Mapping – Mapping EER Model Constructs to Relations.	6	
Unit V	Functional Dependencies and Normalization for Relational Database: Functional Dependencies – Definition of Functional Dependency – Normal Forms based on Primary Keys.	6	Lecture, Quiz, Seminar
	Normalization of Relations – First Normal Form – Second Normal Form – Third Normal Form – BCNF- Fourth Normal Form- Fifth Normal Form.	6	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO–1	Describe the basic DBMS models and various architectures.	K2
CLO–2	Examine the power of SQL Queries and PL/SQL Blocks.	K4
CLO–3	Focus on Relational Models and its operations on the database.	K4
CLO–4	Construct the data base design using ER Model.	K3
CLO–5	Utilize the concept of Normalization Techniques for database design.	K3

Mapping of CLOs with PSOs:

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	1	1	1
CLO-2	3	3	3	1	3
CLO-3	3	2	2	3	2
CLO-4	3	3	3	3	2
CLO-5	3	3	3	1	3

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	1	1	1	1	1
CLO-2	3	3	3	1	3	3
CLO-3	3	2	2	3	2	2
CLO-4	3	3	2	3	3	2
CLO-5	3	3	3	1	3	3

Advanced application– 3; Intermediate level–2; Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
3	CLO 3	Up to K4	2	K1 & K2	1	K1	2(K3&K3)	1(K4)
4	CLO 4	Up to K3	2	K1 & K2	1	K2	2(K2&K2)	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			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 with 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: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Core Practical	23U3FCCP3	Relational Database Management System Lab	3	3	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To create Relations, Insert, Modify, Delete and Display tuples.
- To Master the basics of SQL and Control the access data stored in a database.
- To construct multiple Sub queries and Blocks.
- To impart the knowledge of Functions and Procedures.
- To understand the concepts of Exceptions, and Triggers.

Unit	Description	Hours	K-level	CLO
I	DDL and DML Commands 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.	9	K2	CLO 1
	2. 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 i. DA – 50% of the Salary ii. HRA – 10% of the Salary iii. PF – 8% of the salary c) Grosspay = salary + DA + HRA d) Netpay = Grosspay – PF e) Display all the updated records.			

II	SQL Built-in functions and DCL Commands 3. Create table for book with attributes bookcode, bookname, authername, 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. 4. Execute the following queries. - Create new user “Tester” - Grants a SELECT permission on employee table to “Tester”. - Revoke a select permission on employee table from Tester”.	9	K4	CLO 2
III	Using Sub Queries and PL/SQL 5. 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. - Find the people who work for the company Infosys with a salary more than Rs.50000/-. - Find the names of the persons who live and work in the same city. - Find the names of the persons who do not work for Infosys. - List the names of the people, along with the street and city addresses. 6. 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. - Retrieve the names of all senior students (class=3) majoring in CS.	9	K3	CLO 3

	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. 7. 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. 8. Write a PL/SQL program to prepare an Electricity bill.			
IV	Procedures and User-defined functions 9. Write a program to find the minimum of two values using procedure. 10. Write a program to count the total number of employees using the function.	9	K3	CLO 4
V	Exception Handling and Triggers 11. Write a PL/SQL code to create exception for string employee names in a string. 12. Write a program to create a trigger to avoid inserting data during weekend in the employee table.	9	K4	CLO 5

Books for Study:

1. Fundamentals of Database Systems – Ramez Elmasri, Shamkant B. Navathe (2014), – Sixth edition – Pearson Education, New Delhi.
2. SQL, PL/SQL-The Programming Language of Oracle – Ivan Bayross (2003 Reprint) – Second Revised Edition – BPB Publications, New Delhi.

Books for References:

1. Database System Concepts – Abraham Silberschatz, Henry F.Korth, S.Sudarshan – Tata McGraw Hill Publication, 4th Edition.
2. Database Systems – Thomas Connolly – Addison Wesley – New Print 2000.

3. Database Management Systems – Ragu Rama Krishnan, Johannes Gehrke – McGraw Hill Edition.

Web Resources:

1. <https://www.geeksforgeeks.org/dbms-architecture-2-level-3-level/>
2. <https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/>
3. <https://www.javatpoint.com/dbms-relational-algebra>
4. <https://www.tutorialspoint.com/normal-forms-in-dbms>

Rationale for Nature of the course:

- Facilitates Data Integrity, Accuracy, and Consistency & reduce Redundancy.
- Illustrates Data Scalability and Flexibility.
- Redeem knowledge on Normalization Techniques, to get opportunity as back-end designer.

Activities having direct bearing on Skill development / Employability:

- Practice to write Queries & Blocks of codes.
- Practice to design a Database in a required Normalized Form.
- Exercising debugging routines.

Pedagogy:

- Demonstration using Projector and Practical Session.

Course Designer:

- Mrs. S. Sasikala

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	DDL and DML Commands 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.	5	Demo & Practical Session

	2. 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	4	
Unit II	SQL Built-in functions and DCL Commands 3. Create table for book with attributes bookcode, bookname, authorname, publication and 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. f) Display the minimum and maximum cost of the book.	5	Demo & Practical Session
	4. Execute the following queries. a) Create new user “Tester” b) Grants a SELECT permission on employee table to “Tester”. c) Revoke a select permission on employee table from “Tester”.	4	
Unit III	Using Sub Queries and PL/SQL 5. 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.	5	Demo & Practical Session

	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. 6. 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.		
	7. 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. 8. Write a PL/SQL program to prepare an Electricity bill.	4	
Unit IV	Procedures and User-defined functions 9. Write a program to find the minimum of two values using procedure.	5	Demo & Practical Session
	10. Write a program to count the total number of employees using the function.	4	

Unit V	Exception Handling and Triggers 11. Write a PL/SQL code to create exception for string employee names in a string.	5	Demo & Practical Session
	12. Write a program to create a trigger to avoid inserting data during weekend in the employee table.	4	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Demonstrate DDL, DML Queries.	K2
CLO-2	Focus on basic queries; apply Aggregate functions and DCL Queries.	K4
CLO-3	Construct multiple sub queries and Blocks.	K3
CLO-4	Construct Procedures and Functions.	K3
CLO-5	Devise Exceptions and Triggers.	K4

Mapping of CLOs with PSOs:

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	1	1	1
CLO-2	3	3	3	1	3
CLO-3	3	2	2	3	2
CLO-4	3	3	3	3	2
CLO-5	3	3	3	1	3

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	1	1	1	1	1
CLO-2	3	3	3	1	3	3
CLO-3	3	2	2	3	2	2
CLO-4	3	3	2	3	3	2
CLO-5	3	3	3	1	3	3

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

DEPARTMENT OF INFORMATION TECHNOLOGY					CLASS: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	SEC	23U3FSED4	Multimedia systems	2	2	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

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 impart the knowledge of making multimedia.
- To learn various skills and user interface in designing.

Unit	Description	Hours	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.	6	K2	CLO 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.	6	K3	CLO 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	6	K3	CLO 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.	6	K3	CLO 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-Multimedia Content Creation blog category of the projects.(Audio Story Telling, Digital Video Story Telling).	6	K4	CLO 5

Book for Study:

Multimedia Making It Work, Tay Vaughan, MCH Education, Ninth Edition.

Unit – I : 1,2

Unit – II : 3,4

Unit – III : 5,6

Unit – IV : 7

Unit – V : 8,10

Books for References:

1. Multimedia an Introduction, Villamil & Molina, PHI.
2. Multimedia Sound & Video - Lozano, PHI.
3. Multimedia: Production, Planning and Delivery, Villamil & Molina, PHI.
4. Multimedia on the Pc, Sinclair, BPB.

Web Resources

1. https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm
2. <https://www.includehelp.com/basics/multimedia-technology-images-videos-audio-animation.aspx>
3. <https://www.geeksforgeeks.org/difference-between-multimedia-and-animation/>
4. <https://www.geeksforgeeks.org/multimedia-projects-and-its-stages/>
5. https://www.tutorialspoint.com/multimedia/multimedia_systems.htm

Rationale for Nature of the course

- Helps to vary and enhance the learning process and leads to better knowledge retention.
- Students can learn more deeply from words and pictures than from words alone.

Activities having direct bearing on Skill development / Employability:

- Give practices to conduct seminar and group discussion and preparing assignments.
- By providing DTP oriented tasks such as video and audio editing and practicing simple video game designing.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz

Course Designer:

- Mrs. R.Tamilselvi

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Multimedia Definition-Use Of Multimedia-Delivering Multimedia-Text: About Fonts and Faces - Using Text in Multimedia	3	Lecture, PPT, Quiz, Test, Seminar
	Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.	3	
Unit II	Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats.	3	Lecture, Assignment, Quiz, Test, Seminar
	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.	3	
Unit III	Animation: The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work.	3	Lecture, Group Discussion, Quiz, Test, Seminar
	Video: Using Video - Working with Video and Displays-Digital Video Containers-Obtaining Video Clips - Shooting and Editing Video	3	
Unit IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs - The Hardware Needs.	3	Lecture, Quiz, Test, Seminar
	The Software Needs - An Authoring Systems Needs-Multimedia Production Team.	3	
Unit V	Planning and Costing: The Process of Making Multimedia-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing	3	Lecture, Quiz, Seminar
	Content and Talent : Acquiring Content-Ownership of Content Created for Project-Acquiring Talent	3	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Describe about the Usage of Multimedia.	K2
CLO-2	Make use of Bitmaps and colours.	K3
CLO-3	Use the Audio Editing tools in applications.	K3
CLO-4	Utilize Animations tools to design effective videos.	K3
CLO-5	Focus with Multimedia skills to design simple applications.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	1	1	1
CLO-2	2	1	1	1	3
CLO-3	3	2	1	2	3
CLO-4	2	2	1	2	3
CLO-5	3	2	2	2	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	1	1	1	1	1	1
CLO-2	3	1	3	1	1	1
CLO-3	2	1	3	2	2	2
CLO-4	3	2	3	2	3	3
CLO-5	1	3	1	3	3	3

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

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1 & K2	1	K1	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	K2	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			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 with 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: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	SEC	23U3FSED5	Digital Logic Fundamentals	2	2	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		Entrepreneurship Oriented			

Objectives:

- To acquire knowledge on Number systems.
- To examine the various Boolean Expressions and logic gates.
- To analyze various Data circuits & Arithmetic operations.
- To characterize various Synchronous Sequential Circuits.
- To characterize various Asynchronous Sequential Circuits.

Unit	Description	Hours	K-level	CLO
I	Binary Systems: Digital Computers and Digital Systems - Binary Numbers - Number base Conversion - Octal and Hexadecimal numbers – Complements - Binary codes – Binary Logic.	6	K2	CLO 1
II	Boolean Algebra and Logic gates: Basic definitions - Axiomatic definition of Boolean algebra - Basic theorems and properties of Boolean algebra - Digital logic gates. Simplification of Boolean function: The Map method - Up to five variables.	6	K4	CLO 2
III	Combinational logic: Introduction - Design procedure – Adders - Subtractors. Combinational logic with MSI and LSI: Decoders - Multiplexers.	6	K3	CLO 3
IV	Sequential logic: Introduction - Flip-Flops - Triggering of Flip-Flops.	6	K3	CLO 4
V	Registers, Counters and the memory unit: Introduction – Registers - Shift registers - Ripple counters.	6	K3	CLO 5

Books for Study:

1. Logic and computer design fundamentals - M. M. Mano - 5th Edition – 2016 - PHI.
2. Digital Logic and Computer Design – M. Morris Mano – 2nd Edition
 - Unit I – 1
 - Unit II – 2.1, 2.2, 2.3, 2.7, 3.1, 3.2, 3.3, 3.4
 - Unit III – 4.1, 4.2, 4.3, 4.4, 5.5, 5.6
 - Unit IV – 6.1, 6.2, 6.3
 - Unit V – 7.1, 7.2, 7.3, 7.4

Books for References:

1. Digital Design - R. Anantha Natarajan - PHI Learning - 2015.
2. Principles of Digital Electronics - K. Meena - PHI Learning - 2013.
3. Digital Circuits and Design - S. Salivahanan and S. Arivazhagan - Vikas Publishers - 2005.
4. Digital Computer Fundamentals - Thomas C. Bartee – TMH - 2007.

Web Resources:

1. https://www.tutorialspoint.com/digital_circuits/
2. https://www.electronics-tutorials.ws/sequential/seq_5.html
3. <https://soaneemrana.org/onewebmedia/DIGITAL%20PRINCIPLES%20AND%20APPLIC%20ATION%20BY%20LEACH%20&%20MALVINO.pdf>

Rationale for Nature of the course:

- Facilitates to understand the significance of Number systems and Gates.
- Practice to solve various Boolean algebra operations.
- Illustrates circuit design using gates.

Activities having direct bearing on Skill development:

- Practice to design logic circuits.
- Exercising K-Map and Boolean algebra problems.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Quiz and Test.

Course Designer:

- Mrs. S. Rajalakshmi

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Binary Systems: Digital Computers and Digital Systems - Binary Numbers - Number base Conversion	3	Lecture, Quiz, PPT, Test, Seminar
	Octal and Hexadecimal numbers – Complements - Binary codes – Binary Logic.	3	
Unit II	Boolean Algebra and Logic gates: Basic definitions - Axiomatic definition of Boolean algebra - Basic theorems and properties of Boolean algebra - Digital logic gates.	3	Lecture, Quiz, Test, Seminar
	Simplification of Boolean function: The Map method - Up to five variables.	3	
Unit III	Combinational logic: Introduction - Design procedure – Adders - Subtractors.	3	Lecture, Quiz, Group Discussion, Test, Seminar
	Combinational logic with MSI and LSI: Decoders - Multiplexers.	3	

Unit IV	Sequential logic: Introduction - Flip-Flops.	3	Lecture, Quiz, Assignment, Test, Seminar
	Triggering of Flip-Flop.	3	
Unit V	Registers, Counters and the memory unit: Introduction – Registers - Shift registers.	3	Lecture, PPT, Seminar, Quiz
	Ripple counters.	3	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO–1	Understand the fundamental concepts and techniques of digital logic.	K2
CLO–2	Devise the simplification of Logical Expressions using Boolean laws & K-Map.	K4
CLO–3	Collect the significance of various Data circuits and organize Arithmetic operations.	K3
CLO–4	Utilize the concept of the Sequential Circuits for counter design.	K3
CLO–5	Identify the importance of various sequential circuits.	K3

Mapping of CLOs with PSOs:

#	PSO–1	PSO–2	PSO–3	PSO–4	PSO–5
CLO–1	3	1	3	2	3
CLO–2	3	3	3	3	3
CLO–3	3	2	2	1	2
CLO–4	3	2	1	2	2
CLO–5	3	2	1	2	3

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO–1	3	1	3	2	3	3
CLO–2	3	3	3	3	3	3
CLO–3	3	2	2	1	2	2
CLO–4	3	2	1	2	1	2
CLO–5	3	2	1	2	1	3

Advanced application– 3; Intermediate level–2; Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K2	2(K1&K1)	1(K2)
2	CLO 2	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K4)
3	CLO 3	Up to K3	2	K1 & K2	1	K1	2(K3&K3)	1(K3)
4	CLO 4	Up to K3	2	K1 & K2	1	K2	2(K2&K2)	1(K3)
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			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 with 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: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	Core Theory	23U4FCCT4	DOT NET PROGRAMMING	4	4	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To understand the basic model of Dot net framework and architecture.
- To make aware of Control Statements in C#.
- To study about Arrays, Strings, LINQ.
- To impart the knowledge of Web based Application in ASP.net using C#.
- To learn various controls like Validation control , Data Source control, Binding control, AdRotator control.

Unit	Description	Hours	K-level	CLO
I	The Creation of C#: C# Relates to the .Net Framework - Common Language Runtime - Managed vs unmanaged code - An Overview of C#: Object-Oriented Programming - First Simple Program- Handling Syntax errors - Using code blocks-semicolon, positioning and Indentation-The C# Keywords-Identifiers-The .Net Framework Class Library-Data Types, Literals and Variables- Operators.	12	K2	CLO 1
II	Program Control Statements: If Statement- switch Statement-For Loop- While loop do-while loop- foreach loop-using break to exit a loop-using continue- goto- Introducing Classes and objects: Class Fundamentals- objects creation-Methods-constructors-Garbage Collection and Destructors-Exception Handling.	12	K4	CLO 2
III	Arrays and Strings: Arrays-Multidimensional Arrays-Jagged Arrays-for each loop Strings- Methods and classes: Method overloading-Main Method-Recursion-static Classes Delegates, Events and Lambda Expressions: Delegates -Lambda Expressions-LINQ.	12	K3	CLO 3
IV	Developing ASP.NET Applications: Visual Studio: Creating Websites- The Anatomy of a Web Form – Web Form Fundamentals: Converting HTML Page to an ASP.Net Page – Page Class – Web Controls. State Management: View State - Transferring Information between Pages – Cookies – Session State – Application State.	12	K3	CLO 4

V	Controls: Validation Controls – AdRotator Control. ADO.NET Fundamentals: Direct Data Access – Disconnected Data Access. Data Binding: Data Binding with ADO.NET –Data Source Controls. The Data Controls: The GridView – Formatting the GridView – Selecting GridView Row – Editing, Sorting and Paging the GridView-Generating Crystal Reports.	12	K4	CLO 5

Books for Study:

1. C# 4.0 The Complete Reference- Herbert Schildt (2010), Tata McGraw-Hill Pvt Ltd .
Unit U: 1, 2, 3, 4
Unit II: 5, 6, 13
Unit III: 7, 8, 15, 19
2. Beginning ASP.NET 4 in C#- Mathew MacDonald, (2010), Fourth Edition, Apress.
Unit IV: 1, 2, 3, 4, 5, 6
Unit V: 9, 10, 14, 15, 16

Books for References:

1. ASP.NET – Developer’s guidel, Greg Buczek (2002), — Tata McGraw Hill Publication.
2. Programming C#, 3.0l, Jesse Liberty, (2002), — O’Reilly Press.
3. Microsoft Visual C# 2008 Step by Step, J.Sharp (2009), — PHI Learning Private Ltd.
4. Professional C# 2005 with .NET 3.0l, Christian Nagel et al. — Wiley India, 2007.

Web Resources

1. <http://ssw.jku.at/Teaching/Lectures/CSharp/Tutorial/>
2. <http://www.w3schools.com/aspnet/default.asp>
3. <https://www.geeksforgeeks.org/csharp-programming-language/>

Rationale for Nature of the course

- Excellent choice for developing Window Applications, Web Services on the Microsoft Platform and Window based Mobile application.
- Illustrates Built-in design Patterns and Best Practices.
- Maximize the return of investment of skills and can build almost any kind of applications. .

Activities having direct bearing on Skill development / Employability:

- Problem Solving, Verbal Communication, Time Management, Collaboration.
- Potentially be Setting up for a wider array of Career Opportunities.

Pedagogy:

- Chalk and Talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Mrs. D. Geetharamani

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	The Creation of C#: C# Relates to the .Net Framework - Common Language Runtime - Managed vs. unmanaged code - An Overview of C#: Object-Oriented Programming - First Simple Program. Handling Syntax errors - Using code blocks-semicolon, positioning and Indentation	6	Lecture, PPT, Quiz, Test, Seminar
	The C# Keywords-Identifiers - The .Net Framework Class Library-Data Types, Literals and Variables- Operators.	6	
Unit II	Program Control Statements: If Statement- switch Statement-For Loop- While loop do-while loop- foreach loop-using break to exit a loop-using continue- goto.	6	Lecture, Assignment, Quiz, Test, Seminar
	Introducing Classes and objects: Class Fundamentals- objects creation-Methods-constructors-Garbage Collection and Destructors - Exception Handling.	6	
Unit III	Arrays and Strings: Arrays-Multidimensional Arrays-Jagged Arrays- for each loop Strings- Methods and classes: Method overloading- Main Method-Recursion	6	Lecture, Group Discussion, Quiz, Test, Seminar
	static Classes Delegates, Events and Lambda Expressions: Delegates -Lambda Expressions-LINQ	6	
Unit IV	Developing ASP.NET Applications: Visual Studio: Creating Websites- The Anatomy of a Web Form – Web Form Fundamentals: Converting HTML Page to an ASP.Net Page – Page Class.	6	Lecture, Test, Quiz, Seminar
	Web Controls. State Management: View State - Transferring Information between Pages – Cookies – Session State – Application State.	6	
Unit V	Validation Controls – AdRotator Control. Working with Data: ADO.NET Fundamentals:– Direct Data Access – Disconnected Data Access - Data Binding: Data Binding with ADO.NET	6	Lecture, Quiz, Seminar
	Data Source Controls - The Data Controls: The GridView – Formatting the Grid View – Selecting GridView Row – Editing, Sorting and Paging the GridView-Generating Crystal Reports.	6	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Outline the features of C# programming language and ASP.NET applications	K2
CLO-2	Discover the salient properties of C# and ASP.NET applications.	K4
CLO-3	Identify the various stages in developing a web forms.	K3
CLO-4	Apply the appropriate controls to create a web form.	K3
CLO-5	Focus on data driven web application by connecting to the data sources.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	1	1	1
CLO-2	3	3	3	1	3
CLO-3	3	2	2	3	2
CLO-4	3	3	3	3	3
CLO-5	3	3	3	1	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	1	1	1	1	1
CLO-2	3	3	3	1	3	3
CLO-3	3	2	2	3	2	2
CLO-4	3	3	3	3	3	3
CLO-5	3	3	3	1	3	3

Advanced application– 3; Intermediate level–2; Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K4	2	K1 & K2	1	K1	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	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			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

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Distribution of Section-wise Marks with K Levels

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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: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	Core Practical	23U4FCCP4	DOT NET PROGRAMMING LAB	3	3	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To gain the Knowledge in the Concept of Dot NET Framework as a whole and the Technologies that constitutes the framework.
- To gain Programming Skills in C# in basic levels.
- To build Simple Window Applications.
- To design an Web based Application using various controls like Validation controls etc.
- To understand the concepts of Database Connectivity.

Unit	Description	Hours	K-level	CLO
I	C# Basics Programs-Console Application - Program to Print a number if it is prime, otherwise display the largest factor of that number. - Program to calculate the hypotenuse of a triangle using dynamic initialization of variable. - Program to Finds the Roots of a Quadratic equation. - Program to Check whether a given number is Armstrong Number or not.	9	K2	CLO 1
II	C# - Classes and Objects, Constructors, Exception handling, Arrays , Strings - Program to Perform Arithmetic operations -using Classes and objects. - Program to Display the details of a student (Regno, Name, mark1,mark2,mark3,mark4,mark5) and calculate the Total and Average marks of a student-using Constructor. - Program to accept a number from the User, and throw an Exception if the number is not an Even Number. - Program to implement Jagged Array and Rectangular Array.	9	K4	CLO 2
III	C# - Method Overloading, Inheritance, Delegates, Lambda Expression - Program to swap two integer numbers, and swap two float numbers Using Method Overloading. - Program to implement Multiple Inheritance Using Interface.	9	K3	CLO 3

	11. Program to create a delegate called TraficDel and a class called Traffic Signal with the delegate Methods as yellow(),Green(),Red() .Also include a method IdentifySignal() to initialize an array of delegate with the above methods and a method show() to invoke members of the above array. 12. Program to implement Lambda Expression.			
IV	Window Application, Asp. Net Web Application with C# Code 13. Develop a Simple Calculator Program with Necessary Controls. 14. Develop an Application using Image Button Control. 15. Develop an Application using AdRotator Control. 16. Develop a Application to manage the Session.	9	K3	CLO 4
V	Asp.Net Web Application With C# Code 17. Develop an Application using Validation Control. 18. Develop an Application using HTML Control. 19. Develop an Application using ADO.NET and Data Source Control. 20. Develop an Application using LINQ.	9	K4	CLO 5

Books for Study:

1. C# 4.0 The Complete Reference- Herbert Schildt (2010), Tata McGraw-Hill Pvt Ltd .
2. Beginning ASP.NET 4 in C#- Mathew MacDonald, (2010), Second Edition, Apress

Books for References:

1. ASP.NET – Developer’s guidel, Greg Buczek (2002), — Tata McGraw Hill Publication.
2. Programming C#, 3.0l, Jesse Liberty, (2002), — O’Reilly Press.
3. Microsoft Visual C# 2008 Step by Step-J.Sharp (2009), — PHI Learning Private Ltd.
4. Professional C# 2005 with .NET 3.0l, Christian Nagel et al.(2007) — Wiley India,

Web Resources

1. <http://ssw.jku.at/Teaching/Lectures/CSharp/Tutorial/>
2. <http://www.csharpkey.com/csharp/>
3. <http://www.w3schools.com/aspnet/default.asp>
4. <https://www.c-sharpcorner.com>

Rationale for Nature of the course:

- Excellent choice for developing Window Applications, Web Services on the Microsoft Platform and Window based Mobile application.
- Illustrates Built-in design Patterns and Best Practices.
- Maximize the return of investment of skills and can build almost any kind of applications. .

Activities having direct bearing on Skill development / Employability:

- Practice to write Basic Programs and to gain Knowledge about Dot net Framework
- Practice to design a Windows Application, Web Based Application
- Exercising the concepts of Database Connectivity

Pedagogy:

- Demonstration using Projector and Practical Session.

Course Designer:

- Mrs. D.Geetharamani

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	C# Basics Programs-Console Application 1. Program to Print a number if it is prime, otherwise display the largest factor of that number. 2. Program to calculate the hypotenuse of a triangle using dynamic initialization of variable.	4	Demo & Practical Session
	3. Program to Finds the Roots of a Quadratic equation. 4. Program to Check whether a given number is Armstrong Number or not.	5	
Unit II	C#- Classes and Objects, constructors, Exception handling, Arrays , Strings 5. Program to Perform Arithmetic operations using Classes and objects. 6. Program to Display the details of a student (Regno, Name, mark1, mark2, mark3, mark4, mark5) and calculate the Total and Average marks of a student-using Constructor.	4	Demo & Practical Session
	7. Program to accept a number from the User, and throw an Exception if the number is not an Even Number. 8. Program to implement Jagged Array and Rectangular Array.	5	
Unit III	C# - Method Overloading, Inheritance, Delegates, Lambda Expression 9. Program to swap two integer numbers, and swap two float numbers Using Method Overloading. 10. Program to implement Multiple Inheritance Using Interface.	4	Demo & Practical Session
	11. Program to create a delegate called TraficDel and a class called Traffic Signal with the delegate Methods as yellow(),Green(),Red() .Also include a method IdentifySignal() to initialize an array of delegate with the above methods and a method show() to invoke members of the above array. 12. Program to implement Lambda Expression.	5	

Unit IV	Window Application ,Asp.Net Web Application with C# 13. Develop a Simple Calculator Program with Necessary Controls. 14. Develop an Application using Image Button Control.	4	Demo & Practical Session
	15. Develop an Application using AdRotator Control. 16. Develop an Application to manage the Session.	5	
Unit V	Asp.Net Web Application With C# code 17. Develop an Application using Validation Control. 18. Develop an Application using HTML Control.	4	Demo & Practical Session
	19. Develop an Application using ADO.NET and Data Source Control. 20. Develop an Application using LINQ.	5	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Demonstrate C# Basics Programs -Console Application.	K2
CLO-2	Devise Classes and Objects, constructors, Exception handling, Arrays, strings.	K4
CLO-3	Construct Method Overloading, Inheritance, Delegates, Lambda Expression.	K3
CLO-4	Build Window Application, Asp.Net Web Application with C#.	K3
CLO-5	Illustrate Asp.Net Web Application With C# code.	K4

Mapping of CLOs with PSOs:

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	1	1	1
CLO-2	3	3	3	1	3
CLO-3	3	2	2	3	2
CLO-4	3	3	3	3	2
CLO-5	3	3	3	1	3

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	1	1	1	1	1
CLO-2	3	3	3	1	3	3
CLO-3	3	2	2	3	2	2
CLO-4	3	3	2	3	3	2
CLO-5	3	3	3	1	3	3

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

DEPARTMENT OF INFORMATION TECHNOLOGY					CLASS: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	SEC	23U4FSED6	Advanced Excel	2	2	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To handle large amounts of data.
- To filtering, sorting, and grouping data or subsets of data.
- To create pivot tables to consolidate data from multiple files.
- To aggregate numeric data and summarise into categories and subcategories.
- To presenting data in the form of charts and graphs.

Unit	Description	Hours	K-level	CLO
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - Data Validations - Specifying a valid range of values - Specifying a list of valid values - Specifying custom validations based on formula - Working with Templates Designing the structure of a template.	6	K2	CLO 1
II	Sorting and Filtering Data - Sorting tables - multiple-level sorting- custom sorting - Filtering data for selected view - advanced filter options - Working with Reports Creating subtotals- Multiple-level subtotal. More Functions. Date and time functions - Text functions - Database functions - Power Functions - Formatting Using auto formatting option for worksheets - Using conditional formatting option for rows, columns and cells.	6	K3	CLO 2
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables - data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot	6	K4	CLO 3
IV	WhatIf Analysis - Data Tables - Lookup and reference functions - VlookUP with Exact Match, Approximate Match - Nested VlookUP with Exact Match - VlookUP with Tables, Dynamic Ranges - Using VlookUP to consolidate Data from Multiple Sheets.	6	K3	CLO 4

V	Charts - Formatting Charts - 3D Graphs - Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint/MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts.	6	K3	CLO 5

Books for Study:

1. Excel 2019 All-in-One for Dummies – 2018- Greg Harvey
Unit I: book1- 1, 2
Unit II: book3-1,2
Unit IV: 7
2. Microsoft Excel 2019 Pivot Table Data Crunching-2019, BillJelen and Michael Alexander.
Unit III: 1, 2, 5
3. Excel 2010 Advanced – Stephen Moffat, The Mouse training Company &Ventus Publishing ApS – 2011
Unit II: 3
Unit IV: 1
Unit V: 4

Books for References:

1. Excel: Quick start Guide from Beginner to Expert (Excel, Microsoft Office7 by William Fischer.
2. Advanced Excel Essentials -Jordan Gold meier.
3. Excel 2016 Bible-John Walkenbach.

Web Resources:

1. <https://corporatefinanceinstitute.com/resources/excel/basic-excel-formulas-beginners/>
2. <https://www.simplilearn.com/tutorials/excel-tutorial/excel-formulas>
3. <https://www.smartsheet.com/how-to-make-charts-in-excel>
4. https://www.w3schools.com/excel/excel_formulas.php
5. <https://www.datacamp.com/tutorial/basic-excel-formulas-for-everyone>

Rationale for Nature of the course:

- Increasing demand for data analysis, reporting, and decision-making in various professional domains.
- Empower users to analyze large datasets efficiently.
- Help in retrieving and organizing data, facilitating better decision-making.

Activities having direct bearing on Skill development / Employability:

- Practice to create dynamic and interactive reports, dashboards and Visualizations.
- Practice to solve complex financial analysis using Formulas.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Mrs. S. Brindha

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells.	2	Lecture, Quiz, PPT, Test, Seminar
	Working with Functions - Writing conditional expressions - logical functions - Data Validations - Specifying a valid range of values - Specifying a list of valid values	2	
	Specifying custom validations based on formula - Working with Templates Designing the structure of a template.	2	
Unit II	Sorting and Filtering Data - Sorting tables - multiple-level sorting- custom sorting - Filtering data for selected view - advanced filter options.	2	Lecture, Quiz, PPT, Test, Seminar
	Working with Reports Creating subtotals - Multiple-level subtotal. More Functions. Date and time functions - Text functions - Database functions - Power Functions.	2	
	Formatting Using auto formatting option for worksheets - Using conditional formatting option for rows, columns and cells.	2	
Unit III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables	2	Lecture, Quiz, PPT, Test, Seminar
	Pivot charts- Consolidating data from multiple sheets and files using Pivot tables - data consolidation feature to consolidate data	2	
	Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot	2	
Unit IV	WhatIf Analysis - Data Tables - Lookup and reference functions - VlookupUP with Exact Match, Approximate Match.	2	Lecture, Quiz, Assignment, Test, Seminar
	Nested VlookupUP with Exact Match - VlookupUP with Tables, Dynamic Ranges.	2	
	Using VlookupUP to consolidate Data from Multiple Sheets.	2	
Unit V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together	2	Lecture , PPT, Quiz, Seminar
	Secondary Axis in Graphs, Sharing Charts with PowerPoint / MS Word, Dynamically	2	
	New Features Of Excel Sparklines, Inline Charts, data Charts	2	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Describe about the workbook, worksheet and its basic operations.	K2
CLO-2	Identify the significance of Data validation.	K3
CLO-3	Correlate different types of pivot table.	K4
CLO-4	Determine the importance of function and formulas.	K3
CLO-5	Collect various charts in Excel.	K3

Mapping of CLOs with PSOs:

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	1	1	2	3
CLO-2	2	2	1	2	3
CLO-3	3	2	1	2	3
CLO-4	3	3	1	2	3
CLO-5	3	3	1	2	3

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	3	2	3	1	2
CLO-2	3	3	2	2	1	2
CLO-3	3	3	3	2	2	3
CLO-4	3	2	2	2	2	3
CLO-5	3	3	2	3	2	3

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

Summative - Blue – Print – Model
(Mapping with Course 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 & 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			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 with 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: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	SEC	23U4FSED7	Introduction to HTML	2	2	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To understand the basic HTML tag concept.
- To learn about Font style elements and Lists.
- To acquire knowledge on Table and cell alignment tags.
- To practice the Frame and Form tags.
- To learn about the Document Object Model and how to update a web page with Dynamic HTML.

Unit	Description	Hours	K-level	CLO
I	Introduction: Web Basics: What is Internet – Web browsers – What is Web page – HTML Basics: Tags for Document structure (HTML, Head, and Body Tag). Block level text elements: Headings paragraph(<p> tag).	6	K2	CLO 1
II	Font style elements: (bold, italic, font, small, strong, strike, big tags). Lists: Types of lists: Ordered, Unordered – Nesting Lists – Other tags: Marquee, HR, BR - Using Images – Creating Hyperlinks.	6	K3	CLO 2
III	Tables: Creating basic Table, Table elements, Caption – Table and cell alignment – Rowspan, Colspan –Cell padding.	6	K4	CLO 3
IV	Frames: Frameset – Targeted Links – No frame – Forms : Input, Text area, Select, Option.	6	K4	CLO 4
V	Java Script: Introduction to JavaScript-Functions, DOM, Forms, and Event Handlers. Additional JavaScript Basics : window Object, if Statement, Strings, Numbers and Input Validation.(Introduction, alert and confirm Methods, if statement if by self, prompt method, if statement else and else if clauses, strings, Arithmetic Operators, Constraints Validation for Form Controls, Constraints Validation using the Number Control's Attributes.	6	K3	CLO 5

Books for Study:

1. Mastering HTML5 and CSS3 Made Easy, Teach UComp Inc., 2014.
Unit I : 1,3
Unit II : 6,7
Unit III : 9
Unit IV : 10,11
2. Web programming with HTML5 , CSS , and JavaScript john dean,2019.
Unit V : 8,9

Books for References:

1. The complete reference HTML & CSS - Thomas A. Fifth edition - Powell by Indian Education 2017.
2. HTML 5 in easy steps - Mike McGrath - second edition.
3. HTML & XHTML : The Definitive Guide Fourth edition by Chuck Musciano - Bill Kennedy

Web Resources

1. https://www.w3schools.com/html/html_intro.asp
2. https://www.tutorialspoint.com/html/html_fonts.htm
3. <https://www.geeksforgeeks.org/html-lists/>
4. https://www.tutorialspoint.com/html/html_tables.htm
5. <https://www.geeksforgeeks.org/html-forms/>

Rationale for Nature of the course

- It helps the students to build your own unique website.
- It gives structure to the web page, defining things like headings, paragraphs, and links
- Practice to develop a design web page.

Activities having direct bearing on Skill development / Employability:

- Practice to write HTML code.
- Practice to design a web page.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Mrs. R.Tamilselvi

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction: Web Basics: What is Internet – Web browsers – What is Web page.	3	Lecture, PPT, Quiz, Test, Seminar
	HTML Basics: Tags for Document structure (HTML, Head, and Body Tag). Block level text elements: Headings paragraph(<p> tag).	3	
Unit II	Font style elements: (bold, italic, font, small, strong, strike, big tags).	3	Lecture, Assignment, Quiz, Test, Seminar
	Lists: Types of lists: Ordered, Unordered – Nesting Lists – Other tags: Marquee, HR, BR- Using Images – Creating Hyperlinks.	3	
Unit III	Tables: Creating basic Table, Table elements, Caption.	3	Lecture, Group Discussion, Quiz, Test, Seminar
	Table and cell alignment – Rowspan, Colspan – Cell padding.	3	
Unit IV	Frames: Frameset – Targeted Links – No frame.	3	Lecture, Test, Quiz, Seminar
	Forms: Input, Text area, Select, Option.	3	
Unit V	Java Script: Introduction to JavaScript-Functions, DOM, Forms, and Event Handlers.	3	Lecture, Seminar, Quiz
	Additional JavaScript Basics : window Object ,if Statement, Strings , Numbers and Input Validation.(Introduction, alert and confirm Methods, if statement if by self, prompt method, if statement else and else if clauses, strings, Arithmetic Operators, Constraints Validation for Form Controls, Constraints Validation using the Number Control's Attributes).	3	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Describe the basic concept in HTML tags.	K2
CLO-2	Apply the various font style tags to design a web page.	K3
CLO-3	Classify the table tags attributes.	K4
CLO-4	Focus on frame and form tags.	K4
CLO-5	Utilize the concept of JavaScript's in web page development.	K3

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	3	3
CLO-2	3	3	2	3	3
CLO-3	2	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	2	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	2	2	1	1	3
CLO-2	3	2	3	2	1	1
CLO-3	2	2	1	3	2	2
CLO-4	3	2	2	1	2	2
CLO-5	3	2	1	2	1	1

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

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1 & K2	1	K1	2(K3&K3)	1(K3)
3	CLO 3	Up to K4	2	K1 & K2	1	K2	2(K2&K2)	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			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 with 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%

VALUE ADDED COURSES

DEPARTMENT OF INFORMATION TECHNOLOGY					CLASS: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	Add On-I	23U4FAD1	Multimedia Tools	2	2	25	75	100

Objectives:

- To understand the basic concepts of GIMP's Tools.
- To know the importance of text, image and colors.
- To familiarize the principles of GIMP animation package.
- To make use of basic concepts of Flash.
- To learn about shape Tweening.

Unit	Description	Hours
I	GIMP's Tools- Taking Advantage of Paths - Working with Layers and masks - Using Channels-Enlarge a Logo using path-Create an ink drawing using path-Replace Background of image using Channels.	6
II	Manipulating Images: Transforming Images - Using The Image Tools - Adjusting Colors - Working with Text - Painting in Gimp: Creating new brushes - Enhancing Photos - Exploring Filters and Effects-Design Front Cover for a Book.-Create a customized logo -Use clone tool to remove text from an image-Remove Red eye using Filter.	6
III	Using GIMP animation package - Managing the Frames of Image Sequence with GAP - Morphing - onion skinning - Creating a Storyboard-Morphing - Create smooth transitions from one image to another-Create a Story board for your project.	6
IV	Flash: Introduction - Creating and Editing Objects - Color and Text. Animations: Frame- by- frame animation-Motion Tweening- Motion Guides-Creating Frame-by-frame Animation-Create a Motion Tween for Graphic and Text Object-Create a Motion guide Layer.	6
V	Shape Tweening - Masking - Interactivity: Adding Script to Buttons - Testing and Publishing-Create a Shape Tween for Graphic Object-Create a Mask Layer-Adding buttons with Action Script.	6

Books for Study:

1. GIMP Bible-Jason Van Gumster, Robert Shimonski (2010), Wiley, 2nd edition.
Unit I: 4,5
Unit II : 8,9,10
Unit III : 13,19

2. Adobe Flash Professional CC 2014 release Russell Chun.

Unit IV : 1,3,4,5,8

Unit V : 6,7,10

Books for References:

1. GIMP 2.6 Cookbook-Juan Manuel Ferreyra (2011),PACK publishing Ltd.
2. Macromedia Flash MX Bible-Robert Reinhard (2003), Wiley Dreamtech India Pvt Ltd.

Web Resources

1. https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm
2. <https://www.includehelp.com/basics/multimedia-technology-images-videos-audio-animation.aspx>
3. https://www.gimp.org/tutorials/Using_GAP/
4. <https://www.geeksforgeeks.org/introduction-to-macromedia-flash-8/>
5. <https://www.studiobinder.com/blog/what-is-tweening-in-animation/>

Pedagogy

- Chalk and talk, Materials, PPT, Assignment, Seminar, Group discussion and Quiz.

Course Designer:

- Mrs. D. Geetharamani

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 / Test	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 AMCQs	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

DEPARTMENT OF INFORMATION TECHNOLOGY					CLASS: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Add On - II	23U3FAD2	R Programming	2	2	50	50	100

Objectives:

- To understand the basics in R programming.
- To understand the use of Multidimensional Arrays and Data Frames.
- To learn feeding data into R.
- To make use of Control Statements and Functions in R.
- To learn the implementation of Graphs and Plots

Unit	Description	Hours
I	Basics of R - Basic Math – Variables - Data Types – Vectors - Calling Functions -Function – Documentation - Missing Data – Pipes.	6
II	Advanced Data Structures – data frames – Lists – Matrices – Arrays.	6
III	Reading Data into R - Reading CSVs - Excel Data - Reading from Databases - Data from Other Statistical Tools - R Binary Files - Data Included with R - Extract Data from Web Sites - Reading JSON Data.	6
IV	Writing R functions - Hello, World! - Function Arguments - Return Values – do call - Control Statements - if and else – switch – if else - Compound Tests - Loops, the Un-R Way to Iterate - for Loops - while Loops - Controlling Loops.	6
V	Graphics-Creating Graphs - The Workhorse of R Base Graphics-the plot() Function-Customizing Graphs-Saving Graphs to Files. Case Studies.	6

Books for Study:

1. R for Everyone: Advanced Analytics and Graphics - Jared P. Lander Addison, Wesley Data & Analytics Series, 2013.
Unit I : 4
Unit II : 5
Unit III : 6
Unit IV : 8,9,10
2. Art of R Programming: A Tour of Statistical Software Design - Norman Matloff, No Starch Press, 2011.
Unit V : 12

Books for References:

1. Beginning R – The Statistical Programming Language by Mark Gardener, Wiley, 2013
2. Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R - Robert Knell – Amazon Digital South Asia Services Inc, 2013.
3. The Art of R Programming – A K Verma – Cengage Learning.

Web Resources:

1. <https://www.w3schools.com/r/>
2. https://www.tutorialspoint.com/r/r_useful_resources.htm
3. <https://www.geeksforgeeks.org/graph-plotting-in-r-programming/>
4. <https://statisticsglobe.com/graphics-in-r/>

Pedagogy

- Chalk and talk, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction and Demonstration.

Course Designer:

- 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 / Test	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

DEPARTMENT OF INFORMATION TECHNOLOGY					CLASS: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
	Certificate Course	23FC01	Web Designing Tools	2	2	50	50	100

Objectives:

- To impart knowledge about the web development and their applications.
- To create forms with radio groups, check boxes and/or text fields.
- To Place image and text elements within a web page using Cascading Style Sheets.
- To learn the concept of creating a new Layers, Color and Tone in Photoshop.
- To Utilize a basic Tools, Brushes and Filters in Photoshop.

Unit	Description	Hours
I	Basics of HTML: Introduction to HTML – HTML browsers - Different versions of HTML-HTML tags - Document Overview - Header Elements - Section headings - Body Section.	6
II	Working with HTML: Block headings – Lists-Inline elements – Images - Working with Tables, Forms, and Frames.	6
III	Cascading Style Sheets: Introduction to Dynamic HTML – CSS – Document Object Model – Event Handling – Filters and Transitions – Data Binding.	6
IV	Introducing Photoshop: First steps in Photoshop: Resize your images- Save, export and share your photos- Learn to copy and paste. Basic Corrections: Improve composition in photos-Master the Transform tool - Utilise the Recompose tool-Use the Gradient tool. Layers: Understand the Layers palette- Organise Layers - Navigate the Layer menu - Learn to control layer opacity. Color and Tone: Color in Photoshop- Use Levels to improve photos- The Sponge tool.	6
V	Image Retouching: Conquer the Clone Stamp- Sharpen your photos- Improve shadows and highlights. Brushes: Grasp the Brush tool- Use tools with brushes- Use the History tools in Photoshop. Filters: What are filters - Discover the Blur filters-Master the Blur Gallery filters- Lighting Effects filter- Apply the Reduce Noise filter. Selections: Select with the Lasso tool- Understand Quick Mask- Wield the Magic Wand tool- Master the Refine Edge tool	6

Books for Study:

1. Web Technology - A Developer's Perspective -N P Gopalan, J Akilandeswari, PHI, II Edition, New Delhi ,2008.
Unit I – 1, 2
Unit II – 4, 5, 6
Unit III - 7

2. Photoshop for Beginners - William Gibbons, Gordon and Gotch Pvt.Ltd., 11th Edition.
Unit IV – 1, 2, 3, 4
Unit V – 5, 6, 7, 8, 9

Books for References:

1. Web Technology and Design – C. Xavier, New Age International Publisher
2. Web Enabled Commercial Application Development Using HTML, DHTML, JavaScript, Perl CGI - Ivan Bayross, BPB Publication.

Web Resources:

1. https://www.w3schools.com/html/html_tables.asp
2. <https://www.geeksforgeeks.org/dom-document-object-model/>
3. <https://www.pdf-files.net/storage/Books/software/photoshop-for-beginners-11th-edition.pdf>

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction and Demonstration.

Course Designer:

- Mr. M. Ashok Kumar

Evaluation Pattern

- Distribution of marks for Internal and External examinations will be 50% each.
- Course teacher will fix the components for the distribution of marks in both internal and external examinations.

DEPARTMENT OF INFORMATION TECHNOLOGY					Certificate Course			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
	Certificate Course	23FC02	PC Hardware and Trouble shooting	2	2	50	50	100

Objectives:

- To understand basic concepts and structure of computer hardware components.
- To acquire basic and troubleshooting knowledge in Memory Devices.
- To identify the various External I/O Interfaces.
- To know about how to connect a system in LAN and Internet.
- To acquire knowledge of building a PC.

Unit	Content	Hours
I	PC Components, Features, and System Design: What is a PC? – System Types – System Components – Processor Types and Specifications: Processor Specifications. (List only). Mother Boards and Buses: Mother Board Form Factors – Mother Board Selection Criteria.	6
II	Memory: Memory Basics – Memory Standards – Speed and Performance – RAM Upgrades – Troubleshooting Memory – Memory Defect Isolation Procedures.	6
III	Flash and Removable Storage: USB Flash Drives. External I/O Interfaces: Introduction to Input / Output Ports. Local Area Networking: Defining a Network – Client/Server Versus Peer Networks – Hardware Elements of Your Network	6
IV	Internet Connectivity: Broadband Internet Access Types – Internet Connection Security. Building or Upgrading Systems: System Components – Hardware and Software Resources – System Assembly and Disassembly – System Startup – Installing the OS	6
V	Troubleshooting New Installations – PC Diagnostics, Testing and Maintenance: PC Diagnostics – Diagnostics Software – The Boot Process – PC Maintenance Tools – Preventive Maintenance – Trouble shooting Tips and Techniques.	6

Book for Study

1. Upgrading and Repairing PCs- Scott Mueller, 22nd Edition, Pearson Education, 2015.
Unit I – 2, 3, 4
Unit II – 6
Unit III – 10, 14, 17
Unit IV – 16, 19
Unit V - 20

Books for Reference

1. Comdex Hardware and Networking Course Kit-Vikas Gupta, Dreamtech Press.
2. Essential Computer Hardware Second Edition : The Illustrated Guide to understanding Computer Hardware(Computer Essentials)-Kevin Wilson.

Web Resources

1. <https://www.instructables.com/How-To-Assemble-A-Basic-Desktop-PC/>
2. <https://www.cpu-world.com/info/id/Intel-identification.html>
3. https://www.ifixit.com/Wiki/Desktop_PC_Troubleshooting

Pedagogy

- Chalk and talk, Materials, PPT, Assignment, Seminar, Problem solving, Group discussion, Interaction and Demonstration.

Course Designer(s) Name

- Mr. N. Radha Krishnan

Evaluation Pattern

- Distribution of marks for Internal and External examinations will be 50% each.
- Course teacher will fix the components for the distribution of marks in both internal and external examinations.

DEPARTMENT OF INFORMATION TECHNOLOGY					CLASS: II B.Sc. (IT)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III & IV	Self Study Course		Quantitative Aptitude	2	-	-		100

Objectives:

- To understand various number systems.
- To get an idea of age, profit and loss related problem solving.
- To understand time series simple and compound interests.
- To impart knowledge on the problem related to probability, and series.
- To understand graphs, charts.

Unit	Description
I	Numbers- HCF and LCM of numbers - Decimal fractions – Simplification – Average - Problems on Numbers.
II	Problems on Ages - percentage - profits and loss - ratio and proportion-partnership.
III	Time and work - Time and Distance - problems on trains - simple interest - compound interest - Area - Volume and surface area.
IV	Permutation and combination – Probability – True Discount - Odd man out and Series.
V	Calendar - Clocks - Data representation - Bar Graphs - Pie charts.

Book for Study:

Quantitative Aptitude For Competitive Examinations- R.S. Aggarwal - S. Chand & Company Ltd - Revised and Enlarged edition - 2017.

Unit I – 1, 2, 3, 4, 6, 7

Unit II – 8, 11, 12, 13, 14

Unit III – 17, 18, 20, 22, 23, 24, 25

Unit IV – 30, 31, 32, 35

Unit V – 27, 28, 37, 38

Books for References:

1. Quantitative Aptitude and Reasoning, R.V. Praveen, Second Edition, PHI, 2013.
2. Rapid Quantitative Aptitude with Shortcuts and Tricks for Competitive Exams, Er. Deepak Agarwal, D.P. Gupta, Disha Publications.
3. A Pearson Guide to Quantitative Aptitude for Competitive Exams, Dinesh Khattar, Pearson.

Web Resources:

1. <https://www.math-shortcut-tricks.com/>
2. <https://www.sanfoundry.com/quantitative-aptitude-questions-answers/>
3. <https://www.indiabix.com/aptitude/questions-and-answers/>

Course Designer:

- Mrs. S. Rajalakshmi

Blue Print – Model for Self Study Course for Advanced Learners**Summative Assessment****Distribution of Section – wise Marks**

Section	Components	Marks
Section A	Assignment	25
Section B	Improvisation of Experiment / Creativity / Analysis / Innovation	25
Section C	Project Work & Viva Presentation / Quiz	25
Section D	Internal Test	25
	Total	100



The Madura College (Autonomous), Madurai – 625 011
Department of Information Technology

B.Sc. (IT) - Course List

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	23U1FCCT1	Programming in C	5	5	✓		✓			✓	32%
	23U1FCCP1	C Programming Lab	3	3	✓		✓			✓	30%
	23U1FFCT1	Fundamentals of Computers	2	2			✓	✓			New Paper
	23U1FSED1	Office Automation	2	2			✓		✓		75%
II	23U2FCCT2	JAVA Programming	5	5	✓		✓			✓	33.2%
	23U2FCCP2	JAVA Programming Lab	3	3	✓		✓			✓	26.7%
	23U2FSED2	Problem Solving Techniques	2	2			✓		✓		New Paper
	23U2FSED3	Fundamentals of Information Technology	2	2			✓	✓			24.4%

Seme ster	Course Code	Title of the Course	Hou rs	Credit s	Nature of Course(Employabilit y/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision/New
					Emp l	Ent	Skill	Loca l	Nationa l	Globa l	
III	23U3FCCT3	Relational Database Management System	4	4	✓		✓			✓	31.1%
	23U3FCCP3	Relational Database Management System Lab	3	3	✓		✓			✓	20%
	23U3FSED4	Multimedia Systems	2	2	✓		✓			✓	35.3%
	23U3FSED5	Digital Logic Fundamentals	2	2			✓	✓			9%
IV	23U4FCCT4	Dot Net Programming	4	4	✓		✓			✓	100%
	23U4FCCP4	Dot Net Programming Lab	3	3	✓		✓			✓	100%
	23U4FSED6	Advanced Excel	2	2	✓		✓			✓	New Paper
	23U4FSED7	Introduction to HTML	2	2	✓		✓			✓	12.1%

Emp- Employability; Ent- Entrepreneurship; Skill- Skill Development

Curriculum Structure for M.Sc. Computer Science

Part	Course Description	Course Code	Course Title	Contact Hours/ Week	Credits
SEMESTER I					
A	Core Course – I	23P1DCCT1	Analysis & Design of Algorithms	6	5
	Core Course – II	23P1DCCT2	Object Oriented Analysis and Design & C++	6	5
	Core Course Practical – I	23P1DCCP1	Practical I: Algorithm And OOPS Lab	6	4
	Discipline Elective Course – I	23P1DECT1	Python Programming/Web Services	5	3
	Discipline Elective Course – II	23P1DECT2	Advanced Software Engineering / Critical Thinking, Design Thinking And Problem Solving	5	3
B	Skill Enhancement Course – I	23P1DSED1	R Programming	2	2
	Total			30	22
SEMESTER II					
A	Core Course – III	23P2DCCT3	Data Mining And Warehousing	6	5
	Core Course – IV	23P2DCCT4	Advanced Java Programming	6	5
	Core Course Practical – II	23P2DCCP2	Practical II: Advanced Java & Data Mining Lab using R	6	4
	Discipline Elective Course – III	23P2DECT3	Artificial Intelligence & Machine Learning / Internet of Things	5	3
	Discipline Elective Course –IV	23P2DECT4	Advanced Operating Systems / Mobile Computing	5	3
B	Skill Enhancement NME – I	23P2DSEN1	Multimedia And Its Applications	2	2
	Total			30	22

Part	Course Description	Course Code	Course Title	Contact Hours/ Week	Credits
SEMESTER III					
A	Core Course – V	23P3DCCT5	Advanced Relational Database Management System	6	5
	Core Course – VI	23P3DCCT6	Data Science & Analytics	6	5
	Core Practical – III	23P3DCCP3	Advanced Relational Database Management System Lab	6	4
	Discipline Elective Course – V	23P3DECT5	Network Security & Cryptography /Digital Image Processing	5	3
	MDC	23P3DMDC1	Embedded Systems	5	3
B	Skill Enhancement NME – II	23P3DSEN2	Basic Excel Techniques	2	2
	Internship/Industrial Activity	23P3DINTR		-	2
	Total			30	24
SEMESTER IV					
A	Core Course – VII	23P4DCCT7	Web Application Development	6	5
	Core Practical – IV	23P4DCCP4	Web Application Development Lab	6	4
	Project	23P4DPROV	Project with Viva-Voce	8	8
	Discipline Elective Course – VI	23P4DECT6	Blockchain Technology/ Cloud Computing	6	3
B	Skill Enhancement Course/Professional Competency Skill	23P4DSED2	Quantitative Aptitude	4	2
	Extension Activity	23P4DEXTN		-	1
	Total			30	23

VALUE ADDED COURSE

Course Description	Course Type	Course Title	Contact Hours/week	Credits
Add-On	23P3DAD1	Values and Ethics in Research	2	2

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Core Theory	23P3DCCT5	Advanced Relational Database Management System	5	6	25	75	100

Nature of Course								
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented				

Objectives:

- To understand the concept of Database design and Normalizations.
- To master SQL queries and Control the access.
- To focus on transactions and concurrency control.
- To impart the knowledge of Complex data types, Indexing and Physical storage.
- To provide the knowledge of NoSQL and its tools.

Unit	Description	Hours	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 Relational Database Design: Features of Good Relational Designs - Decomposition Using Functional Dependencies - Normal Forms - Functional-Dependency Theory - Decomposition Using Multivalued Dependencies - Atomic Domains and First Normal Form.	18	K2	CLO 1
II	SQL : SQL Data Definition – Basic structure of SQL Queries – Additional Basic Operation – Set Operations – Null Values – Aggregate Functions – Nested Subqueries – Modification of the Database. 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	CLO 2
III	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. Concurrency Control: - Lock-Based Protocols - Deadlock Handling - Multiple	18	K3	CLO 3

	Granularity - Insert Operations, Delete Operations, and Predicate Reads - Timestamp-Based Protocols -Validation-Based Protocols.			
IV	Complex Data Types: Semi-structured Data - Object Orientation - Textual Data - Spatial Data. Indexing: Basic Concepts - Ordered Indices - B+-Tree Index Files - B+-Tree Extensions. Physical Storage System – RAID.	18	K4	CLO 4
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 python - language bindings for php.	18	K4	CLO 5

Books for Study:

1. Database System Concepts, Abraham Silberschatz, Henry F Korth, S Sudarshan, 7th edition, McGraw-Hill International Edition , 2019.
Unit I: 6.1 – 6.9 , 7.1 – 7.4 , 7.6 , 7.8
Unit II: 3, 4 , 5.2 – 5.5
Unit III: 17, 18.1 – 18.6
Unit IV: 8, 14.1 -14.4, 12.5
2. Professional NoSQL, Shashank Tiwari, John Wiley & Sons
Unit V: 1, 2, 3(Mongo DB , Apache Cassandra, Python , PHP)

Books for References:

1. Fundamentals of Database Systems – Ramez Elmasri, Shamkant B. Navathe (2014), – Sixth edition – Pearson Education, New Delhi.
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill, 3rd Edition, 2013.

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
5. db-book.com/slides-dir/index.html

Rationale for Nature of the course

- Facilitates Data Integrity, Accuracy, and Consistency & reduce Redundancy.
- Illustrates a standard way of representing and querying data used by any application.
- Redeem knowledge on Normalization Techniques, to get opportunity as back-end designer.

Activities having direct bearing on Skill development / Employability:

- Practice to write Queries & Blocks of codes.
- Practice to design a Database in a required Normalized Form.
- Exercising NoSQL tools.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Quiz, Test and Group discussion.

Course Designer:

- Mrs. K.R.Ramadevi

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Database Design Using the E-R Model: Overview of the Design Process - The Entity-Relationship Model - Complex Attributes - Mapping Cardinalities - Primary Key.	5	Lecture, PPT, Quiz, Test, Seminar
	Removing Redundant Attributes in Entity Sets - Reducing E-R Diagrams to Relational Schemas - Extended E-R Features.	5	
	Relational Database Design: Features of Good Relational Designs - Decomposition Using Functional Dependencies - Normal Forms - Functional-Dependency Theory - Decomposition Using Multivalued Dependencies - Atomic Domains and First Normal Form.	8	
Unit II	SQL : SQL Data Definition – Basic structure of SQL Queries – Additional Basic Operation – Set Operations – Null Values – Aggregate Functions – Nested Subqueries – Modification of the Database.	6	Lecture, Quiz, Test, Seminar
	Intermediate SQL: Join Expressions - Views – Transactions - Integrity Constraints - SQL Data Types and Schemas - Index Definition in SQL – Authorization.	6	
	Advanced SQL: Functions and Procedures - Triggers - Recursive Queries - Advanced Aggregation Features.	6	
Unit III	Transactions: Transaction Concept - A Simple Transaction Model - Storage Structure - Transaction -Atomicity and Durability - Transaction Isolation – Serializability.	6	Lecture, Quiz, Group Discussion, Test, Seminar
	Transaction Isolation and Atomicity - Transaction Isolation Levels - Implementation of Isolation Levels - Transactions as SQL Statements.	6	

	Concurrency Control: - Lock-Based Protocols - Deadlock Handling - Multiple Granularity - Insert Operations, Delete Operations, and Predicate Reads - Timestamp-Based Protocols - Validation-Based Protocols.	6	
Unit IV	Complex Data Types: Semi-structured Data - Object Orientation.	6	Lecture, Assignment, Quiz, Test, Seminar
	Textual Data - Spatial Data. Indexing: Basic Concepts - Ordered Indices.	6	
	B+-Tree Index Files - B+-Tree Extensions. Physical Storage System – RAID.	6	
Unit 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	Lecture, Seminar, Quiz
	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	6	
	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 python - language bindings for php.	6	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO–1	Describe the data base design using ER Model and Normalization.	K2
CLO–2	Apply Queries and its operations on the database.	K3
CLO–3	Identify Transactions Concurrency control.	K3
CLO–4	Focus on complex data types, Indexing and Physical Storage system.	K4
CLO–5	Examine the power of NoSQL with MangoDB.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	2	2
CLO-2	3	3	3	3	3
CLO-3	3	2	2	2	2
CLO-4	3	2	2	2	2
CLO-5	3	3	3	3	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	3	3	1	3	1
CLO-2	3	3	3	1	3	3
CLO-3	3	2	2	1	2	2
CLO-4	3	1	2	1	3	2
CLO-5	3	3	3	1	3	3

Advanced application– 3; Intermediate level–2; Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1 & K2	1	K1	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(K3)
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			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 withou t 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

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Core Theory	23P3DCCT6	Data Science & Analytics	5	6	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To understand the concept of data science and its techniques.
- To familiarize the concept of Data Analytics life cycle.
- To Apply and determine appropriate Data Mining techniques using R to real time applications.
- To analyze on clustering algorithms.
- To familiarize on Deep learning methods for Data Science.

Unit	Description	Hours	K-level	CLO
I	Introduction of Data Science : data science and big data –facets of data-data science process- Eco system. The Data Science process – six steps- Machine Learning.	18	K2	CLO 1
II	Basics Of Data Analytics: Data Analytics life cycle –review of data analytics – Advanced data Analytics – technology and tools.	18	K4	CLO 2
III	Basic Data Analytics using R : R Graphical User Interfaces – Data Import and Export – Attribute and Data Types –Descriptive Statistics – Exploratory Data Analysis –Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.	18	K3	CLO 3
IV	Overview of Clustering : K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R –Classification – Decision Trees – Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes’ Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.	18	K3	CLO 4
V	Deep Learning Methods for Data Science: Introduction - Convolution Neural Network - Recurrent Neural Network - Denoising Auto encoder - Recursive Neural Network (RCNN) - Deep Reinforcement Learning - Deep Belief Networks (DBNS).	18	K4	CLO 5

Books for Study:

1. Introducing Data Science: Big Data, Machine Learning and more using Python tools – Davy Cielen, Arno D.B.Meysman, Mohamed Ali – DreamTech Press 2016.
Unit I: 1, 2, 3
2. Data science in big data analytics- John Wiley & Sons (2015), Wiley Publications.
Unit II: 1, 2, 3, 11
3. David Dietrich, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, John Wiley & Sons, 2015
Unit III: 3.1, 3.2
Unit IV: 4.1, 4.2, 7.1.3, 7.1.4, 7.1.5, 7.2.1, 7.2.2, 7.2.3, 7.2.5
4. Advanced Analytics and Deep Learning Models - Archana Mire, Shaveta Malik , Amit Kumar Tyagi – Wiley publications.
Unit V: 7

Books for References:

1. A simple introduction to Data Science – Lars Nielson 2015
2. Introducing Data Science - Davy Cielen, Arno D.B.Meysman, Mohamed Ali (2016), Manning Publication.
3. R Programming for Data Science – Roger D. Peng (2015), Lean Publication
4. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data

Web Resources

1. https://www.tutorialspoint.com/python_data_science/index.htm
2. <https://www.javatpoint.com/data-science>
3. <https://nptel.ac.in/courses/106/106/106106179/>

Rationale for Nature of the course

- Involves mining large datasets containing structured and unstructured data and identifying hidden patterns to extract actionable insights.
- Facilitates it with its power to extract information from large volumes of data.
- With Data Science, one can analyze massive graphical data, temporal data, and geospatial data to draw insights. It also helps in seismic interpretation and reservoir characterization.

Activities having direct bearing on Skill development / Employability:

- Practice to write Assignment and present seminars in relevant topics.
- Practicing Data Analyses and Database Designing.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Mrs. K. Imaya

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction of Data Science: Data science and big data - Facets of data - data science process- Eco system.	9	Lecture, PPT, Quiz, Test, Seminar
	The Data Science process – six steps- Machine Learning.	9	
Unit II	Basics of data analytics: Data Analytics life cycle – review of data analytics.	9	Lecture, Assignment, Quiz, Test, Seminar
	Advanced data Analytics – technology and tools.	9	
Unit III	Basic Data Analytics using R: R Graphical User Interfaces – Data Import and Export – Attribute and Data Types - Descriptive Statistics.	9	Lecture, Group Discussion, Quiz, Test, Seminar
	Exploratory Data Analysis – Visualization Before Analysis – Dirty Data. Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.	9	
Unit IV	Overview of Clustering: K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R - Classification - Decision Trees.	9	Lecture, Test, Quiz, Seminar
	Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree - Decision Tree in R – Bayes’ Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.	9	
Unit V	Deep Learning Methods for Data Science: Introduction - Convolution Neural Network - Recurrent Neural Network - Denoising Auto encoder	9	Lecture, Seminar, Quiz
	Recursive Neural Network (RCNN) - Deep Reinforcement Learning - Deep Belief Networks (DBNS).	9	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Describe the concept of data science and its techniques.	K2
CLO-2	Focus on Data Analytics life cycle and review data analytics.	K4
CLO-3	Apply and determine appropriate Data Mining techniques using R to real time applications.	K3
CLO-4	Identify the significance of clustering algorithms.	K3
CLO-5	Analyze on Deep learning methods for Data Science.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	2	2
CLO-2	3	2	1	1	1
CLO-3	3	3	2	3	3
CLO-4	3	2	2	3	1
CLO-5	3	3	3	3	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	2	3	3	1	3	1
CLO-2	2	3	3	1	3	3
CLO-3	3	3	3	2	3	2
CLO-4	3	3	3	2	3	2
CLO-5	3	3	3	1	3	3

Advanced application– 3; Intermediate level–2; Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K4	2	K1 & K2	1	K1	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	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			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 with 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%

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Core Practical	23P3DCCP3	Advanced Relational Database Management System Lab	4	6	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To create database and implement DDL, DML and Join Queries.
- To design Normalized database and implement DCL Queries.
- To impart the knowledge of Upsert, Trigger and User defined function.
- To understand the concepts of Exceptions and Views.
- To familiarize the concept of mongoDB and Cassandra.

Unit	Description	Hours	K-level	CLO
I	1. Create the library database with suitable records. member(memb no, name) book(isbn, title, authors, publisher) borrowed(memb no, isbn, date) Write and execute the following queries in SQL. a) Write an SQL DDL definition of this database. Identify referential-integrity constraints that should hold, and include them in the DDL definition. b) Find the member number and name of each member who has borrowed at least one book published by “McGraw-Hill”. c) Find the member number and name of each member who has borrowed every book published by “McGraw-Hill”. d) For each publisher, find the member number and name of each member who has borrowed more than five books of that publisher. e) 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 2. Given the relations a(name, address, title) and b(name , address, salary), show how to express a natural full join b using the full outer-join operation with an on condition rather than using the natural full join syntax. This can be done using the coalesce operation. Make sure that the relation does not contain two copies of the attributes name and address and the solution is correct even if some tuples in a and b have null values for attributes name or address.	18	K2	CLO 1

II	3. Design a Database for a worldwide package delivery company (e.g., DHL or FedEx). The database must be able to keep of customers who ship items and customers who receive items, some customers may do both. Each package must be identifiable and trackable, so the database must be able store the location of the package and its history of locations. Location includes trucks, planes, airports and warehouses. a) The design should include set of relational schemas and List of constraints including Primary key and Foreign Key. b) Identify and eliminate Transitive Dependencies in an above schema. 4. Execute the following queries. Create new user “Tester” Grants a SELECT permission on employee table to “Tester”. Revoke a select permission on employee table from “Tester”.	18	K3	CLO 2
III	5. Lets consider a scenario where you have a target table named Employee and a source table named Employee Updates. The goal is to update employee records if they exist, and insert new records if they don't. Explore the usage of MERGE statement for upsert operations. 6. Define triggers to create a audit trail login the information into the relation called takes_trail. The logged information should include the user_id and time_stamp in addition to old and new values. You must also provide the schema of the takes_trail relation. 7. Explore the usage of user-defined functions.	18	K3	CLO 3
IV	8. Create a user-defined exception for the built-in exceptions “NO DATA FOUND” and “TOO MANY ROWS” . 9. Consider that the view is created with ISBN, title, Number of times borrowed and materialized; that is, the view is computed and stored in the Library database. Write triggers to maintain the view, that is, to keep it up-to-date on insertions, deletions and modifications.	18	K4	CLO 4
V	10. Design a Database in mongoDB server for a Car Insurance Company whose customers own one more cars each. Each car has associated with it zero to any number of recorded accidents. Each insurance policy covers one or more cars and has one more premium payments associated with it. Each payment is for a particular period of time and has an associated due date and the date when the payment was received. Execute the following queries, a) Create a collection within the database. b) Insert documents into the collection. c) Query documents from the collection. d) Update documents in the collection. e) Delete documents from the collection.	18	K4	CLO 5

	11. Use the above database, - Create an index on a specific field in a collection. - Execute queries with and without the index to observe the performance difference. 12. Design a database in Cassandra. The database must keep track of customers and their reservation, flights and their status, seat assignments on individual flights and the schedule and routing of future flights. Execute the following queries, - Create a keyspace. - Create a table within the keyspace. - Insert records into the table. - Query records from the table using CQL (Cassandra Query Language). - Update and delete records in the table.			

Books for Study:

Database System Concepts - Abraham Silberschatz, Henry F Korth , S Sudarshan, 7th edition , McGraw-Hill International Edition , 2019

Books for References:

1. Fundamental of Database Systems - Ramez Elmasri, Shamkant B Navathe, Pearson, 7th edition 2016.
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill, 3rd Edition, 2013.

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
5. db-book.com/slides-dir/index.html

Rationale for Nature of the course:

- Facilitates Data Integrity, Accuracy, and Consistency & reduce Redundancy.
- Illustrates a standard way of representing and querying data used by any application.
- Redeem knowledge on Normalization Techniques, to get opportunity as back-end designer.

Activities having direct bearing on Skill development / Employability:

- Practice to write Queries & Blocks of codes.
- Practice to design a Database in a required Normalized Form.
- Exercising debugging routines.

Pedagogy:

- Demonstration using Projector and Practical Session.

Course Designer:

- Mrs. K.R.Ramadevi

Course Schedule

Unit	Description	Hours	Mode
I	1. Create the library database with suitable records. member(memb no, name) book(isbn, title, authors, publisher) borrowed(memb no, isbn, date) Write and execute the following queries in SQL. a) Write an SQL DDL definition of this database. Identify referential-integrity constraints that should hold, and include them in the DDL definition. b) Find the member number and name of each member who has borrowed at least one book published by “McGraw-Hill”. c) Find the member number and name of each member who has borrowed every book published by “McGraw-Hill”. d) For each publisher, find the member number and name of each member who has borrowed more than five books of that publisher. e) 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.	9	Demo & Practical Session.
	2. Given the relations a(name, address, title) and b(name, address, salary), show how to express a natural full join b using the full outer-join operation with an on condition rather than using the natural full join syntax. This can be done using the coalesce operation. Make sure that the relation does not contain two copies of the attributes name and address and the solution is correct even if some tuples in a and b have null values for attributes name or address.	9	
II	3. Design a Database for a worldwide package delivery company (e.g., DHL or FedEx). The database must be able to keep of customers who ship items and customers who receive items, some customers may do both. Each package must be identifiable and trackable, so the database must be able store the location of the package and its history of locations. Location includes trucks, planes, airports and warehouses.	9	Demo & Practical Session.

	a) The design should include set of relational schemas and List of constraints including Primary key and Foreign Key. b) Identify and eliminate Transitive Dependencies in an above schema.		
	4. Execute the following queries. a) Create new user “Tester” b) Grants a SELECT permission on employee table to “Tester”. c) Revoke a select permission on employee table from “Tester”.	9	
III	5. Lets consider a scenario where you have a target table named Employee and a source table named EmployeeUpdates. The goal is to update employee records if they exist, and insert new records if they don't. Explore the usage of MERGE statement for upsert operations.	9	Demo & Practical Session.
	6. Define triggers to create a audit trail login the information into the relation called takes_trail. The logged information should include the user_id and time_stamp in addition to old and new values. You must also provide the schema of the takes_trail relation. 7. Explore the usage of user-defined functions.	9	
IV	8. Create a user-defined exception for the built-in exceptions , NO DATA FOUND“ and „TOO MANY ROWS“	9	Demo & Practical Session.
	9. Consider that the view is created with ISBN, title, Number of times borrowed and materialized; that is, the view is computed and stored in the Library database. Write triggers to maintain the view, that is, to keep it up-to-date on insertions, deletions and modifications.	9	
V	10. Design a Database in mongoDB server for a Car Insurance Company whose customers own one more cars each. Each car has associated with it zero to any number of recorded accidents. Each insurance policy covers one or more cars and has one more premium payments associated with it. Each payment is for a particular period of time and has an associated due date and the date when the payment was received. Execute the following queries, a) Create a collection within the database. b) Insert documents into the collection. c) Query documents from the collection. d) Update documents in the collection. e) Delete documents from the collection.	9	Demo & Practical Session.

	11. Use the above database, - Create an index on a specific field in a collection. - Execute queries with and without the index to observe the performance difference. 12. Design a database in Cassandra. The database must keep track of customers and their reservation, flights and their status, seat assignments on individual flights and the schedule and routing of future flights. Execute the following queries, - Create a keyspace. - Create a table within the keyspace. - Insert records into the table. - Query records from the table using CQL (Cassandra Query Language). - Update and delete records in the table.	9	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Demonstrate DDL, DML, Join Queries.	K2
CLO-2	Apply the concept of Normalization and DCL Queries.	K3
CLO-3	Build a User defined functions and to implement Triggers.	K3
CLO-4	Devise Exceptions and Views.	K4
CLO-5	Focus on the concept of mongoDB and Cassandra.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	2	2
CLO-2	3	3	3	3	3
CLO-3	3	2	2	2	2
CLO-4	3	2	2	2	2
CLO-5	3	3	3	3	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	3	3	1	3	1
CLO-2	3	3	3	1	3	3
CLO-3	3	2	2	1	2	2
CLO-4	3	1	2	1	3	2
CLO-5	3	3	3	1	3	3

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

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Discipline Elective	23P3DECT5	Network Security & Cryptography	3	5	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To enable students to learn the Introduction to Cryptography.
- To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory.
- To explore the working principles and utilities of various cryptographic algorithms.
- To explore the design issues and working principles of various authentication Applications.
- To impact the knowledge of Web Security and also provide the Case studies in Cryptography.

Unit	Description	Hours	K-level	C LO
I	Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.	15	K2	CLO 1
II	Public-key Cryptosystem: Introduction to Number Theory-RSA Algorithm–Key Management Diff Hellman Key exchange Elliptic Curve Cryptography Message Authentication and Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.	15	K3	CLO 2
III	Network Security Practice: Authentication Applications–Kerberos–X.509Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.	15	K3	CLO 3
IV	Web Security: Secure Socket Layer Secure Electronic Transaction. System Security-Intruders and Viruses – Firewalls– Password Security.	15	K4	CLO 4
V	Case Studies: Implementation of Cryptographic Algorithms –RSA– DSA– ECC (C/JAVA Programming). Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Stenography – Water Marking	15	K4	CLO 5

Books for Study:

1. Cryptography and Network Security- William Stallings, PHI/Pearson Education. 7th edition.
Unit I – 1, 3, 4, 6, 7
Unit II – 9, 10, 11, 12, 13
Unit III – 14, 15, 19
Unit IV – 22, 23
2. Applied Cryptography-Bruce Schneier- CRC Press.

Books for References:

1. Hand Book of Applied Cryptography - A.Menezes, P Van Oorschot and S.Vanstone, CRC Press, 1997.
2. Network Security- Ankit Fadia MacMillan.
3. Cryptography and Network Security - Behrouz A. Forouzan , Mc Graw Hill.

Web Resources:

1. <https://www.geeksforgeeks.org/rsa-algorithm-cryptography/>
Unit V – RSA algorithm implementation
2. <https://www.educative.io/answers/how-to-create-digital-signature-in-python-using-ecdsa-signingkey>
Unit V – DSA algorithm implementation
3. <https://blog.cryptographyengineering.com/2012/01/12/useful-cryptography-resources/>
4. <https://www.tutorialspoint.com/cryptography/index.htm>
5. <https://www.geeksforgeeks.org/web-security-considerations>
6. http://almuhammadi.com/sultan/books_2020/Forouzan.pdf
7. <https://www.techtarget.com/searchsecurity/definition/RSA>

Rationale for Nature of the course:

- Network security helps to protect sensitive data, improve network efficiency, and prevent cybercrime.
- Cryptography ensures confidentiality by encrypting sent messages using an algorithm with a key only known to the sender and recipient.
- Web security maintains the smooth operation of any business that uses computers and prevents hackers and malware from manipulating your systems, software, or network.

Activities having direct bearing on Skill development / Employability:

- Analyze and design classical encryption techniques and block ciphers.
- Bearing Physical abilities, Critical thinking, Problem-solving, Communication, Observation, and teamwork.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Mrs. K.Vairameenakshi

Course Schedule:

Unit	Topics	Hrs	Mode
Unit I	Introduction to Cryptography – Security Attacks – Security Services - Security Algorithm- Stream cipher and Block cipher	7	Lecture, Quiz, PPT, Test, Seminar
	Symmetric and Asymmetric key - Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.	8	
Unit II	Public-key Cryptosystem: Introduction to Number Theory-RSA Algorithm. Key Management Diff Hellman Key exchange Elliptic Curve Cryptography.	7	Lecture, Quiz, Assignment, Test, Seminar
	Message Authentication and Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.	8	
Unit III	Network Security Practice: Authentication Applications– Kerberos.	7	Lecture, Quiz, Group Discussion, Test, Seminar
	X.509 Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.	8	
Unit IV	Web Security: Secure Socket Layer Secure Electronic Transaction.	7	Lecture, Quiz, Test, Seminar
	System Security-Intruders and Viruses – Firewalls– Password Security.	8	
Unit V	Case Study: Implementation of Cryptographic Algorithms –RSA–DSA– ECC (C/JAVA Programming).	7	Lecture, Seminar, Quiz, Group Discussion
	Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Stenography – Water Marking.	8	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Describe the process of the crypto graphical algorithms.	K2
CLO-2	Apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.	K3
CLO-3	Apply and analyze appropriate security techniques to solve network security problem.	K3
CLO-4	Focus on Intruders and Intruder Detection mechanism. Types of Malicious software and Firewall.	K4
CLO-5	Analyze different digital signature algorithms to achieve authentication and design secure applications.	K4

Mapping of CLOs with PSOs:

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	2	3
CLO-2	3	3	3	2	3
CLO-3	3	3	3	2	3
CLO-4	3	3	2	2	3
CLO-5	3	3	2	2	3

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	2	2	2	2	3
CLO-2	3	3	3	2	3	3
CLO-3	3	3	3	2	3	3
CLO-4	3	3	2	2	2	3
CLO-5	3	3	2	2	2	3

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

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1 & K2	1	K1	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(K3)
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			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 with 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%

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Discipline Elective	23P3DECT5	Digital Image Processing	3	5	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		Entrepreneurship Oriented			

Objectives:

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To Design and implement algorithms that perform Image Enhancement and spatial filtering.
- To familiarize students with Image Restoration techniques.
- To Gain knowledge in Image Compression.
- To acquire the knowledge of Image Segmentation techniques for getting quality images.

Unit	Description	Hours	K-level	CLO
I	Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.	15	K2	CLO 1
II	Image Enhancement: Image Enhancement in the spatial domain - Background – some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.	15	K4	CLO 2
III	Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations	15	K3	CLO 3
IV	Image Compression: Fundamentals–Image compression models– Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.	15	K3	CLO 4
V	Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.	15	K4	CLO 5

Book for Study:

Digital Image Processing – Rafael C.Gonzalez, Richard E.Woods, - Second Edition, PHI/Pearson Education.

Unit I – 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6

Unit II - 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8

Unit III - 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11

Unit IV – 8.1, 8.2, 8.3, 8.4, 8.5, 8.6

Unit V – 10.1, 10.2, 10.3, 10.4, 10.5, 10.6

Books for References:

1. Fundamentals of Digital Image Processing - Anil K.Jain – Prentice Hall.
2. Digital Image Processing using MATLAB - Rafael C. Gonzalez, Richard E. Woods, 2nd Edition, Prentice Hall of India, 2002.
3. Computer Vision and Image Processing - Adrian Low - Second Edition, B.S.Publications.
4. Introduction to Digital Image Processing with Matlab - Alasdair McAndrew, Thomson Course Technology
5. Digital Image Processing and Analysis B.Chanda, D.Dutta Majumder, 2001 – PHI.

Web Resources:

1. https://www.cet.edu.in/noticefiles/272_Digital-Image-Processing.pdf
2. <http://www.eie.polyu.edu.hk/~enyhchan/imagee.pdf>
3. <https://www.tutorialsduniya.com/notes/digital-image-processing-notes/>

Rationale for Nature of the course:

- To perform some operations on an image, in order to get an enhanced image or to extract some useful information from it.

Activities having direct bearing on Skill development:

- Practice to compare various algorithm on image processing.
- Practice to implement some algorithm as Assignment.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Mrs. R. Lakshapriya

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP.	5	Lecture, Quiz, PPT, Test, Seminar
	Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition	5	
	Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.	5	
Unit II	Image Enhancement: Image Enhancement in the spatial domain - Background – some basic Gray level Transformations.	5	Lecture, Quiz, Test, Seminar
	Histogram Processing – Enhancement using Arithmetic / Logic operations	5	
	Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.	5	
Unit III	Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only.	5	Lecture, Quiz, Group Discussion, Test, Seminar
	Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering.	5	
	Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.	5	
Unit IV	Image Compression: Fundamentals–Image compression models.	5	Lecture, Quiz, Assignment, Test, Seminar
	Elements of Information Theory – Error Free compression.	5	
	Lossy compression – Image compression standards.	5	
Unit V	Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction.	5	Lecture, Quiz, Group Discussion, Seminar
	Thresholding – Region-Based segmentation	5	
	Segmentation by Morphological watersheds – The use of motion in segmentation.	5	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Describe the fundamental concepts of a digital image processing system.	K2
CLO-2	Analyze the various methods of Image Enhancement.	K4
CLO-3	Apply image restoration to "compensate for" or "undo" defects which degrade an image.	K3
CLO-4	Utilize the compression techniques on Image to minimize its size in bytes without degrading image quality.	K3
CLO-5	Inspect the significance of Image Segmentation	K4

Mapping of CLOs with PSOs:

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	1	1	3
CLO-2	3	2	3	1	3
CLO-3	3	2	3	1	3
CLO-4	3	2	3	1	3
CLO-5	3	2	3	1	3

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	1	1	1	1	2	1
CLO-2	2	3	3	1	3	3
CLO-3	2	3	3	1	3	2
CLO-4	2	3	3	1	3	2
CLO-5	2	3	3	1	3	3

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

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K4	2	K1 & K2	1	K1	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	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			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 with 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%

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	MDC	23P3DMDC1	Embedded Systems	3	5	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To understand the concept of 8051 microcontroller.
- To impart knowledge in micro programming and its applications.
- To study the basics of RTOS.
- To acquire knowledge on Analyze and Design various real time embedded system using RTOS.
- To familiarize the concepts of Grammars and Languages.

Unit	Description	Hours	K - level	CLO
I	8051 Architecture: Introduction-8051 Microcontroller Hardware - Input / Output Pins, Ports and Circuits- External Memory - Counters and Timers - Serial Data Input / Output –Interrupts.	15	K2	CLO 1
II	Moving Data: Addressing Modes – External Data Moves – Code Memory Read-Only Data Moves – PUSH and POP Opcodes – Data Exchanges. Logical operations - Arithmetic Operations - Jump and Call Instructions - Simple Program.	15	K2	CLO 2
III	Applications: Keyboard Interface - Display Interface - Pulse Measurements – D/A and A/D Conversions - Multiple Interrupts.	15	K2	CLO 3
IV	CONCEPTS ON RTOS: Introduction to RTOS - Selecting an RTOS -Task and Task states - Tasks and data - Semaphores and shared data. MORE operating systems services: Interrupt Process communication - Message Queues, Mailboxes and pipes - Timer Functions-Events - Memory Management - Interrupt Routines in an RTOS Environment.	15	K2	CLO 4
V	Languages and Grammars – Introduction , Phrase – Structure Grammars, Types of Phrase – Structure Grammars, Derivation Trees, Finite State Machines with Output: Introduction - Finite State Machines with Outputs, Finite State Machines with No Output: Introduction – Set of Strings – Finite – State Automata – Language Recognition by Finite - State Machines, Nondeterministic Finite – State Automata, Turing Machines: Introduction, Definition of Turing Machines, Using Turing Machines to Recognize Sets, Computing Functions with Turing Machines, Different Types of Turing Machines, Computational Complexity , Computability and Decidability	15	K2	CLO 5

Books for Study:

1. The 8051 Microcontroller and Architecture programming and application – Kenneth J Ayala, Second Edition, Penram International.
Unit I – 2
Unit II – 3, 4, 5, 6
Unit III - 8
2. An Embedded Software Primer - David E. Simon - Pearson Education Asia, 2003.
Unit IV – 6, 7
3. Discrete Mathematics and its Applications - Kenneth H.Rosen , Special Indian edition, Tata McGraw – HillPub. Co.Ltd., New Delhi, 2011.
Unit V – 13.1.1, 13.1.2, 13.1.3, 13.1.4, 13.2, 13.3.1, 13.3.2, 13.3.3, 13.3.4, 13.3.8, 13.5.1, 13.5.2, 13.5.3, 13.5.4, 13.5.5, 13.5.

Books for References:

1. Embedded Systems Architecture, Programming and Design - D Raj Kamal, Tata McGraw–Hill, 2003.
2. Embedded Systems: Design, Programming and Applications - A.K. Ganguly – Alpha Science International Limited, 2014.
3. Hands-On RTOS with Microcontrollers – Brain Amos – Packt publications, 2020.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs14/preview
2. <https://www.javatpoint.com/embedded-system-tutorial>
3. https://www.tutorialspoint.com/embedded_systems/index.htm
4. <https://www.geeksforgeeks.org/relationship-between-grammar-and-language-in-theory-of-computation/>

Rationale for Nature of the course:

- The purpose of embedded systems is to combination of computer hardware and software designed to control a specific function within a device.

Activities having direct bearing on Skill development / Employability:

- Embedded system operates in an efficient and reliable manner by managing hardware and software resources.
- To provide an abstraction layer to simplify the process of developing higher layers of software.

Pedagogy:

- Chalk and Talk, PPT, Assignment, Seminar, Group Discussion, Test and Quiz.

Course Designer:

- Mr. N. Radha Krishnan
- Dr.P.Pandi
- Dr.S.Vallirani

Course Schedule:

Unit	Topics	Hrs	Mode
Unit I	8051Microcontroller: Introduction – 8051 Architecture - Input / Output Pins, Ports and Circuits.	7	Lecture, Quiz, PPT, Test, Seminar
	External Memory - Counters / Timers - Serial Data Input / Output –Interrupts.	8	
Unit II	Moving Data: Addressing Modes – External Data Moves – Code Memory Read-Only Data Moves – PUSH and POP Opcodes – Data Exchanges. Logical operations.	7	Lecture, Quiz, Assignment, Test, Seminar
	Arithmetic Operations - Jump and Call Instructions - Simple Program.	8	
Unit III	Applications: Keyboard Interface - Display Interface.	7	Lecture, Quiz, Test, Seminar
	Pulse Measurements – D/A and A/D Conversions - Multiple Interrupts	8	
Unit IV	CONCEPTS ON RTOS: Introduction to RTOS - Selecting an RTOS -Task and Task states - Tasks and data - Semaphores and shared data.	7	Lecture, Quiz, Group Discussion, Test, Seminar
	MORE operating systems services: Interrupt Process communication - Message Queues, Mailboxes and pipes - Timer Functions-Events - Memory Management - Interrupt Routines in an RTOS Environment.	8	
Unit V	Languages and Grammars – Introduction , Pharse – Structure Grammars, Types of Phrase – Structure Grammars, Derivation Trees, Finite State Machines with Output: Introduction - Finite State Machines with Outputs.	7	Lecture, Seminar, Quiz
	Finite State Machines with No Output: Introduction – Set of Strings – Finite – State Automata – Language Recognition by Finite - State Machines, Nondeterministic Finite – State Automata, Turing Machines: Introduction, Definition of Turing Machines, Using Turing Machines to Recognize Sets, Computing Functions with Turing Machines, Different Types of Turing Machines, Computational Complexity , Computability and Decidability	8	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Describe the concepts of 8051 Microcontroller and its architectures.	K2
CLO-2	Summarize various instruction types in micro programming and its applications.	K2
CLO-3	Illustrate the basics of Instruction Set and Programming logics.	K2
CLO-4	Discuss the concepts of RTOS and its environments.	K2
CLO-5	Represent various grammar and languages using Automata.	K2

Mapping of CLOs with PSOs:

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	2	2
CLO-2	3	2	1	2	1
CLO-3	3	2	1	2	1
CLO-4	3	2	1	2	1
CLO-5	3	2	2	2	2

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	3	3	1	1	1
CLO-2	3	1	1	1	1	1
CLO-3	3	3	3	1	3	3
CLO-4	3	2	2	3	2	2
CLO-5	3	2	2	2	2	2

Advanced application– 3; Intermediate level–2; Basic level–1

Summative - Blue – Print – Model
(Mapping with Course Learning Outcomes (CLOs))

Units	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	CLO 1	Up to K2	2	K1	1	K2 & K2	1(K2)
2	CLO 2	Up to K2	2	K1	1	K2 & K2	1(K2)
3	CLO 3	Up to K2	2	K1	1	K2 & K2	1(K2)
4	CLO 4	Up to K2	2	K1	1	K2 & K2	1(K2)
5	CLO 5	Up to K2	2	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			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 (No Choice)	Section B (Either / or Choice)	Section C (Open Choice)	Total Marks	% of Marks with 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. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	NME	23P3DSEN2	Basic Excel Techniques	2	2	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		✓

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 Aggregate numeric data and summarize into categories and subcategories.
- To Present the data in the form of charts and graphs.

Unit	Description	Hours	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.	6	K2	CLO 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.	6	K2	CLO 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 .	6	K2	CLO 3
IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- WhatIf Analysis - Goal Seek- Data Tables- Scenario Manager.	6	K2	CLO 4
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	6	K2	CLO 5

Books for Study:

1. Microsoft Excel 2013 Bible The Comprehensive Tutorial Resource- John Walkenbach – John Wiley & Sons, Inc.
Unit –I: 1, 2, 3
Unit –II: 4, 5, 9
Unit –III: 10, 13 , 14
2. Excel 2019 All-in-One for Dummies – 2018- Greg Harvey
Unit – IV: Book 1 ((book3 Chapter (1,2,3),book2 Chapter(2,3), book7 (Chapter 1))
3. Excel 2010 Advanced – Stephen Moffat, The Mouse training Company &Ventus Publishing ApS – 2011
Unit – V: Book3(Chapter 19)

Books for References:

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://corporatefinanceinstitute.com/resources/excel/basic-excel-formulas-beginners/>
2. <https://www.simplilearn.com/tutorials/excel-tutorial/excel-formulas>

3. <https://www.smartsheet.com/how-to-make-charts-in-excel>
4. https://www.w3schools.com/excel/excel_formulas.php
5. <https://www.datacamp.com/tutorial/basic-excel-formulas-for-everyone>

Rationale for Nature of the course:

- The most used spreadsheet program in many business activities, educational training and personal data organization.
- Excel functions as software for processing numbers, but in detail, this software is also used to create, edit, sort, analyze, and summarize data.
- By organizing data using software like Excel, data analysts and other users can make information easier to view as data is added or changed.

Activities having direct bearing on Skill development / Employability:

- By giving enough practices on Data Management with Interaction & Demonstration.
- By Practicing Business Process Outsourcing and Knowledge Process Outsourcing according to the requirements.
- Developing Payrolls, managing data and perform statistical analysis.

Pedagogy:

- Chalk and Talk, PPT, Assignment, Seminar, Quiz, Test and Group Discussion.

Course Designer:

- Mrs. K.Vairameenakshi

Course Schedule:

Unit	Topics	Hrs	Mode
Unit 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	Lecture Quiz, PPT, Test, Seminar
	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.	2	
	Essential Worksheet Operations: Learning the Fundamentals of Excel Worksheets - Controlling the Worksheet View - Working with Rows and Columns.	2	

Unit II	Working with Cells and Ranges: Understanding Cells and Ranges - Copying or Moving Ranges - Using Names to Work with Ranges- Adding Comments to Cells.	2	Lecture , Quiz, Group Discussion, Assignment, Test, Seminar
	Introducing Tables: What Is a Table? - Creating a Table - Changing the Look of a Table - Working with Tables - Navigating in a table.	2	
	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.	2	
Unit 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	2	Lecture , PPT, Test, Quiz, Seminar
	Correcting Common Formula Errors - Using Advanced Naming Techniques - Working with Formulas - Creating Formulas That Count and Sum: Counting and Summing Worksheet Cells.	2	
	Basic Counting Formulas - Advanced Counting Formulas – Summing Formulas - Conditional Sums Using a Single Criterion - Conditional Sums Using Multiple	2	
Unit IV	More Functions Date and time functions- Text functions- Database functions	2	Lecture, Quiz, Test, Seminar
	Power Functions - Formatting Using auto formatting option for worksheets. Using conditional formatting option for rows, columns and cells	2	
	WhatIf Analysis - Goal Seek- Data Tables - Scenario Manager.	2	
Unit V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together	2	Lecture, Seminar, Quiz
	Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word.	2	
	Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	2	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Describe about the workbook, worksheet and its basic operations.	K2
CLO-2	Outline the significance of using cell ranges and tables.	K2
CLO-3	Show the importance of function and formulas.	K2
CLO-4	Demonstrate the Date and time functions	K2
CLO-5	Discuss about the Creating chart and graphics	K2

Mapping of CLOs with PSOs:

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	1	2
CLO-2	3	2	2	2	1
CLO-3	3	3	3	2	3
CLO-4	3	1	1	1	3
CLO-5	2	1	1	1	2

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	2	3	1	2	2
CLO-2	3	2	2	2	1	1
CLO-3	3	3	2	2	3	3
CLO-4	3	1	3	1	3	3
CLO-5	2	1	3	1	2	2

Advanced application– 3; Intermediate level–2; Basic level–1

Summative - Blue – Print – Model
(Mapping with Course Learning Outcomes (CLOs))

Units	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	CLO 1	Up to K2	1	K1	1	K2 & K2	1(K1)
2	CLO 2	Up to K2	1	K1	1	K2 & K2	1(K1)
3	CLO 3	Up to K2	1	K1	1	K2 & K2	1(K1)
4	CLO 4	Up to K2	1	K1	1	K2 & K2	1(K1)
5	CLO 5	Up to K2	1	K1	1	K2 & K2	1(K1)
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			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 (No Choice)	Section B (Either/or)	Section C (Open Choice)	Total Marks	% of Marks with choice	Consolidated
K1	10	-	50	60	46.15	100
K2	-	70	-	70	53.85	
Total Marks	10	70	50	130	100	100%

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Internship/Industrial Activity	23P3DINTR	Internship	2	-	-	-	-
Nature of Course								
Skill Oriented		✓	Employability Oriented	✓	Entrepreneurship Oriented		✓	

Course Objectives:

- To motivate students to takeup internship in research institutions / industry.
- To develop the employability of students.
- To promote entrepreneurial tendencies among students.

During the second semester vacation, students shall undertake internship for a minimum period of two weeks and submit a report and certificate from the company / industry / institution offering internship.

At the end of the internship, the students will be able to

CLOs	Course Learning Outcomes	K level
CLO 1	Work independently and as a team in mission critical projects in real-time	K4
CLO 2	Develop into a critical thinker and solve every day problems in the industry.	K5
CLO 3	Learn and analyze problems faced by the industry and workforce at large.	K4
CLO 4	Survey the job market / understand entrepreneurial opportunities / research opportunities available to them.	K2
CLO 5	Communicate precisely and accurately with team members and supervisors.	K3

Mapping of CLOs with 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

Advance application –3, Intermediate level –2 , Basic level–1

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	3	3	3	3
CLO 2	3	3	3	3	3
CLO 3	3	3	3	3	3
CLO 4	3	3	3	3	3
CLO 5	3	3	3	3	3

Advance application –3, Intermediate level –2 , Basic level–1

Valuation schema for Internship

The student will be graded on a seven point scale with corresponding GPAs as mentioned below.

Grade	GPA
Outstanding	10
Excellent	9
Very Good	8
Good	7
Average	6
Below average	5
Reappearance	1-4

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	Core Theory	23P4DCCT7	Web Application Development	5	6	25	75	100
Nature of Course								
Skill Oriented			Employability Oriented	✓	Entrepreneurship Oriented			

Objectives:

- To know the various HTML tags and to design simple web pages.
- To practice the CSS properties and Java Script.
- To impart the knowledge on the fundamentals of PHP.
- To create interactive applications using functions in PHP.
- To learn and use open source database management system MySQL.

Unit	Description	Hours	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. Images, Audio, and Video: Adding Images Using the Element, Tables: Introducing Tables, Grouping Section of a Table, Nested 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.	18	K2	CLO 1
II	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. Java Script: Functions - Message box, Dialog Boxes, Alert Boxes, Confirm Boxes, and Prompt Boxes. Working with JavaScript: Practical Tips for Writing Scripts.	18	K4	CLO 2
III	Basic development Concepts – Creating first PHP Scripts –Using Variable and Operators-Storing Data in variable-Understanding Data types-Using Constants-Writing Simple Conditional Statements -Repeating Action with Loops – Working with String and Numeric Functions-Storing Data in Arrays-Working with Dates and Times.	18	K3	CLO 3

IV	Creating User-Defined Functions - Creating Classes – Using Advanced OOP Concepts. Working with Files and Directories: Reading Files- Writing Files Processing Directories.	18	K3	CLO 4
V	Introducing Database and SQL- Using MySQL- Adding and modifying Data Handling Errors – Using SQLite Extension and PDO Extension. Introduction XML - Simple XML and DOM Extension.	18	K4	CLO 5

Books for Study:

1. Beginning HTML, XHTML, CSS and Java script-Jon Duckett, Wiley Publishing.
Unit I: 1 to 6
Unit II: 7, 8
2. PHP A Beginner's Guide-Vikram Vaswani- Tata McGraw-Hill.
Unit III: 1 to 4
Unit IV: 5, 6
Unit V: 7, 8

Books for References:

1. Web Programming- Chris Bates-Wiley Publishing 3d Edition.
2. The PHP Complete Reference – Steven Holzner – Tata McGraw-Hill Edition.
3. Spring into PHP5 – Steven Holzer- Tata McCraw Hill Edition

Web Resources:

1. <https://www.w3schools.com/html/default.asp>
2. <https://www.w3schools.com/Css/>
3. <https://www.tutorialride.com/web-technologies.htm>
4. <https://www.tutorialspoint.com/php/index.htm>

Rationale for Nature of the course:

- Enhances practical skills to develop dynamic and interactive web sites.
- Fostering creativity in designing functional and user-friendly web applications.
- Build scalable, secure and user-centric solutions in today's technology-driven landscape.

Activities having direct bearing on Skill development / Employability:

- Practice to write programs and bug fixing.
- Practice to design a dynamic web page.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Mr. M. Ashok Kumar

Course Schedule

Unit	Topics	Hrs	Mode
Unit 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. Images, Audio, and Video: Adding Images Using the Element.	9	Lecture, PPT, Quiz, Test, Seminar
	Tables: Introducing Tables, Grouping Section of a Table, Nested 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.	9	
Unit II	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.	9	Lecture, Quiz, Test, Seminar
	Java Script: Functions - Message box, Dialog Boxes, Alert Boxes, Confirm Boxes, and Prompt Boxes. Working with JavaScript: Practical Tips for Writing Scripts.	9	
Unit III	Basic development Concepts – Creating first PHP Scripts –Using Variable and Operators-Storing Data in variable-Understanding Data types-Using Constants.	9	Lecture, Group Discussion, Quiz, Test, Seminar
	Writing Simple Conditional Statements -Repeating Action with Loops – Working with String and Numeric Functions. Storing Data in Arrays-Working with Dates and Times.	9	
Unit IV	Creating User-Defined Functions - Creating Classes – Using Advanced OOP Concepts.	9	Lecture, Assignment, Quiz, Test, Seminar
	Working with Files and Directories: Reading Files- Writing Files Processing Directories.	9	
Unit V	Introducing Database and SQL- Using MySQL- Adding and modifying Data Handling Errors – Using SQLite Extension and PDO Extension.	9	Lecture, PPT, Seminar, Quiz
	Introduction XML - Simple XML and DOM Extension.	9	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Demonstrate the various HTML tags to create web pages.	K2
CLO-2	Analyze the various CSS properties to display the HTML elements.	K4
CLO-3	Construct PHP script to create dynamic web applications.	K3
CLO-4	Collect the procedures for Working with Files and Directories in PHP.	K3
CLO-5	Illustrate SQL commands to database development environment.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	1	3	3
CLO-2	3	3	2	3	3
CLO-3	3	2	2	2	2
CLO-4	3	2	1	3	2
CLO-5	3	3	2	3	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	2	1	3	1	3
CLO-2	3	3	2	3	2	3
CLO-3	3	2	2	2	2	2
CLO-4	3	2	1	3	1	2
CLO-5	3	3	2	3	2	3

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

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K4	2	K1 & K2	1	K1	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	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			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 with 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%

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	Core Practical	23P4DCCP4	Web Application Development Lab	4	6	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To know the various HTML tags and to design simple web pages.
- To practice the CSS properties and Java Script.
- To impart the knowledge on the fundamentals of PHP.
- To create interactive applications using functions in PHP.
- To learn and use open source database management system MySQL.

Unit	Description	Hours	K-level	CLO
I	Introducing HTML : 1. Develop a HTML document to i) display Text with Bullets / Numbers - Using Lists ii) to display the Table Format Data. 2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India. 3. Develop a Complete Web Page using Frames and Framesets which gives the Information about a Hospital using HTML. 4. Develop a website for your college using advanced tags of HTML.	18	K2	CLO 1
II	Cascading Style Sheets: 5. Write a HTML document to print your Bio-Data in a neat format using CSS. 6. Write HTML for demonstration of CSS: Embedded style sheets, External style sheets and Inline Styles. 7. Develop JavaScript program to display a Registration Form for an inter-collegiate function. 8. Write a JavaScript program to validate user login page.	18	K4	CLO 2

III	PHP Script: - Write a PHP script using nested for loop that creates a chess board. - Write a program to accept two numbers n1 and n2 using HTML form and display the Prime numbers between n1 and n2 using PHP. - Create a PHP script which display the capital and country name from the given array. Sort the list by the name of the country. - Using HTML form accept Customer details like Name, City, Pin code, Phone number and Email address and validate the data and display appropriate messages for violations using PHP(Eg.Name is Mandatory field; Pin code must be 6digits, etc.)	18	K3	CLO 3
IV	PHP Functions and Files: - Write a PHP function that checks if a string is all lower case. - Write a PHP program for User-defined function. - Write a PHP program to print the personal details using file. - Write a PHP program to perform a file operation.	18	K3	CLO 4
V	SQL MySQL and XML: - Write a PHP program to create a database and table using SQL Query. - Write a PHP program to Insert, Update, Delete and Select data from database using MySQL. - Write a program for implementing XML document for customer details. - Write an XML for person information and access second students data using DOM.	18	K4	CLO 5

Books for Study:

- Beginning HTML, XHTML, CSS and Java script-Jon Duckett- Wiley Publishing.
- Web Enabled Commercial Applications Development Using HTML, JavaScript, DHTML and PHP-Ivan Bayross -BPB Publications, 4th Revised Edition, 2010

Books for References:

- Web Programming- Chris Bates-Wiley Publishing 3d Edition.
- The PHP Complete Reference – Steven Holzner – Tata McGraw-Hill Edition.
- Spring into PHP5 – Steven Holzer- Tata McCraw Hill Edition

Web Resources:

- <https://www.w3schools.com/html/default.asp>
- <https://www.w3schools.com/Css/>
- <https://www.tutorialride.com/web-technologies.htm>

4. <https://www.w3schools.com/php/>
5. <https://www.tutorialspoint.com/php/index.htm>

Rationale for Nature of the course:

- Enhances practical skills to develop dynamic and interactive web sites.
- Fostering creativity in designing functional and user-friendly web applications.
- Build scalable, secure and user-centric solutions in today's technology-driven landscape.

Activities having direct bearing on Skill development / Employability:

- Practice to write programs and bug fixing.
- Practice to design a dynamic web page.

Pedagogy:

- Demonstration using Projector and Practical Session.

Course Designer:

- Mr. M. Ashok Kumar

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	1. Develop a HTML document to i) display Text with Bullets / Numbers - Using Lists ii) to display the Table Format Data. 2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India.	9	Demo & Practical Session
	3. Develop a Complete Web Page using Frames and Framesets which gives the Information about a Hospital using HTML. 4. Develop a website for your college using advanced tags of HTML.	9	
Unit II	5. Write a HTML document to print your Bio-Data in a neat format using CSS. 6. Write HTML for demonstration of CSS: Embedded style sheets, External style sheets and Inline styles	9	Demo & Practical Session.
	7. Develop JavaScript program to display a Registration Form for an inter-collegiate function. 8. Write a Java Script program to validate user login page.	9	
Unit III	9. Write a PHP script using nested for loop that creates a chess board. 10. Write a program to accept two numbers n1 and n2 using HTML form and display the Prime numbers between n1 and n2 using PHP.	9	Demo & Practical Session

	11. Create a PHP script which display the capital and country name from the given array. Sort the list by the name of the country. 12. Using HTML form accept Customer details like Name, City, Pin code, Phone number and Email address and validate the data and display appropriate messages for violations using PHP(Eg. Name is Mandatory field; Pin code must be 6digits,etc)	9	
Unit IV	13. Write a PHP function that checks if a string is all lower case. 14. Write a PHP program for User-defined function.	9	Demo & Practical Session.
	15. Write a PHP program to print the personal details using file. 16. Write a PHP program to perform a file operation.	9	
Unit V	17. Write a PHP program to create a database and table using SQL Query. 18. Write a PHP program to Insert, Update, Delete and Select data from database using MySQL.	9	Demo & Practical Session.
	19. Write a program for implementing XML document for customer details. 20. Write an XML for person information and access second students data using DOM.	9	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Demonstrate the various HTML tags to create web pages.	K2
CLO-2	Analyze the various CSS properties to display the HTML elements.	K4
CLO-3	Construct PHP script to create dynamic web applications.	K3
CLO-4	Collect the procedures for Working with Files and Directories in PHP.	K3
CLO-5	Illustrate SQL commands to database development environment.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	1	3	3
CLO-2	3	3	2	3	3
CLO-3	3	2	2	2	2
CLO-4	3	2	1	3	2
CLO-5	3	3	2	3	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	2	1	3	1	3
CLO-2	3	3	2	3	2	3
CLO-3	3	2	2	2	2	2
CLO-4	3	2	1	3	1	2
CLO-5	3	3	2	3	2	3

Advanced application– 3; Intermediate level–2; Basic level–1

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	Project	23P4DPROV	Project with Viva-voce	8	8	60	40	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		✓

Objectives:

- To motivate students to take up research projects in their field of interest.
- To promote scientific temper and systematic approach to problem solving and research methodology.
- To promote research writing aptitude among students.

During the fourth semester, students shall undertake a project work and submit the project report.

CLOs	Course Learning Outcomes	K level
CLO 1	Survey scientific literature available and identify gaps in existing studies	K4
CLO 2	Design a scientific study taking practical constraints into account	K5
CLO 3	Perform the scientific study taking practical constraints into account.	K3
CLO 4	Analyze the results.	K4
CLO 5	Communicate the findings based on ethical standards of reporting.	K3

Mapping of CLOs with 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

Advance application –3, Intermediate level –2 , Basic level–1

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	3	3	3	3
CLO 2	3	3	3	3	3
CLO 3	3	3	3	3	3
CLO 4	3	3	3	3	3
CLO 5	3	3	3	3	3

Advance application –3, Intermediate level –2 , Basic level–1

Internal and External Valuation for Project

Internal	External
25 marks	75 Mark
Guide Evaluation: ● 10 Marks for Students ability and interest ● 10 Marks for Regularity and Punctuality ● 5 Marks for Quality of the work and Presentation	Dept. Evaluation: 25 (Min (No.) 50 % of faculty must be present) ● 15 Marks for Presentation using ICT tools. ● 10 Marks for Quality and Publications / Presentation in Seminar/ conferences External Evaluation: 50 ● 20 Marks for the Report ● 30 Marks for Presentation, Quality of work and Viva voce.

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	Discipline Elective	23P4DECT6	Blockchain Technology	3	6	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To understand the fundamentals of Blockchain and its application.
- To learn security features and its significance.
- To acquire knowledge on Cryptocurrency and bitcoin protocols.
- To know the impact of cryptocurrency regulation on financial stability.
- To identify opportunities & challenges posed by Blockchain.

Unit	Description	Hours	K-level	CLO
I	Introduction: Introduction To Blockchain - The Big Picture Of The Industry – Size, Growth, Structure, Players. Bitcoin Versus Crypto Currencies Versus Blockchain - Distributed Ledger Technology (Dlt). Strategic Analysis Of The Space – Blockchain Platforms, Regulators, Application Providers. The Major Application: Currency, Identity, Chain Of Custody.	18	K2	CLO 1
II	Network And Security: Advantage Over Conventional Distributed Database, Blockchain Network, Mining Mechanism, Distributed Consensus, Blockchain 1.0, 2.0 And 3.0 – Transition, Advancements And Features. Privacy, Security Issues In Blockchain.	18	K4	CLO 2
III	Cryptocurrency: Cryptocurrency - History, Distributed Ledger, Bitcoin Protocols -Symmetric-Key Cryptography - Public-Key Cryptography - Digital Signatures -High And Low Trust Societies - Types Of Trust Model: Peer-To-Peer, Leviathan, And Intermediary. Application Of Cryptography To Blockchain.	18	K3	CLO 3
IV	Cryptocurrency Regulation: Cryptocurrency Regulation-Stakeholders, Roots Of Bit Coin, Legal Views-Exchange Of Cryptocurrency - Black Market-Global Economy. Crypto Economics-Assets, Supply And Demand, Inflation And Deflation – Regulation.	18	K3	CLO 4
V	Challenges In Blockchain: Opportunities And Challenges In Blockchain – Application Of Blockchain: Industry 4.0 – Machine To Machine Communication –Data Management In Industry4.0–Future Prospects. Blockchain In Health 4.0 – Blockchain Properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges For Using Blockchain For Healthcare Data.	18	K4	CLO 5

Books for Study:

1. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction - Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder (July 19, 2016) - Princeton University Press.
Unit 2: 5
Unit 4: 7
2. Mastering Bitcoin: Unlocking Digital Crypto currencies – Antonopoulos.
Unit 1: 1
Unit 3: 4
3. Blockchain Technology for Industry 4.0 -Rodrigoda Rosa Righi, Antonio Marcos Alberti, Madhusudan Singh -Springer 2020
Unit 5:

Books for References:

1. Bitcoin: A Peer-to-Peer Electronic Cash System –Satoshi Nakamoto.
2. Mastering Blockchain – Imran Bashir – Packt Publishing Ltd., 2nd Edition, 2017.

Web Resources:

1. <https://www.javatpoint.com/blockchain-tutorial>
2. <https://www.tutorialspoint.com/blockchain/index.htm>
3. <https://www.investopedia.com/terms/b/blockchain.asp>

Rationale for Nature of the course:

- Helps in the verification and traceability of multistep transactions.
- Provide secure transactions, reduce compliance costs, and speed up data transfer processing.

Activities having direct bearing on Skill development / Employability:

- By having group discussions and interactive session at regular basis on cryptography concepts.
- Deploying a model of smart contracts.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Ms. S. Saranya

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction: Introduction To Blockchain - The Big Picture Of The Industry – Size, Growth, Structure, Players. Bitcoin Versus Crypto Currencies Versus Blockchain - Distributed Ledger Technology (Dlt). Strategic Analysis Of The Space.	9	Lecture, PPT , Quiz, Test, Seminar
	Blockchain Platforms, Regulators, Application Providers. The Major Application: Currency, Identity, Chain Of Custody.	9	
Unit II	Network And Security: Advantage Over Conventional Distributed Database, Blockchain Network, Mining Mechanism, Distributed Consensus, Blockchain 1.0, 2.0 And 3.0.	9	Lecture, Quiz, Assignment, Test, Seminar
	Transition, Advancements And Features. Privacy, Security Issues In Blockchain.	9	
Unit III	Cryptocurrency: Cryptocurrency - History, Distributed Ledger, Bitcoin Protocols -Symmetric-Key Cryptography - Public-Key Cryptography - Digital Signatures.	9	Lecture, Group Discussion ,Quiz, Test, Seminar
	High and Low trust societies - Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary. Application of Cryptography to Blockchain.	9	
Unit IV	Cryptocurrency Regulation: Cryptocurrency Regulation-Stakeholders, Roots Of Bit Coin, Legal Views-Exchange Of Cryptocurrency.	9	Lecture, Test, Quiz, Seminar
	Black Market-Global Economy. Crypto Economics–Assets, Supply And Demand, Inflation And Deflation – Regulation.	9	
Unit V	Challenges In Blockchain: Opportunities And Challenges In Blockchain – Application Of Blockchain: Industry 4.0 – Machine To Machine Communication –Data Management In Industry4.0–Future Prospects.	9	Lecture, PPT, Seminar, Quiz
	Blockchain In Health 4.0 – Blockchain Properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges For Using Blockchain For Healthcare Data.	9	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Demonstrate blockchain technology and cryptocurrency.	K2
CLO-2	Analyze the mining mechanism in blockchain.	K4
CLO-3	Apply and identify security measures and various types of services that allow people to trade and transact with bitcoins.	K3
CLO-4	Identify the impact of cryptocurrency regulation on financial stability, markets and innovation.	K3
CLO-5	Analyze Blockchain in healthcare industry.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	1	2	2
CLO-2	3	2	2	2	3
CLO-3	3	3	2	3	3
CLO-4	3	2	1	2	3
CLO-5	3	3	2	3	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	2	1	2	1	3	1
CLO-2	3	2	3	2	3	2
CLO-3	3	2	3	2	2	2
CLO-4	2	1	3	2	3	1
CLO-5	2	2	2	1	3	2

Advanced application– 3; Intermediate level–2; Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K4	2	K1 & K2	1	K1	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	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			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 with 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%

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	Discipline Elective	23P4DECT6	Cloud Computing	3	6	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		✓

Objectives:

- To understand the fundamental and essential of Cloud Computing.
- To provide sound foundation and start using and adopting Cloud Computing services and tools in real life scenarios.
- To focus on the importance of cloud computing driven commercial systems and applications.
- To expose the students to frontier areas of Cloud Computing and information systems web services.
- To acquire knowledge in storage and role of virtualization in the cloud.

Unit	Description	Hours	K-level	CLO
I	Introduction: Cloud Computing Introduction – From Collaboration to cloud - Working of cloud computing - pros and cons – benefits - developing cloud computing services- Cloud service development- discovering cloud services.	18	K2	CLO 1
II	Cloud Computing For Everyone: Centralizing Email Communications - Cloud Computing for Community - Collaborating on Schedules - Collaborating on Group Projects and Events - Cloud Computing for Corporation - Mapping Schedules - Managing Projects - Presenting on Road.	18	K3	CLO 2
III	Using Cloud Services: Collaborating on calendars - Schedules and Task Management – Exploring Online Scheduling and Planning - Collaborating on Event Management - Collaborating on Contact Management - Collaborating on Project Management - Collaborating on Word Processing – Spreadsheets - Databases.	18	K3	CLO 3
IV	Outside the cloud : Evaluating Web mail services –Evaluating Instant Messaging – Evaluating Web Conference Tools –Creating Groups on Social Networks – Evaluating Online Groupware – Collaborating via Blogs and Wikis.	18	K4	CLO 4
V	Storing and Sharing: Understanding Cloud Storage - Evaluating Online File storage - Exploring on line Book marking services - Exploring on line Photo editing Applications - Exploring photo Sharing Communities - Controlling it with Web Based Desktops.	18	K4	CLO 5

Book for Study:

Cloud Computing – Michael Miller, Pearson Education, New Delhi, 2009.

Unit I : 1 , 2 , 3

Unit II : 4 , 5, 6

Unit III : 7 , 8 , 9 , 10 , 11 , 12 ,13

Unit IV : 18 , 19 , 20

Unit V : 15 ,16 ,17

Books for References:

1. Cloud Computing: A Practical Approach - Anthony T.Velte First Edition, Tata McGraw Hill Education Private Limited, 2009.
2. Mastering Cloud Computing – Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi - Tata McGraw Hill Education Private Limited, 2013.
3. Cloud Computing – Sandeep Bhowmic, Cambridge University Press, 2017.

Web Resources:

1. <https://nptel.ac.in/courses/106/105/106105167/>
2. https://www.tutorialspoint.com/cloud_computing/index
3. <https://www.javatpoint.com/cloud-computing-tutorial>
4. http://academia.edu/30948967/_THE_CLOUD_A_Practical_Framework_for_Undersanding_Cloud_Computing
5. <http://geeksforgeeks.org/cloud-computing/>

Rationale for Nature of the course:

- Cloud as an infrastructure base for innovation can lead to improved performance, lowered costs, and increased agility.
- Improve DevOps in the quality and pace of innovative solution deployments.
- Lowered Complexity of IT Security and Infrastructure Management.
- With AI, machine learning, and edge computing all becoming widespread in the industry will continue its rapid growth and evolution.

Activities having direct bearing on Skill development / Employability/Entrepreneurship:

- To build, test and deploy applications and store, back up and recover data.
- To architect, plan, implement and operating workloads on cloud.
- To utilize according to individual creativity.
- To Collaborate with Vendors, Contractors and Partners.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test and Quiz.

Course Designer:

- Mrs. K.R.Ramadevi

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction: Cloud Computing Introduction – From Collaboration to cloud.	6	Lecture, PPT, Quiz, Test, Seminar
	Working of cloud computing - pros and cons – benefits - developing cloud computing services.	6	
	Cloud service development- discovering cloud services.	6	
Unit II	Cloud Computing For Everyone: Centralizing Email Communications - Cloud Computing for Community.	6	Lecture, Assignment, Quiz, Test, Seminar
	Collaborating on Schedules - Collaborating on Group Projects and Events.	6	
	Cloud Computing for Corporation - Mapping Schedules - Managing Projects - Presenting on Road.	6	
Unit III	Using Cloud Services : Collaborating on calendars - Schedules and Task Management - Exploring on Line Scheduling and Planning	6	Lecture, Group Discussion, Quiz, Test, Seminar
	Collaborating on Event Management - Collaborating on Contact Management - Collaborating on Project Management	6	
	Collaborating on Word Processing – Spreadsheets - Databases.	6	
Unit IV	Outside the Cloud : Evaluating Web mail services –Evaluating Instant Messaging	6	Lecture, Test, Quiz, Seminar
	Evaluating Web Conference Tools –Creating Groups on Social Networks.	6	
	Evaluating Online Groupware – Collaborating via Blogs and Wikis.	6	
Unit V	Storing and Sharing: Understanding Cloud Storage - Evaluating on line File storage.	6	Lecture, Seminar, Quiz
	Exploring on line Book marking services - Exploring on line Photo editing Applications	6	
	Exploring photo Sharing Communities - Controlling it with Web Based Desktops.	6	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Explain the core concepts of the cloud computing paradigm.	K2
CLO-2	Apply the fundamental concepts in data centers to understand the tradeoffs in power, efficiency and cost.	K3
CLO-3	Make use of different cloud services and determine their significance.	K3
CLO-4	Analyze existing software development strategies as applied to web design Compare and contrast Web based client-server models.	K4
CLO-5	Identify resource management fundamentals and outline their role in managing infrastructure in cloud computing.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	2	3	3
CLO-2	3	3	3	3	3
CLO-3	3	3	2	3	3
CLO-4	3	3	2	3	3
CLO-5	3	3	2	3	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	3	2	2	2	3	3
CLO-2	3	2	1	2	3	3
CLO-3	3	1	1	2	3	3
CLO-4	3	2	1	2	3	3
CLO-5	3	2	1	2	3	3

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

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1 & K2	1	K1	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(K3)
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			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

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	SEC	23P4DSED2	Quantitative Aptitude	2	4	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To understand the basic concepts of numbers.
- To understand and apply the concept of percentage, profit and loss.
- To study the basic concepts of time and work, interests.
- To learn the concepts of permutation, probability and discounts.
- To study about the concepts of data representation, graphs.

Unit	Description	Hours	K-level	CLO
I	Numbers - Decimal fractions – Simplification - Square roots and cube roots – Average - Problems on Numbers.	12	K4	CLO 1
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership - Chain rule.	12	K4	CLO 2
III	Time and work - pipes and cisterns - Time and Distance - problems on trains - Boats and streams - Logarithms – races and Games of skill.	12	K4	CLO 3
IV	Permutation and combination – Probability – True Discount – Bankers Discount – Height and Distances - Odd man out and Series.	12	K4	CLO 4
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs - Pie charts - Line graphs. General Mental Ability: Classification – Coding – Decoding. Non-Verbal Reasoning: Classification – Analytical Reasoning.	12	K4	CLO 5

Books for Study:

- Quantitative Aptitude For Competitive Examinations- R.S. Aggarwal - S. Chand & Company Ltd - Revised and Enlarged edition - 2017.
 Unit I – 1, 3, 4, 5, 6, 7
 Unit II – 8, 9, 11, 12, 13, 14, 15
 Unit III – 10, 16, 17, 18, 19, 20, 26
 Unit IV – 30, 31, 32, 33, 34, 35
 Unit V – 27, 28, 36, 37, 38, 39

2. A Modern Approach to Verbal & Non Verbal Reasoning - R.S. Aggarwal - S. Chand & Company Ltd – 15th edition, 2007.
Unit V – 2, 4, Part II - 3, 4

Books for References:

1. Quantitative Aptitude and Reasoning, R.V. Praveen, Second Edition, PHI, 2013.
2. Rapid Quantitative Aptitude with Shortcuts and Tricks for Competitive Exams, Er. Deepak Agarwal, D.P. Gupta, Disha Publications.
3. A Pearson Guide to Quantitative Aptitude for Competitive Exams, Dinesh Khattar, Pearson.

Web Resources:

1. <https://www.geeksforgeeks.org/quantitative-aptitude/>
2. <https://www.javatpoint.com/aptitude/quantitative>
3. <https://byjus.com/govt-exams/quantitative-aptitude/>

Rationale for Nature of the course:

- Aids to understand real time problems and get solutions.
- Assesses the candidate's problem-solving skills by making them utilize their rational thinking and quick decision-making ability to solve complex and time-constrained problems.
- Accelerate to represent data in a graphical way.

Activities having direct bearing on Skill development / Employability:

- Facilitates to understand the easy ways to solve complex problems.
- Practice to solve problems using analytical thinking method.
- Expedite to win competitive exams.

Pedagogy:

- Chalk and talk, PPT, Assignment, Seminar, Group discussion, Test, Quiz and Demonstration.

Course Designer:

- Mrs. S. Rajalakshmi

Course Schedule:

Unit	Topics	Hrs	Mode
Unit I	Numbers- HCF and LCM of numbers - Decimal fractions – Simplification.	6	Lecture, Quiz, PPT, Test, Seminar
	Square roots and cube roots – Average - Problems on Numbers.	6	
Unit II	Problems on Ages - Surds and Indices - percentage - profits and loss	6	Lecture, Quiz, Assignment, Test, Seminar
	Ratio and proportion-partnership - Chain rule.	6	
Unit III	Time and work - pipes and cisterns - Time and Distance - problems on trains - Boats and streams	6	Lecture, Quiz, Group Discussion, Test, Seminar
	Simple interest - compound interest - Logarithms - Area - Volume and surface area – races and Games of skill.	6	
Unit IV	Permutation and combination – Probability – True Discount.	6	Lecture, Quiz, Test, Seminar
	Bankers Discount – Height and Distances - Odd man out and Series.	6	
Unit V	Calendar - Clocks - stocks and shares - Data representation	6	Lecture, PPT, Seminar, Quiz
	Tabulation – Bar Graphs - Pie charts - Line graphs.	6	

Course Learning Outcomes:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Simplify the equations based on numbers.	K4
CLO-2	Analyze the importance of percentage, profit and loss.	K4
CLO-3	Test for the problems related with time and work, interests.	K4
CLO-4	Classify the different types of permutation, probability and discounts related problems.	K4
CLO-5	Correlate the data representation techniques with different types of charts and graphs.	K4

Mapping of CLOs with PSOs:

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	1	2	1
CLO-2	3	2	2	2	2
CLO-3	3	2	2	2	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

Mapping of CLOs with POs:

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO-1	2	3	1	1	1	1
CLO-2	2	3	2	2	2	2
CLO-3	2	3	2	2	2	3
CLO-4	3	3	3	3	3	3
CLO-5	3	3	3	3	3	3

Advanced application– 3; Intermediate level–2; Basic level–1

Blue Print – Model for Internal Assessment

Components	Marks
Test Component	10
Group Discussion	5
Quiz	5
Assignment	5
Total	25

Summative - Blue – Print – Model
(Mapping with Course Learning Outcomes (CLOs))

Units	CLOs	K-Level	Section A		Section B (Open Choice)	Section C (Open Choice)
			MCQs			
			No. of Questions	K-Level		
1	CLO 1	Up to K4	6	K3 & K4	1(K1)	1(K2)
2	CLO 2	Up to K4	6	K3 & K4	1(K2)	1(K3)
3	CLO 3	Up to K4	6	K3 & K4	1(K1)	1(K2)
4	CLO 4	Up to K4	6	K3 & K4	1(K2)	1(K3)
5	CLO 5	Up to K4	6	K3 & K4	1(K2)	1(K3)
No. of Questions to be asked			30		5	5
No. of Questions to be answered			30		3	3
Marks for each question			1		5	10
Total marks for each			30		15	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 (Open Choice)	Section D (Open Choice)	Total Marks	% of Marks with choice	Consolidated
K1	-	10	-	10	9.52	43%
K2	-	15	20	35	33.33	
K3	15	-	30	45	42.85	43%
K4	15	-	-	15	14.28	14%
Total Marks	30	25	50	105	100	100%

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
IV	Extension Activity	23P4DEXTN	Extension	1	-	-	-	-
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		✓

Course Objectives:

- To motivate students to take up community driven activities and projects.
- To develop the societal awareness of students.
- To promote environmental, sustainability and G20 High-Level Principles on Lifestyles for Sustainable Development (LiFE) among students.

During the duration of the programme, students shall undertake extension activities for a minimum duration of 15 hours including preparation and submit a work diary and report of activities along with certificates (if any) from trusts/ NGOs/ public offices / schools.

At the end of the programme, the students will be able to

CLOs	Course Learning Outcomes	K level
CLO 1	Work independently and as a team in extension activities and community projects	K4
CLO 2	Develop into dutiful and morally upright citizens of the country with an understanding of the problems of the society	K5
CLO 3	Suggest and implement out of the box solutions to the problems of the society from their domain knowledge and through their learning.	K4
CLO 4	Survey and understand the problems of the society and humanity as a whole.	K2
CLO 5	Communicate the problems of the society to civil administration/government forums for finding solutions to the problems of the locality.	K3

Mapping of CLOs with 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

Advance application –3, Intermediate level –2 , Basic level–1

Mapping of CLOs with PSOs

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	3	3	3	3
CLO 2	3	3	3	3	3
CLO 3	3	3	3	3	3
CLO 4	3	3	3	3	3
CLO 5	3	3	3	3	3

Advance application –3, Intermediate level –2 , Basic level–1

Valuation Schema for Extension Activity

The student will be graded on a seven point scale with corresponding GPAs as mentioned below.

Grade	GPA
Outstanding	10
Excellent	9
Very Good	8
Good	7
Average	6
Below average	5
Reappearance	1-4

VALUE ADDED COURSE

PG DEPARTMENT OF COMPUTER SCIENCE					CLASS: II M.Sc. (CS)			
Sem.	Course Type	Course Code	Course Title	Credits	Contact Hours/Week	CIA	Ext.	Total
III	Add-on Course	23P3DAD1	Values and Ethics in Research	2	2	25	75	100
Nature of Course								
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented		

Objectives:

- To learn about ethical principles
- To create awareness on the research concepts.
- To understand the various data collection methods in research.
- To acquire knowledge in various Plagiarism techniques.
- To familiarize in Report writing.

Unit	Description	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 – Non discrimination – Non exploitation – 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 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	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
IV	Plagiarism: What is plagiarism-Why might plagiarism occur –Positive Reasons for not plagiarism-Plagiarism in practice-Plagiarism –How do I avoid it –What else do I need to Know - Conclusions.	6
V	Report Writing: Introduction-Types of Report-Writing the Research Report-The Preliminary Pages of Research Report –Main Components or Chaptering of Research Report –Style and Layout of the Report-Common Weaknesses in Report Writing and Finalizing the Text.	6

Books for Study:

1. Ethics in Scientific Research - Cortney Weinbaum, Eric Landree, Marjory Blumenthal, Tepring Piquado, Carlos Ignacio Gutierrez, Rand Corporation, 2019.
Unit I - 1,2
2. Research Methodology Methods & Techniquesl - C. R. Kothari, 2nd edition, New Age International Publishers, 2009.
Unit II - 1, 2
Unit III - 3
Unit IV - 4, 6
3. The little book of plagiarism university of Stirling 5th edition 2016.
Unit IV - 1

Books for Reference:

1. Research Methodology: A step by step Guide for Beginners, Ranjith Kumar, Sage Publications, 2014.
2. Operations Research an Introduction by Hamdy A. Taha, PHI, 8th edition.

Web Resources:

1. <https://www.egyankosh.ac.in/bitstream/123456789/39238/1/Unit-5.pdf>
Unit V - 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7
2. <https://www.discoverphds.com/blog/types-of-research>.
3. <https://www.coursehero.com/file/p4c7oact/Random-sample-from-an-infinite-universe-So-far-we-have-talked-about-random/>
4. <https://www.acsce.edu.in/acsce/wp-content/uploads/2020/03/Operation-Research-17CS653-Module5.pdf>
5. <https://www.enago.com/academy/how-to-plan-a-research-thesis/>

Pedagogy:

- Chalk and talk, Materials, PPT, Assignment, Seminar, Group discussion, Quiz.

Course Designer Name:

- Mrs. R.Tamilselvi

Blue Print - Model for Add-On Course Internal Assessment
Distribution of Section – wise Marks

Section	Components	Marks
Section A	Project / Assignment	15
Section B	Modeling / Creativity / Test	15
Section C	Innovation in Experiment / Quiz	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



The Madura College (Autonomous), Madurai – 625 011
PG Department of Computer Science
M.Sc. (CS) - Course List

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	23P1DCCT1	Analysis & Design of Algorithms	6	5	✓		✓			✓	29%
	23P1DCCT2	Object Oriented Analysis and Design & C++	6	5	✓		✓			✓	100%
	23P1DCCP1	Practical I: Algorithm And OOPS Lab	6	4	✓		✓			✓	64%
	23P1DECT1	Python Programming	5	3	✓		✓			✓	34.57%
		Web Services	5	3	✓		✓			✓	100%
	23P1DECT2	Advanced Software Engineering	5	3			✓			✓	35.7%
		Critical Thinking, Design Thinking And Problem solving	5	3			✓		✓		100%
	23P1DSED1	R Programming	2	2	✓		✓			✓	100%
II	23P2DCCT3	Data Mining And Warehousing	6	5			✓			✓	74.5%
	23P2DCCT4	Advanced Java Programming	6	5	✓		✓			✓	55.4%

	23P2DCCP2	Practical : Advanced Java & Data Mining Lab using R	6	4	✓		✓			✓	67.7%
	23P2DECT3	Artificial Intelligence & Machine Learning	5	3			✓			✓	100%
		Internet of Things	5	3	✓		✓			✓	76.5%
	23P2DECT4	Advanced Operating Systems	5	3			✓		✓		70.5%
		Mobile Computing					✓	✓			40.6%
	23P2DSEN1	Multimedia And Its Applications	2	2	✓		✓			✓	100%
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	
III	23P3DCCT5	Advanced Relational Database Management System	6	5	✓		✓			✓	9.2%
	23P3DCCT6	Data Science & Analytics	6	5	✓		✓			✓	New Paper
	23P3DCCP3	Advanced Relational Database Management System Lab	6	4	✓		✓			✓	83.3%
	23P3DECT5	Network Security & Cryptography	5	3	✓		✓		✓		100%
		Digital Image Processing	5	3			✓			✓	New Paper

	23P3DMDC1	Embedded System	5	3			✓		✓		New Paper
	23P3DSEN2	Basic Excel Techniques	2	2	✓	✓	✓		✓		New Paper
IV	23P4DCCT7	Web Application Development	6	5	✓		✓			✓	51.8%
	23P4DCCP4	Web Application Development Lab	6	4	✓		✓			✓	100%
	23P4DPROV	Project with Viva-Voce	8	8	✓		✓			✓	No Change
	23P4DECT6	Blockchain Technology	6	3	✓		✓			✓	79.8%
		Cloud Computing	6	3	✓	✓	✓			✓	97.5%
	23P4DSED2	Quantitative Aptitude	4	2	✓		✓		✓		New Paper

Emp- Employability; Ent- Entrepreneurship; Skill- Skill Development



DEPARTMENT OF MICROBIOLOGY

Revised Curriculum

TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION (TANSCH)
(Choice Based Credit system with Outcome Based Education)

Academic Year 2023-2024 onwards

III and IV semesters (B.Sc. Microbiology)

III and IV semesters (M.Sc. Microbiology)

Department of Microbiology
The Madura College
Madurai
B.Sc., Microbiology

Semester	Part	Subject code	Course	Title of the Course	H	C
I	Part I	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	Language -I	Tamil / Hindi / Sanskrit	6	3
	Part II	23U1NENG1	Language - II	English	6	3
	Part III	23U1RCCT1	Core Theory 1	Fundamentals of Microbiology and Microbial Diversity	5	5
		23U1RCCP1	Core Practical 1	Major Practical - I	3	3
		23U1LGET1	Allied Theory -1	Basic and clinical biochemistry	4	4
		23U1LGEP1	Allied Practical - 1	Allied Practical - 1	2	1
	Part IV	23U1RSED1	Skill Enhancement Course SEC – 1	Social and Preventive Medicine	2	2
		23U1RFCT1	Foundation Course	Introduction to Microbial World	2	2
					30	23
II	Part I	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	Language -I	Tamil / Hindi / Sanskrit	6	3
	Part II	23U2NENG2	Language - II	English	6	3
	Part III	23U2RCCT2	Core Theory - 2	Microbial Physiology and Metabolism	5	5
		23U2RCCP2	Core Practical - 2	Major Practical - II	3	3
		23U2LGET2	Allied Theory -2	Clinical Laboratory Technology	4	4
		23U2LGEP2	Allied Practical - 2	Allied Practical - II	2	1
	Part IV	23U2RSED2	Skill Enhancement Course SEC - 2	Nutrition & Health Hygiene	2	2
		23U2RSED3	Skill Enhancement Course -SEC-3	Sericulture	2	2
					30	23
Semester	Part	Subject code	Course	Title of the Course	H	C
	Part I	23U3TLAN3/ 23U3HLAN3/ 23U3SLAN3	Language -I	Tamil / Hindi / Sanskrit	6	3

III	Part II	23U3NENG3	Language - III	English	6	3
	Part III	23U3RCCT3	Core Theory - III	Molecular biology and Microbial genetics	4	4
		23U3RCCP3	Core Practical - III	Major Practical - III	3	3
		23U3CGET1	Ancillary Theory	Bioinstrumentation	4	4
		23U3CGEP1	Ancillary Practical 3 Practical 11 - 2	Ancillary Practical I	2	1
	Part IV	23U3RSED4	Skill Enhancement Course SEC - IV	Organic farming and biofertilizer technology	2	2
		23U3RSED5	Skill Enhancement Course -SEC-V	Aquaculture \	2	2
		23U3EVST1		EVS	1	-
					30	22
Semester	Part	Subject code	Course	Title of the Course	H	C
IV	Part I	23U4TLAN4/ 23U4HLAN4/ 23U4SLAN4	Language -I	Tamil / Hindi / Sanskrit	6	3
	Part II	23U4NENG4	Language - III	English	6	3
	Part III	23U4RCCT4	Core Theory - IV	Immunology and Immuno technology	4	4
		23U4RCCP4	Core Practical - IV	Major Practical - IV	3	3
		23U4CGET2	Ancillary Theory -II	Food processing technology	4	4
		23U4CGEP2	Ancillary Practical II	Ancillary Practical III	2	1
	Part IV	23U4RSED6	Skill Enhancement Course SEC - VI	Vaccine technology	2	2
		23U4RSED7	Skill Enhancement Course SEC- VII	Apiculture	2	2
		23U4EVST2		EVS	1	2
					30	24

Add-on and Self-Study Papers for B.Sc., Microbiology

Semester	Subject code	Course	Title of the Course	H	C
III	23U3RAD1	Add-on I	Biostatistics and Bioinformatics	2	2
IV	23U4RAD2	Add-on II	Introduction to Medical Coding	2	2
	23U4RSST1	Self- Study	Bioenergy	-	2

Ancillary Microbiology Papers for B.Sc., Biotechnology

Semester	Subject code	Course	Title of the Course	H	C
III	23U3RGET1	Ancillary Theory -I	Fundamentals of Microbiology	4	4
	23U3RGEP1	Ancillary Practical I	Ancillary Practical I	2	1
IV	23U4RGET2	Ancillary Theory -II	Bioinformatics and Biostatistics	4	4
	23U4RGEP2	Ancillary Practical II	Ancillary Practical II	2	1

Programme :	B.Sc. MICROBIOLOGY
Programme code :	22UGMB
Duration :	3 years [UG]
Programme Outcomes	PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study. PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real-life situations. PO4: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints. PO5: Scientific Reasoning: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open-minded and reasoned perspective. PO6: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.
Programme Specific Outcome	PSO-1: Placement Prepare the students in all disciplines like agriculture, industry-medical, pharma, dairy, hotel, food and food processing,

	immunologicals, cosmetics, vermitechnology and water treatment for effective and respectful placement. PSO-2:Entrepreneur To create effective entrepreneur by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. PSO-3:Research and Development Design and implement HR systems that comply with good laboratory practices, following ethical values, leading the organization towards growth and development. PSO-4:Contribution to society To contribute to the development of society and produce microbiological products, by collaborating with stake holders, related to the betterment of environment and mankind at the national and global level. PSO 5 Communication skills To 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.

Assessment Scheme

Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations.

Evaluation pattern - Theory

	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	Question type	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

Evaluation pattern - Practical's

	Components	Marks	Total Marks
Internal [Formative]	Continuous assessment	10	25
	Test (Major 10, Minor 5, Spotters 5 and Record 5marks) scaled down to 15	15	
External [Summative]		75	75
Total Marks			100

Question Paper pattern for External examination - Practical's (75 marks)

Section		Marks
I	Major Question (1 X 25 Marks)	25
II	Minor Question (1 X 20 Marks)	20
III	Spotters (4 X 5 marks)	20
IV	Record Notebook	10
	Total	75

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

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%

DEPARTMENT OF MICROBIOLOGY					CLASS: II-B.Sc., Microbiology			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
III	CORE THEORY	23U3RCCT3	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	4	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To provide knowledge on structure and replication of DNA.
- To illustrate the significance and functions of RNA in protein synthesis.
- To explain the cause and types of DNA mutation and DNA repair mechanisms.
- To outline the role of plasmids and phages in genetics.
- To examine mechanisms of gene transfer and recombination.

Unit	Description	Hours	K-level	CLO
I	DNA Structure - Salient features of double helix, forms of DNA. Denaturation and renaturation. DNA topology – Supercoiling, linking number, topoisomerases. DNA organization in prokaryotes, viruses, eukaryotes. Replication of DNA in prokaryotes and eukaryotes - Bidirectional and unidirectional replication, semi-conservative and semi-discontinuous replication. Mechanism of DNA replication – enzymes involved – DNA polymerases, DNA ligase, primase. DNA replication modes - rolling circle, D-loop modes.	12 Hrs.’	K2	1
II	Transcription in Prokaryotes. Concept of transcription. RNA Polymerases - prokaryotic and eukaryotic. General transcription factors in eukaryotes. Distinction between transcription processes in prokaryotes versus eukaryotes. Translation in prokaryotes and eukaryotes - Translational machinery - ribosome structure in prokaryotes and eukaryotes, tRNA structure and processing. Inhibitors of protein synthesis in prokaryotes and eukaryotes. Overview of regulation of gene expression - <i>lac</i> , <i>trp</i> and <i>ara</i> operons as examples. Regulation of gene expression by DNA methylation.	12 Hrs	K3	2

III	Mutation - Definition and types - base substitutions, frame shifts, deletions, insertions, duplications, inversions. Silent, conditional, and lethal mutations. Physical and chemical mutagens. Reversion and suppression. Uses of mutations. Repair Mechanisms - Photoreactivation, Nucleotide Repair, Base Excision Repair, Methyl Directed Mismatch Repair and SOS Repair.	12 Hrs	K3	3
IV	Plasmid replication and partitioning, host range, plasmid incompatibility, plasmid amplification, regulation of plasmid copy number, curing of plasmids. Types of plasmids – R Plasmids, F plasmids, colicinogenic plasmids, metal resistance plasmids, Ti plasmid, linear plasmids, yeast 2 μ plasmid. Bacteriophage-T4, Virulent Phage – Structure and lifecycle. Lambda phage-Structure, Lytic and Lysogenic cycle. Applications of Phages in Microbial Genetics.	12 Hrs	K3	4
V	Gene Transfer Mechanisms- Conjugation and its uses. Transduction - Generalized and Specialized, Transformation - Natural Competence and Transformation. Transposition and Types of Transposition reactions. Mechanism of transposition: Replicative and non-replicative transposition. Transposable elements - Prokaryotic transposable elements – insertion sequences, composite, and non-composite transposons. Uses of transposons.	12 Hrs	K3	5

Books for study:

1. Malacinski G.M. (2008). Freifelder's Essentials of Molecular Biology. 4th Edition. Narosa Publishing House, New Delhi.
2. Gardner E. J. Simmons M. J. and Snusted D.P. (2006). Principles of Genetics. 8th Edition. Wiley India Pvt. Ltd.
3. Trun N. and Trempey J. (2009). Fundamental Bacterial Genetics. 1st Edition. Blackwell Science Ltd.

Books for References:

1. Glick B. R. and Patten C.L. (2018). Molecular Biotechnology – Principles and Applications of Recombinant DNA. 5th Edition. ASM Press.
2. Russell P.J. (2010). iGenetics - A Molecular Approach, 3rd Edition., Pearson New International edn.
3. Nelson, D.L. and Cox, M.M. Lehninger (2017). Principles of Biochemistry. 7th Edition, W.H. Freeman.

- Snyder L., Peters J. E., Henkin T.M. and Champness W. (2013). Molecular Genetics of Bacteria, 4th Edition, ASM Press Washington-D.C. ASM Press.
- Primrose S.B. and Twyman R. M. (2006). Principles of Gene Manipulation and Genomics. (7th Edition). Blackwell Publishing

Web Resources

- <https://chemistry.com.pk/books/lehninger-principles-of-biochemistry-8e/>
- <https://microbenotes.com/gene-cloning-requirements-principle-steps-applications/>
- <https://courses.lumenlearning.com/boundless-biology/chapter/dna-replication/>

Rationale for Nature of the course

It will give a basic insight on various molecular biology techniques for skills and employment.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Knowledge on DNA, RNA and proteins, mutation, repair mechanism, gene transfer and recombination methods.

Pedagogy

Practical methods, presentation, model making

Course Designer(s):

- Dr.P.Kiruthika Lakshmi**

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	DNA Structure - Salient features of double helix, forms of DNA. Denaturation and renaturation.	2	Chalk and Talk, PPT, Quiz, Seminar and Test
	DNA topology – Supercoiling, linking number, topoisomerases. DNA organization in prokaryotes, viruses, eukaryotes.	3	
	Replication of DNA in prokaryotes and eukaryotes - Bidirectional and unidirectional replication, semi-conservative and semi-discontinuous replication.	3	
	Mechanism of DNA replication – enzymes involved – DNA polymerases, DNA ligase, primase.	3	
	DNA replication modes - rolling circle, D-loop modes.	2	
Unit II	Transcription in Prokaryotes. Concept of transcription.	3	Chalk and Talk, PPT, Quiz, Seminar and Test
	RNA Polymerases - prokaryotic and eukaryotic. General transcription factors in eukaryotes.	3	
	Distinction between transcription processes in prokaryotes versus eukaryotes.	2	
	Translation in prokaryotes and eukaryotes - Translational machinery - ribosome structure in prokaryotes and eukaryotes, tRNA structure and processing. Inhibitors of protein synthesis in prokaryotes and eukaryotes.	3	

	Overview of regulation of gene expression - <i>lac</i> , <i>trp</i> and <i>ara</i> operons as examples. Regulation of gene expression by DNA methylation.	4	
Unit III	Mutation - Definition and types - base substitutions, frame shifts, deletions, insertions, duplications, inversions.	4	Chalk and Talk, Seminar, Screening of educational videos, Quiz
	Silent, conditional, and lethal mutations.	2	
	Physical and chemical mutagens.	2	
	Reversion and suppression. Uses of mutations.	3	
	Repair Mechanisms - Photoreactivation, Nucleotide Repair, Base Excision Repair, Methyl Directed Mismatch Repair and SOS Repair.	4	
Unit IV	Plasmid replication and partitioning, host range, plasmid incompatibility, plasmid amplification, regulation of plasmid copy number, curing of plasmids.	4	PPT, Quiz Seminar, Screening of educational videos
	Types of plasmids – R Plasmids, F plasmids, colicinogenic plasmids, metal resistance plasmids, Ti plasmid, linear plasmids, yeast 2 μ plasmid.	4	
	Bacteriophage-T4, Virulent Phage – Structure and lifecycle.	3	
	Lambda phage-Structure, Lytic and Lysogenic cycle.	2	
	Applications of Phages in Microbial Genetics.	2	
Unit V	Gene Transfer Mechanisms- Conjugation and its uses.	4	Chalk and talk, PPT, Assignment, Group discussion
	Transduction - Generalized and Specialized, Transformation - Natural Competence and Transformation.	4	
	Transposition and Types of Transposition reactions. Mechanism of transposition: Replicative and non- replicative transposition.	3	
	Transposable elements - Prokaryotic transposable elements – insertion sequences, composite, and non-composite transposons.	3	
	Uses of transposons.	1	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Analyze the significance of DNA and elucidate the replication mechanism.	K2
CLO-2	Illustrate the types of RNA and protein synthesis machinery.	K3
CLO-3	Infer the causes and types of DNA mutation and summarize the DNA repair mechanisms.	K3
CLO-4	Evaluate the importance of plasmids and phages in genetics.	K3
CLO-5	Analyze gene transfer and recombination methods.	K3

Mapping of CLOs with PSO

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	1	1	1
CLO-2	2	2	2	1	1
CLO-3	2	2	2	1	1
CLO-4	2	2	2	1	1
CLO-5	2	2	2	1	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	1	2	2	2
CLO2	3	1	1	2	3	1
CLO3	3	1	1	2	2	2
CLO4	3	1	1	2	3	1
CLO5	3	1	1	2	3	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 K-2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
3	CLO 3	Up to K-3	2	K1 & K2	1	K1	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-3	2	K1 & K2	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			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 with choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	30	40	70	58.33	58%
K4	-	-	-	-	-	-	-
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF MICROBIOLOGY					CLASS: II-B.Sc., Microbiology			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
III	Major practical-III	23U3RCCP3	Major practical III - MOLECULAR BIOLOGY AND MICROBIAL GENETICS	3	3	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To provide knowledge on structure and replication of DNA.
- To elucidate the methods of Genomic and Plasmid DNA isolation.
- To explain methods of protein separation.
- To explain artificial transformation method.
- To outline the role of phages in genetics.

Unit	Description	Hours	K-level	CLO
I	Study of different types of DNA and RNA using micrographs and model / schematic representations. Study of semi-conservative replication of DNA through micrographs / schematic representations.	9 Hrs	K1	1
II	Isolation of Genomic and Plasmid DNA from E. coli and Analysis by Agarose gel electrophoresis. Estimation of DNA using colorimeter (diphenylamine reagent), UV spectrophotometer (A260 measurement).	9 Hrs	K2	2
III	Resolution and visualization of proteins by polyacrylamide gel electrophoresis (SDS-PAGE) – Demonstration. UV induced auxotrophic mutant production and isolation of mutants by replica plating technique – Demonstration.	9 Hrs	K2	3
IV	Perform artificial Transformation in E. coli. Isolation of antibiotic resistant mutants by gradient plate method. - Demonstration	9 Hrs	K2	4
V	Screening and isolation of phages from sewage. Perform RNA isolation. Estimate RNA.	9 Hrs	K2	5

Books for study:

1. Crichton. M. (2014). Essentials of Biotechnology. Scientific International Pvt Ltd. New Delhi.
2. Sambrook J. and Russell D.W. (2001). Molecular Cloning - A Laboratory Manual – 7th Edition. Cold Spring Harbor, N.Y: Cold Spring Harbor Laboratory Press.
3. Dale J. W., Schantz M. V. and Plant N. (2012). From Gene to Genomes – Concepts and Applications of DNA Technology. (3rd Edition). John Wileys and Sons Ltd.

Books for References:

1. Glick B. R. and Patten C.L. Molecular Biotechnology – Principles and Applications of Recombinant DNA. 5th Edition. ASM Press. 2018.
2. Russell P.J. (2010). iGenetics - A Molecular Approach, 3rd Edition., Pearson New International edn.
3. Nelson, D.L. and Cox, M.M. Lehninger(2017). Principles of Biochemistry. 7th Edition, W.H. Freeman.
4. Synder L., Peters J. E., Henkin T.M. and Champness W. (2013). Molecular Genetics of Bacteria, 4th edition, ASM Press Washington-D.C. ASM Press.
5. Brown T.A. (2016). Gene Cloning and DNA Analysis. (7th Edition). John Wiley and Jones, Ltd.

Web Resources

1. <https://www.molbiotools.com/usefullinks.html>
2. https://www.researchgate.net/publication/320508474_Molecular_Biology_Laboratory_manual
3. <https://www.molbiotools.com/usefullinks.html>
4. <https://geneticgenie.org3>.
5. <https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5>

Rationale for Nature of the course

It will give basic insight on molecular biology techniques for skills and employment.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Knowledge on isolation, estimation, separation of DNA, RNA and proteins; isolation of mutants, transformation technique.

Pedagogy

Practical methods, Presentation, Demo

Course Designer(s):

1. Dr.P.Kiruthika Lakshmi

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Illustrate different types of DNA and RNA.	K4
CLO-2	Utilize hands-on training in isolation of genomic and plasmid DNA.	K4
CLO-3	Analyze importance of experimental microbial genetics.	K4
CLO-4	Apply the knowledge of molecular techniques in various fields.	K4
CLO-5	Investigate the significance of Phages.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	1	1	1
CLO-2	2	2	2	1	1
CLO-3	2	2	2	1	1
CLO-4	2	2	2	1	1
CLO-5	2	2	2	1	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	1	2	2	2
CLO2	3	1	1	2	3	2
CLO3	3	1	1	2	2	3
CLO4	3	1	1	2	3	2
CLO5	3	1	1	2	3	3

Advance application– 3;

Intermediate level–2;

Basic level–1

DEPARTMENT OF MICROBIOLOGY					CLASS: II B.Sc MICROBIOLOGY			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
III	SKILL ENHANCEMENT COURSE – SEC -4 (ENTREPRENEURIAL SKILL)	23U3RSED4	ORGANIC FARMING AND BIOFERTILISER TECHNOLOGY	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- To impart knowledge about the significance of organic farming and strategies to increase the yield to conserve environment.
- To encourage organic farming in urban areas.
- To comprehensive knowledge about bacterial biofertilizers, its advantages and future perspective.
- To Structure and characteristic features of Cyanobacterial and fungal biofertilizer
- To develop the knowledge and skill to produce, analyze the quality of packaging, storage and assess the shelf life and bioefficacy of biofertilizers.

Unit	Description	Hours	K-level	CLO
I	Principle of organic farming: principles of health, fairness, ecological balance, and care. Environmental benefits of organic farming: sustainability- reduces non-renewable energy by decreasing agrochemical need. Biodiversity-crop rotation, inter-cropping. Ecological services – biological control, soil formation and nutrient cycling.	6	K2	1
II	Organic farming for urban space; Create a Sustainable Organic Garden (Backyard- Square Foot Gardening, Small Space Gardening, Mini Farming) Composting, Vermicomposting	6	K3	2
III	Biofertilizers: Introduction, advantages and future perspective. Structure and characteristic features of bacterial biofertilizers- <i>Azospirillum</i> , <i>Azotobacter</i> , <i>Bacillus</i> , <i>Pseudomonas</i> , <i>Rhizobium</i> and <i>Frankia</i>	6	K3	3
IV	Structure and characteristic features of Cyanobacterial biofertilizers- <i>Anabaena</i> , <i>Nostoc</i> ;Structure and characteristic features of fungal biofertilizers- AM mycorrhiza	6	K4	4
V	Production of <i>Rhizobium</i> , <i>Azotobacter</i> , <i>Anabena</i> ; Biofertilizers - Storage, shelf life, quality control and marketing	6	K4	5

Books for study:

1. A.K. Sharma (2006). Hand book of Organic Farming.
2. A.C.Gaur (2017). Hand book of Organic Farming and Biofertilizers.
3. N.S. Subbarao (2017). Bio-fertilizers in Agriculture and Forestry (4th Edition) Med tech publisher.

Books for References:

1. Masanobu Fukuoka, Frances Moore Lappe Wendell Berry (2009). The One-Straw Revolution: An Introduction to Natural Farming, 1st edition, YRB Classics.
2. Sujit Chakrabarty(2018). Organic Home Gardening Made Easy, 1st Edition.
3. Singh and Purohit (2008). Biofertilizer technology. Agrobios, India.
4. Bansal M (2019). Basics of Organic Farming CBS Publisher.
5. Hurst, C.J., Crawford R.L., Garland J.L., Lipson D.A., Mills A.L. and Stetzenbach L.D. (2007). Manual of Environmental Microbiology. (3rd Edition). American Society for Microbiology.

Web Resources

1. https://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html
2. <https://www.fao.org/organicag/oa-faq/oa-faq6/en/>
3. <https://www.india.gov.in/topics/agriculture/organic-farming>
4. <https://agriculture.nagaland.gov.in/bio-fertilizer/>
5. <https://vlab.amrita.edu/index.php?sub=3&brch=272>

Rationale for Nature of the course

This course will enable the students to grasp the theoretical knowledge and basics techniques of Organic farming, vermin composting setting, crop rotation, microbial fertilizers, Quality control, transportation, packing and Marketing,

Activities having direct bearing on Skill development / Employability Entrepreneurship

The acquiring of knowledge on organic gardening and vermin composting techniques of Organic farming and enriches students' overall understanding of composting techniques which may boost their research temperament and Entrepreneurship

Pedagogy

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

Course Designer(s):

1. Mrs. P.SUMATHI

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Principle of organic farming: principles of health, fairness, ecological balance and care. Environmental benefits of organic farming:	3	Lecture, Chalk and Talk, PPT, Seminar and Group Discussion
	Sustainability- reduces non-renewable energy by decreasing agrochemical need. Biodiversity-crop rotation, inter-cropping. Ecological services – biological control, soil formation and nutrient cycling.	3	
Unit II	Organic farming for urban space; Create a Sustainable Organic Garden (Backyard-	3	Lecture, Chalk and Talk, PPT, Seminar and Group Discussion
	Square Foot Gardening, Small Space Gardening, Mini Farming) Composting, Vermicomposting	3	
Unit III	Biofertilizers: Introduction, advantages and future perspective. Structure and characteristic features of bacterial biofertilizers- <i>Azospirillum</i> ,	3	Lecture, Chalk and Talk, PPT, Assignment, Group Discussion
	Structure and characteristic features of <i>Azotobacter</i> , <i>Bacillus</i> , <i>Pseudomonas</i> , <i>Rhizobium</i> and <i>Frankia</i>	3	
Unit IV	Structure and characteristic features of Cyanobacterial biofertilizers- <i>Anabaena</i> , <i>Nostoc</i>	3	Lecture, Chalk and Talk, PPT, Seminar, Group Discussion
	Structure and characteristic features of fungal biofertilizers- AM mycorrhiza	3	
Unit V	Production of <i>Rhizobium</i> , <i>Azotobacter</i> , <i>Anabena</i> ;	3	Lecture, Chalk and Talk, PPT, Assignment, Group Discussion
	Biofertilizer -Storage, shelf life, quality control and marketing	3	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Understand the basic principles and benefits of Organic farming.	K2
CLO-2	Analyse the soil quality for composting.	K3
CLO-3	Apply the knowledge on vermicomposting techniques for organic farming.	K3
CLO-4	Explain the various bacterial and fungal species of biofertilizers.	K4
CLO-5	Examine the storage and marketing methods of biofertilizers.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	2	1	1
CLO-2	2	2	2	1	1
CLO-3	2	2	2	1	1
CLO-4	2	2	2	1	1
CLO-5	2	2	2	1	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	2	3	2
CLO3	3	1	1	2	3	2
CLO4	3	1	1	2	3	2
CLO5	3	1	1	2	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

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 MICROBIOLOGY					CLASS: II B.SC MICROBIOLOGY			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
III	Skill Enhancement Course – SEC-5	23U3RSED5	AQUACULTURE	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- To provide a deeper knowledge in aquaculture systems and methods.
- To explain the significance and functions of design, types and construction of aquaculture ponds.
- To demonstrate the biological characteristics of various aquaculture species.
- To discuss the methods involved in post stocking management.
- To illustrate major cultivatable species for aquaculture.

Unit	Description	Hours	K-level	CLO
I	Aquaculture Systems and Methods - Scope and definition. Traditional, extensive, semi - intensive and intensive culture. Monoculture, polyculture, composite culture, mixed culture, mono-sex culture, cage culture, pen culture, raft culture, race way culture.	6	K2	1
II	Aquaculture Engineering - Design and construction of pond, lay-out and design of aquaculture farm, construction, water intake system, drainage system - aeration and aerators. Ponds - Types of ponds.	6	K3	2
III	Selection of Species - Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection and transportation. Pre-Stocking Management-Sun drying, ploughing / tilling, desalting, liming and fertilization, eradication of weed fishes. Stocking - Acclimatization of seed and release - species combinations - stocking density and ratio.	6	K3	3
IV	Post Stocking Management - Water and soil quality parameters required for optimum production, control of aquatic weeds and aquatic insects, algal blooms and microorganisms. Food conversion ratio (FCR). Growth - Measurement of growth, length - weight relationship.	6	K4	4

V	Major cultivable species for aquaculture –Culture of Indian Major Carps. Culture of Giant fresh water prawn, <i>Macrobrachium rosenbergii</i> - seed collection formation sources. Hatchery management. Culture of tiger shrimp, <i>Penaeus monodon</i> and <i>Litopenaeus vannamei</i> . Culture of pearl oysters. Culture of sea weeds. Methods of Crab culture. Culture of ornamental fishes. Culture of Molluscs.	6	K4	5

Books for study:

1. Santhanam, R. Velayutham, P. Jegatheesan, G. A (2019). Manual of Freshwater Ecology: An Aspect of Fishery Environment. Daya Publishing House, New Delhi.
2. Stickney, R.R. (2016). Aquaculture: An Introductory Text. 3rd Edition. Centre for Agriculture and Bioscience International Publishing.
3. Ackefors H., Huner J and Konikoff M. (2009). Introduction to the General Principles of Aquaculture. CRC Press.

Books for References:

1. Arumugam N. (2014). Aquaculture. Saras Publication.
2. Pillay T. V. R. and Kutty M.N. (2005). Aquaculture: Principles and Practices. 2nd Edition. Wiley India Pvt. Ltd.
3. Tripathi S. D., Lakra W.S. and Chadha N.K. (2018). Aquaculture in India. Narendra Publishing House.
4. Rath R.K. (2011). Fresh Water Aquaculture. 3rd Edition. Scientific Publishers.
5. Lucas J. S., Southgate P.C. and Tucker C.S. (2019). Aquaculture: Farming Aquatic Animals and Plants. Wiley Blackwell.

Web Resources

1. <https://www.conserve-energy-future.com/aquaculture-types-benefits-importance.php#:~:text=Aquaculture%20systems%20often%20take%20advantage,vicinity%2C%20thereby%20conserving%20natural%20resources.>
2. <https://www.fisheries.tn.gov.in/StartABusiness>
3. <https://www.investindia.gov.in/>

Rationale for Nature of the course

This course will enable the students to grasp the theoretical knowledge and basics techniques of Aquaculture, Aquarium setting, and pond construction, culture of sea weeds, transportation and packing.

Activities having direct bearing on Skill development / Employability Entrepreneurship

The acquiring of knowledge on basic and culture techniques of prawn, fish and sea weed culture enriches students' overall understanding of culture techniques which may boost their research temperament and Entrepreneurship.

Pedagogy

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

Course Designer(s):**1. Mrs. P.SUMATHI****Course Schedule**

Unit	Topics	Hrs	Mode
Unit I	Aquaculture Systems and Methods - Scope and definition. Traditional, extensive, semi - intensive and intensive culture.	3	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	Monoculture, polyculture, composite culture, mixed culture, mono-sex culture, cage culture, pen culture, raft culture, race way culture.	3	
Unit II	Aquaculture Engineering - Design and construction of pond, lay-out and design of aquaculture farm, construction,	3	Lecture, Chalk and Talk, PPT, Group Discussion
	Water intake system, drainage system - aeration and aerators. Ponds - Types of ponds.	3	
Unit III	Selection of Species - Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection and transportation.	3	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	Pre-Stocking Management-Sun drying, ploughing / tilling, desilting, liming and fertilization, eradication of weed fishes. Stocking - Acclimatization of seed and release - species combinations - stocking density and ratio.	3	
Unit IV	Post Stocking Management - Water and soil quality parameters required for optimum production, control of aquatic weeds	3	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	Control of Aquatic insects, algal blooms and microorganisms. Food conversion ratio (FCR). Growth - Measurement of growth, length - weight relationship.	3	
Unit V	Major cultivable species for aquaculture –Culture of Indian Major Carps. Culture of Giant fresh water prawn, <i>Macrobrachium rosenbergii</i> - seed collection formation sources.	3	Lecture, Chalk and Talk, Interaction, PPT, Assignment, Group Discussion
	Hatchery management. Culture of tiger shrimp, <i>Penaeus monodon</i> and <i>Litopenaeus vannamei</i> . Culture of pearl oysters. Culture of sea weeds. Methods of Crab culture. Culture of ornamental fishes. Culture of Molluscs.	3	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Understand the significance and importance of aquaculture	K2
CLO-2	Illustrate the types and construction of aquaculture ponds	K3
CLO-3	Analyze the biological characteristics of species and choose the best species for aquaculture.	K3
CLO-4	Follow methods involved for optimal growth of aquaculture species.	K4
CLO-5	Summarize major species suitable for aquaculture in a particular environment.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	2	1	1
CLO-2	2	2	2	1	1
CLO-3	2	2	2	1	1
CLO-4	2	2	2	1	1
CLO-5	2	2	2	1	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	2	3	2
CLO3	3	1	1	2	3	2
CLO4	3	1	1	2	3	2
CLO5	3	1	1	2	3	3

Advance application– 3;

Intermediate level–2;

Basic level–1

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	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%

DEPARTMENT OF MICROBIOLOGY					CLASS: II B.Sc MICROBIOLOGY			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
IV	CORE - Theory	23U4RCCT4	IMMUNOLOGY AND IMMUNOTECHNOLOGY	4	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To gain knowledge about immune system, organs of immunity and cells involved.
- To distinguish the types of antigens and antibodies; their properties.
- To provide in-depth knowledge on immuno-techniques.
- To discuss the role of MHC system in transplantation; functions of Tumor specific antigens.
- To impart knowledge on immunological disorders.

Unit	Description	Hours	K-level	CLO
I	Organs and Cells in Immune System and Immune Response: Primary lymphoid organs, secondary lymphoid organs, and lymphoid tissues; T – cell and B –cell membrane bound receptors – apoptosis; T - cell processing, presentation and regulation; T –cell subpopulation, properties, functions and T – cell suppression; Physiology of immune response- innate, humoral and cell mediated immunity; Immunohematology.	12	K2	1
II	Antigen and Antibody: Antigens - Properties of haptens, epitopes, adjuvants, and cross reactivity; Antibodies- structure, properties, classes; Antigen and Antibody Reactions: precipitation, agglutination, complement fixation, opsonization, neutralization; Vaccines – active and passive immunization; Classification of vaccines; Other approaches to new vaccines; Types of vaccine - antibacterial, antiviral; Vaccination schedule.	12	K3	2

III	Immunoassay and Immunotechniques - Preparation and standardization of bacterial antigens; Raising of monoclonal and polyclonal antibodies; Purification of antibodies. Immunotechniques - RIA, RAST, ELISA, Immuno fluorescence techniques and Flow cytometry	12	K3	3
IV	Transplantation and Tumor Immunology - MHC Antigens - structure and function; HLA system - Regulation and response to immune system; Transplantation immunology - tissue transplantation and grafting; Mechanism of graft acceptance and rejection; HLA typing; Tumor specific antigens; Immune response to tumors; Immune diagnosis; cancer immune therapy.	12	K3	4
V	Immunological disorders and diseases - Hypersensitivity reactions (Type I, II, III and IV); acquired immunodeficiency syndrome; Auto immune disorders and diseases: organ specific and non-organ specific.	12	K4	5

Books for study:

1. Richard Coico, Geoffrey Sunshine, Eli Benjamini. (2003). Immunology – A Short Course. 5th Edition., Wiley-Blackwell, New York.
2. Judith A.Owen, Jenni Punt, Sharon A. Stranford, Janis Kuby. (2013). Immunology, 7th Edition., W. H. Freeman and Company, New York.
3. Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai. (2021). Cellular and Molecular Immunology, 10th Edition., Elsevier.

Books for References:

1. Janeway Travers. (1997). Immunobiology- the immune system in health and disease. Current Biology Ltd. London, New York. 3rd Edition.
2. Peter J. Delves, Seamus Martin, Dennis R. Burton, Ivan M. Roitt. (2006). Roitt's Essential Immunology, 11th Edition., Wiley-Blackwell.
3. William R Clark. (1991). The Experimental Foundations of Modern Immunology. 3rd Edition. John Wiley and Sons Inc. New York.
4. Frank C. Hay, Olwyn M. R. Westwood. (2002). Practical Immunology, 4th Edition., Wiley-Blackwell.
5. Noel R. Rose, Herman Friedman, John L. Fahey. (1986). Manual of Clinical Laboratory Immunology. ASM. 3rd Edition.

Web Resources

1. <https://www.ncbi.nlm.nih.gov/books/NBK279395/>
2. <https://med.stanford.edu/immunol/phd-program/ebook.html>

3. <https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall-2005/pages/lecture-notes/>
4. <https://www.ncbi.nlm.nih.gov/books/NBK7795/#:~:text=Cells%20of%20the%20immune%20system,and%20macrophages%20are%20termed%20monokines.>

Rationale for Nature of the course

Immunology involves a complex network of interacting molecules and cells that function to recognize and respond to foreign agents. It deals with physical, chemical and physiological characteristics of the Components of immune system *in vitro*, and *in vivo*. Immunology has a vast array of uses in several disciplines of science and medical sciences.

Activities having direct bearing on Skill development / Employability Entrepreneurship

The most important aspect of immunology is research because it is the biggest portion of jobs. Immunologists work in various areas such as biomedical research, healthcare, agriculture and environmental monitoring. A career in scientific research. Immunology has applications in various disciplines of medicine that are virology, organ transplantation, dermatology, oncology, parasitology, bacteriology, and psychiatry.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Designer(s):

1. **M.Rajesh kannan**

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Organs and Cells in Immune System and Immune Response: Primary lymphoid organs, secondary lymphoid organs, and lymphoid tissues; T – cell and B – cell membrane bound receptors – apoptosis; T - cell processing, presentation and regulation	6	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	T –cell subpopulation, properties, functions and T – cell suppression; Physiology of immune response- innate, humoral and cell mediated immunity; Immunohematology.	6	
Unit II	Antigen and Antibody:Antigens - Properties of haptens, epitopes, adjuvants, and cross reactivity; Antibodies-structure, properties, classes; Antigen and Antibody Reactions: precipitation, agglutination, complement fixation, opsonization, neutralization	6	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	Vaccines – active and passive immunization; Classification of vaccines; Other approaches to new vaccines; Types of vaccine - antibacterial, antiviral; Vaccination schedule.	6	
Unit III	Immunoassay and Immunotechniques - Preparation and standardization of bacterial antigens; Raising of monoclonal and polyclonal antibodies	6	Lecture, Chalk and Talk, PPT, , Group Discussion, Quiz, Seminar
	Purification of antibodies. Immunotechniques - RIA, RAST, ELISA, Immuno fluorescence techniques and Flow cytometry	6	
Unit IV	Transplantation and Tumor Immunology - MHC Antigens - structure and function; HLA system - Regulation and response to immune system; Transplantation immunology - tissue transplantation and grafting;	6	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	Mechanism of graft acceptance and rejection; HLA typing; Tumor specific antigens; Immune response to tumors; Immune diagnosis; cancer immune therapy.	6	
Unit V	Immunological disorders and diseases - Hypersensitivity reactions (Type I, II, III and IV)	6	Lecture, Chalk and Talk, PPT, Assignment, Group Discussion
	Acquired immunodeficiency syndrome; Auto immune disorders and diseases: organ specific and non-organ specific	6	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Define the basic biology of the cells of the immune system, including their development and specific functions	K2
CLO-2	Outline how the cells interact with each other in the formation of an immune response	K3
CLO-3	Interpret the molecular basis by which the immune system identifies pathogens.	K3
CLO-4	Perceive what occurs when there are failures of the immune system.	K3
CLO-5	Become skilled at the experimental basis and reasoning that underlies the material in the course.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	2	2	3
CLO-2	2	2	2	2	2
CLO-3	2	2	2	2	3
CLO-4	3	3	2	2	2
CLO-5	2	2	2	3	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	1	2	3	2	3	3
CLO2	2	3	2	2	2	1
CLO3	2	2	3	3	3	1
CLO4	2	2	2	2	2	1
CLO5	2	3	2	3	2	2

Advance application– 3;

Intermediate level–2;

Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 K 3	2	K1 & K2	1	K2	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	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			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 with choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	30	40	70	58.33	58%
K4	-	-	-	-	-	-	-
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF MICROBIOLOGY					CLASS: II B.Sc. MICROBIOLOGY			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	Core Practica I IV	23U4RCCP4	Major Paractical -IV	3	3	25	75	100

Nature of Course							
Skill Oriented		✓	Employability Oriented		✓	Entrepreneurship Oriented	

Objectives:

- To gain hands-on knowledge to identify Blood group and typing
- To acquire adequate skill to perform latex agglutination reactions.
- To analyze precipitation reactions in gels.
- To investigate the antigen & antibody reactions in electrophoresis.
- To familiarize with Separation of Lymphocytes.

Unit	Description	Hours	K-level	CLO
I	Identification of blood group and typing. Coomb's test. TPHA	12	K4	1
II	T cell identification (Demonstration) Latex Agglutination reactions- RF, ASO, CRP	12	K4	2
III	Ouchterlony's Double Diffusion Method (antigen pattern). Single Radial Immuno Diffusion Method.	12	K4	3
IV	Electrophoresis - Serum, Counter and Immuno.	12	K4	4
V	Separation of Lymphocytes by gradient centrifugation method. ELISA: Hepatitis/ HIV	12	K4	5

Books for study:

1. Talwar. (2006). Hand Book of Practical and Clinical Immunology, Vol. I, 2nd edition, CBS.
2. Asim Kumar Roy. (2019). Immunology Theory and Practical, Kalyani Publications.
3. Richard Coico, Geoffrey Sunshine, Eli Benjamini. (2003). Immunology – A Short Course. 5th Edition. Wiley-Blackwell, New York.

Books for References:

1. Frank C. Hay, Olwyn M. R. Westwood. (2008). Practical Immunology, 4th Edition, Wiley-Blackwell.
2. Wilmore Webley. (2016). Immunology Lab Manual, LAD Custom Publishing.
3. Rose. (1992). Manual of Clinical Lab Immunology, ASM.
4. Janeway Travers. (1997). Immunobiology- the immune system in health and disease. Current Biology Ltd. London, New York. 3rd Edition.

5. Peter J. Delves, Seamus Martin, Dennis R. Burton, and Ivan M. Roitt. (2006). Roitt's Essential Immunology, 11th Edition., Wiley-Blackwell.

Web Resources

1. https://www.researchgate.net/publication/275045725_Practical_Immunology-_A_Laboratory_Manual
2. <https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/labs/frelinger-lab/documents/Immunology-Lab-Manual.pdf>
3. https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC106J-lab-manual.pdf
4. Immunology Overview - Medical Microbiology - NCBI Bookshelf (nih.gov)
5. Immunology - an overview | ScienceDirect Topics

Rationale for Nature of the course

Practical skills on immunological techniques help to understand and acquire a wide knowledge on immunity and immune system. It also provides wider knowledge on disease diagnosis and severity of infections. It helps to explore various growth stages of bacteria and the factors affecting bacterial growth.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Applying key concepts in antigen-antibody reaction for immunological diagnosis. Employing scientific principles in the interpretation of immunological responses for devising laboratory methods.

Pedagogy

Demonstration and practical session.

Course Designer(s):

1. **Rajesh Kannan**

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Assess the fundamental concepts of immunity, contributions of the organs and cells in immune responses.	K4
CLO-2	Investigate the structures of Ag and Ab; Immunization.	K4
CLO-3	Justify the Immunoassay and Immunotechniques.	K4
CLO-4	Explain about the immunologic processes governing graft rejection and therapeutic modalities for immunosuppression in transplantation	K4
CLO-5	Analyze the overreaction by our immune system leading to hypersensitive conditions and its consequences.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	1	1	1
CLO-2	2	2	2	1	1
CLO-3	2	2	2	1	1
CLO-4	2	2	2	1	1
CLO-5	2	2	2	1	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	1	2	2	3
CLO2	3	1	1	2	3	2
CLO3	3	1	1	2	2	3
CLO4	3	1	1	2	3	2
CLO5	3	1	1	2	3	2

Advance application– 3;

Intermediate level–2;

Basic level–1

Assessment SchemeComponents of CIA

Component	Weight / Mark
Continuous Internal Assessment Test, Attendance and Class Participation	25
End Semester Examination	75

DEPARTMENT OF MICROBIOLOGY					CLASS: II B.Sc MICROBIOLOGY			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	Skill Enhancement Course SEC -6	23U4RSED6	Vaccine Technology	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- To provide knowledge on the basics of immunization and induction of immunity.
- To learn the types of vaccines, its immunological effects and regulatory guidelines.
- To learn the role of rDNA in vaccine technology.
- To provide the knowledge on conventional to recent technology of vaccine production
- To learn about ethical issues and regulations in vaccine production and clinical trials

Unit	Description	Hours	K-level	CLO
I	History of vaccination, Active and passive immunization; requirements for induction of immunity, Epitopes, linear and conformational epitopes, characterization and location of APC, MHC and immunogenicity,	6	K2	CLO1
II	Viral/bacterial/parasite vaccine differences, methods of vaccine preparation – Live, killed, attenuated, sub unit vaccines; Licensed vaccines, Viral Vaccine - Poliovirus vaccine-inactivated & Live, Rabies vaccines, Hepatitis A & B vaccines, Bacterial Vaccine - Anthrax vaccines, Cholera vaccines, Diphtheria toxoid, Parasitic vaccine - Malaria Vaccine.	6	K2	CLO2
III	Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein-based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines. Recent advances in Malaria, Tuberculosis, HIV.	6	K3	CLO3
IV	Fundamental research to rational vaccine design. Antigen identification and delivery, T-Cell expression cloning for identification of vaccine targets for intracellular pathogens, Rationale vaccine design based on clinical requirements: Scope of future vaccine strategies.	6	K4	CLO4
V	Vaccine additives and manufacturing residuals, Regulation and testing of vaccines, Regulation of vaccines in developing countries, Quality control and regulations in vaccine research, Animal testing, Rational design to clinical trials, Large scale production, Commercialization. Vaccine safety ethics and Legal issues.	6	K3	CLO5

Books for study:

1. Ronald W. Ellis.(2001). New Vaccine Technologies.Landes Bioscience.
2. Cheryl Barton. (2009). Advances in Vaccine Technology and Delivery. Espicom Business Intelligence.
3. Male, David. Ed. (2007). Immunology. 7th Edition. Mosby Publication.

Books for References:

1. Stanley A. Plotkin, Walter Orenstein& Paul A. Offit.(2013). Vaccines, 6th Edition. BMA Medical Book Awards Highly Commended in Public Health. Elsevier Publication.
2. Coico, R. etal. (2003). Immunology: A Short Course. 5th Edition, Wiley – Liss.
3. Parham, Peter.(2005). The Immune System. 2nd Edition, Garland Science.
4. Abbas, A.K. etal. (2007). The Cellular and Molecular Immunology. 6th Edition, Sanders / Elsevier.
5. Weir, D.M. and Stewart, John (2000). Immunology. 8th Edition, Churchill Pvt. Ltd.

Web Resources

1. <https://www.slideshare.net/adammmbbs/pathogenesis-3-rd-internal-updated-43458567>
2. <https://www.bio.fiocruz.br/en/images/stories/pdfs/mpti/2013/selecao/vaccine-processtechnology.pdf>
3. https://www.dcvmn.org/IMG/pdf/ge_healthcare_dcvmn_introduction_to_pd_for_vaccine_production_29256323aa_10mar2017.pdf
4. <https://www.sciencedirect.com/science/article/pii/B9780128021743000059>
5. https://www.researchgate.net/publication/313470959_Vaccine_Scaleup_and_Manufacturin_g

Rationale for Nature of the course

Vaccine innovations have paved the way toward improved human health

Activities having direct bearing on Skill development / Employability Entrepreneurship

Vaccine technology transfer from multinational pharmaceutical companies to laboratories in middle-income countries long pre-dates the COVID

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Designer(s):

- 1.Mr. J.Amala Jeyakumar

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	History of vaccination, Active and passive immunization;	3	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	requirements for induction of immunity, Epitopes, linear and conformational epitopes, characterization and location of APC, MHC and immunogenicity	3	
Unit II	Viral/bacterial/parasite vaccine differences, methods of vaccine preparation – Live, killed, attenuated, sub unit vaccines; Licensed vaccines, Viral Vaccine - Poliovirus vaccine-inactivated & Live, Rabies vaccines,	3	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	Hepatitis A & B vaccines, Bacterial Vaccine - Anthrax vaccines, Cholera vaccines, Diphtheria toxoid, Parasitic vaccine - Malaria Vaccine.	3	
Unit III	Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein-based vaccines, plant-based vaccines	3	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	Reverse vaccinology; Peptide vaccines, conjugate vaccines. Recent advances in Malaria, Tuberculosis, HIV.	3	
Unit IV	Fundamental research to rational vaccine design. Antigen identification and delivery, T-Cell expression cloning for identification of vaccine targets for intracellular pathogens,	3	Lecture, Chalk and Talk, PPT, Group Discussion, Quiz, Seminar
	Rationale vaccine design based on clinical requirements: Scope of future vaccine strategies.	3	
Unit V	Vaccine additives and manufacturing residuals, Regulation and testing of vaccines, Regulation of vaccines in developing countries	3	Lecture, Chalk and Talk, PPT, Assignment, Group Discussion, Quiz, Seminar
	Quality control and regulations in vaccine research, Animal testing, Rational design to clinical trials, Large scale production, Commercialization. Vaccine safety ethics and Legal issues.	3	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Explain the significance of critical antigens, immunogens and adjuvants in developing effective vaccines.	K2
CLO-2	Understand the types of vaccines.	K2
CLO-3	Construct vaccine applying rDNA technology.	K3
CLO-4	Formulate the strategies for developing an innovative vaccine technology with different mode of vaccine delivery.	K4
CLO-5	Evaluate the regulatory issues and guidelines for the management of vaccine production.	K3

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	1	1
CLO-2	2	2	1	1	1
CLO-3	2	2	1	1	1
CLO-4	2	3	2	2	1
CLO-5	3	2	2	2	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	2	2	1	1
CLO2	2	3	2	3	1	1
CLO3	2	3	2	2	1	1
CLO4	1	1	2	2	1	1
CLO5	2	2	1	1	1	1

Advance application- 3;

Intermediate level-2;

Basic level-1

Summative - Blue – Print – Model
(Mapping with Course 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 K-2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K-3	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(K4)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K2&K2)	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			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 with choice	Consolidated
K1	5	4	0	-	9	7.5	42%
K2	5	6	20	10	41	34.17	
K3	-	-	20	10	30	25	25%
K4	-	-	10	30	40	33.33	33%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF MICROBIOLOGY					CLASS: II B.Sc., MICROBIOLOGY			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
IV	SKILL ENHANCEMENT COURSE- SEC – 7	23U4RSED7	APICULTURE	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- To understand the biology of honey bees.
- To study on honey bee colony establishment.
- To develop knowledge on honey extraction.
- To understand the diseases of honey bees and their control.
- To gain information on financial assistance and funding agencies for bee keeping industry.

Unit	Description	Hours	K-level	CLO
I	Biology of Bees: Honeybee – Systematic position – Species of Honey bees – Life history of Honey bee – behaviour – swarming – Pheromone.	6	K2	CLO–1
II	Social life in Bees: Bee colony – Castes – natural colonies and their yield – Types of bee hives – Structure – location, care and management.	6	K2	CLO–2
III	Bee Rearing: Apiary – Care and Management – Artificial bee hives – types – construction of spaceframes – Selection of sites – Handling – Maintenance – Instruments employed in Apiary – Extraction instruments.	6	K3	CLO–3
IV	Bee Economy: Honey – Composition – uses – Bee wax and its uses – yield in national and international market – Diseases of honey bees and their control methods. Economics of bee culture.	6	K4	CLO–4
V	Entrepreneurship: venture – Preparing proposals for financial assistance and funding agencies – Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens.	6	K4	CLO–5

Books for study:

1. R. A. Morse. (1993). Rearing queen honey bees. Wicwas press, NY. ISBN-10 : 1878075055
2. Ted Hooper. (2010). Guide to Bees & Honey: The World's Best Selling Guide to Beekeeping. Northern Bee Books. Oxford. ISBN 10: 1904846513
3. Jayashree K. V., Tharadevi C.S. and Arumugam N. (2014) Apiculture. Saras Publication

Books for References:

1. Dewey M. Caron. (2020). The Complete Bee Handbook: History, Recipes, Beekeeping Basics, and More, Rockridge Press. ISBN-10 : **1646119878**
2. Joachim Petterson. (2016). Beekeeping: A Handbook on Honey, Hives & Helping the Bees, Weldon Owen.
3. Eva Crane. (1999). The World History of Beekeeping and Honey Hunting. Routledge. India. ISBN-10 : 0415924677
4. Pagar B. S. (2016). Textbook of Apiculture. Sahitya Sagar.
5. Sehgal P.K. (2018). Text Book of Sericulture, Apiculture and Entomology. Kalayani.

Web Resources

1. <https://denton.agrilife.org/files/2013/08/beekeeping-basics.pdf>
2. <https://lupinepublishers.com/agriculture-journal/pdf/CIACR.MS.ID.000270.pdf>
3. <https://www.ars.usda.gov/ARUserFiles/20800500/BumbleBeeRearingGuide.pdf>
4. www.homeomagnet.com
5. www.iasri.res.in

Rationale for Nature of the course

Apiculture provides products such as honey and wax that are used commercially.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Apiculture provides an environment for scientists to study and understand bee behavior. Bees collect pollen, create propolis, and produce royal jelly. Pollen grains stick to honeybees as they forage on a flower.

Pedagogy

Chalk and talk, PPT, Group discussion, Assignment, Seminar, Screening of educational videos and quiz

Course Designer(s):

1. Mr. J. Amala Jeyakumar

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Biology of Bees: Honeybee – Systematic position – Species of Honey bees.		Lecture, Chalk and Talk, PPT, Group
	Life history of Honey bee – behaviour – swarming – Pheromone.	3	Discussion, Quiz, Seminar
Unit II	Social life in Bees: Bee colony – Castes – natural colonies and their yiel	3	Lecture, Chalk and Talk, PPT, Group
	Types of bee hives – Structure – location, care and management.	3	Discussion, Quiz, Seminar
Unit III	Bee Rearing: Apiary – Care and Management – Artificial bee hives – types – construction of space frames	3	Lecture, Chalk and Talk, PPT, Group
	Selection of sites – Handling – Maintenance – Instruments employed in Apiary – Extraction instruments.	3	Discussion, Quiz, Seminar
Unit IV	Bee Economy: Honey – Composition – uses – Bee wax and its uses – yield in national and international market	3	Lecture, Chalk and Talk, PPT, Group
	Diseases of honey bees and their control methods. Economics of bee culture.	3	Discussion, Quiz, Seminar
Unit V	Entrepreneurship: venture – Preparing proposals for financial assistance and funding agencies	3	Lecture, Chalk and Talk, PPT, Group
	Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens.	3	Discussion, Assignment

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Understand the systematic position and life history of honey bee.	K2 level
CLO-2	Reveal the different stages and types of bees and discuss about the care and management of apiculture.	K2 level
CLO-3	Describe the practice of bee rearing process and analyze instruments employed in apiary.	K3 level
CLO-4	Compare and contrast the composition of honey and bee wax and interpret the yield in National and International markets.	K4 level
CLO-5	Clarify the proposal for financial assistance and funding agencies and reveal the modern methods employed in artificial bee hives.	K4 level

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	3	2	2	1
CLO-2	2	3	2	2	1
CLO-3	3	3	2	2	1
CLO-4	3	4	3	2	1
CLO-5	2	3	3	2	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	1	2	1	2	1	1
CLO2	3	2	1	2	2	1
CLO3	2	2	2	1	2	1
CLO4	3	2	2	2	2	1
CLO5	2	2	2	1	2	1

Advance application– 3

Intermediate level–2

Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
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 (K2&K2)	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			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 with choice	Consolidated
K1	5	4	0	-	9	7.5	42%
K2	5	6	20	10	41	34.17	
K3	-	-	20	10	30	25	25%
K4	-	-	10	30	40	33.33	33%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF MICROBIOLOGY					CLASS: II-B.Sc., Biotechnology			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
III	Ancillary Theory - 1	23U3RGET1	FUNDAMENTALS OF MICROBIOLOGY	4	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To understand the classification of Microorganisms and structure of bacteria
- To understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms.
- To categorize the methods of sterilization and identify the significance of culture media in the growth of different microbes.
- To exhibit knowledge in analyzing the importance of Bio insecticides, Bio fertilizers prebiotics and probiotics.
- To distinguish between normal flora and pathogens and describe the role of microbes in food intoxications.

Unit	Description	Hours	K-level	CLO
I	History of Microbiology, Classification of bacteria, fungi, virus, protozoa and algae – classical and molecular approaches. Scope of microbiology – Role of microbes in biotechnology.	12 Hrs	K2	1
II	Structure of bacteria - Bacterial growth and measurement of growth, Media – types and preparation- plating methods - staining methods (Gram's, capsule, spore, LCB mount) - methods of preservation and storage of microbes. Culture of fungi, virus and algae.	12 Hrs	K3	2
III	Sterilization methods - physical and chemical methods- Mode of action – Antibiotic in clinical use - Resistance to antibacterial agents - MRSA, ESBL.	12 Hrs	K3	3
IV	Bioinsecticides - <i>Bacillus thuringiensis</i> , Baculoviruses- Biofertilizers - <i>Azospirillum</i> and blue green algae - single cell protein – prebiotics and probiotics - Dairy products (Cheese and Yoghurt).	12 Hrs	K3	4

V	Microbial Disease- host -pathogen interaction, clinical features, lab diagnosis and treatment of Airborne disease (Pneumonia, Chicken pox), food borne disease (Typhoid, Aspergillosis), Water borne disease (Cholera, Amoebiasis), Sexually transmitted disease (AIDS, Trichomoniasis), Vector borne disease (Dengue, Malaria).	12 Hrs	K3	5

Books for study:

1. Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7th Edition., McGraw – Hill, New York.
2. Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand & Co.
3. Ananthanarayanan, Paniker, Kapil, Textbook book of Microbiology, 9th edition, Orient BlackSwan, 2013.

Books for References:

1. Madigan, Martinko, Bender, Buckley, Stahl, Brock Biology of Microorganisms, 14th edition, 2017.
2. Gillespie, Bamford, Medical Microbiology and Infection at a Glance, 4th edition, 2012.
3. Boyd, R.F. (1998). General Microbiology, 2nd Edition., Times Mirror, Mosby College Publishing, St Louis.
4. Tortora, G.J., Funke, B.R., Case, C.L. (2013). Microbiology. An Introduction 11th Edition., A La Carte Pearson.
5. Salle. A.J (1992). Fundamental Principles of Bacteriology. 7th Edition., McGraw Hill Inc. New York.

Web Resources

1. <http://www.ejb.org/content>.
2. www.biotech.kth.se Electronic Journal of biotechnology
3. <https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology>
4. <https://bio.libretexts.org/@go/page/9188>

Rationale for Nature of the course

It will give basic insight on microorganisms and its applications

Activities having direct bearing on Skill development / Employability Entrepreneurship

Knowledge on microorganisms and microbiological techniques

Pedagogy

Practical methods, presentation, model making

Course Designer(s):

Mr.J.Amala Jeakumar

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	History of Microbiology	3	Chalk and Talk, PPT, Quiz, Seminar
	Classification of bacteria, fungi, virus, protozoa and algae – classical and molecular approaches	5	
	Scope of microbiology	2	
	Role of microbes in biotechnology	2	
Unit II	Structure of bacteria - Bacterial growth and measurement of growth	3	Chalk and Talk, PPT, Quiz, seminar
	Media – types and preparation- plating methods	3	
	Staining methods (Gram's, capsule, spore, LCB mount)	2	
	Methods of preservation and storage of microbes	2	
	Culture of fungi, virus and algae	2	
Unit III	Sterilization methods - physical and chemical methods- Mode of action	5	Chalk and Talk, Seminar, Quiz Screening of educational videos
	Antibiotic in clinical use	3	
	Resistance to antibacterial agents - MRSA, ESBL.	4	
Unit IV	Bioinsecticides - <i>Bacillus thuringiensis</i> , Baculoviruses	3	PPT, Seminar, Quiz Screening of educational videos
	Biofertilizers - <i>Azospirillum</i> and blue green algae	3	
	Single cell protein	2	
	Prebiotics and probiotics	2	
	Dairy products (Cheese and Yoghurt)	2	
Unit V	Microbial Disease- host -pathogen interaction	3	Chalk and talk, PPT, Group discussion, Assignment
	Clinical features, lab diagnosis and treatment of Airborne disease (Pneumonia, Chicken pox),	3	
	Food borne disease (Typhoid, Aspergillosis), Water borne disease (Cholera, Amoebiasis),	3	
	Sexually transmitted disease (AIDS, Trichomoniasis), Vector borne disease (Dengue, Malaria).	3	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Study the historical events that led to the discoveries and understand the scope of Microbiology.	K2
CLO-2	Gain Knowledge of detailed structure of bacteria and techniques involved in culturing microorganisms.	K3
CLO-3	Understand the concept of sterilization techniques and Antibiotics.	K3
CLO-4	Evaluate the importance of microorganisms in agriculture and industries	K3
CLO-5	Analyze the clinical features, diagnosis and treatment of various diseases caused by microorganisms	K3

Mapping of CLOs with PSOs

_#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	2	1	1	1
CLO-2	2	2	2	1	1
CLO-3	2	2	2	1	1
CLO-4	2	2	2	1	1
CLO-5	2	2	2	1	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	1	2	2	1
CLO2	3	1	1	2	3	1
CLO3	3	1	1	2	2	1
CLO4	3	1	1	2	3	1
CLO5	3	1	1	2	3	1

Advance application– 3

Intermediate level–2

Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 & K2	1	K2	2 (K2&K2)	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	K1	2 (K3&K3)	1(K3)
4	CLO 4	Up to K3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
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			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 with choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	30	40	70	58.33	58%
K4	-	-	-	-	-	-	-
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF MICROBIOLOGY					CLASS: II-B.Sc., Biotechnology			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
III	Ancillary Practical -1	23U4RGEP1	Ancillary Practical-1	1	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To describe the general Laboratory safety & Sterilization Techniques
- To develop Skills in Media Preparation, Isolation & Serial Dilution Techniques and Pure Culture Techniques
- To microscopically analyze the morphological features of Bacteria and fungi and define various Staining Techniques.
- To perform the Motility of organisms.
- To able to characterize and identify bacteria using Biochemical tests.

Unit	Description	Hours	K-level	CLO
I	Sterilization techniques – Preparation of Media	6	4	1
II	Inoculation techniques- Pour plate, spread plate Isolation of bacteria from various sources and dilution techniques	6	4	2
III	Staining techniques: Simple, Gram's, Capsule (Negative), Spores,	6	4	3
IV	Preparation of temporary mounts- Lacto phenol cotton blue staining.	6	4	4
V	Motility tests: Hanging drop technique. Biochemical characterization - catalase, oxidase, IMVIC test and TSI. Antibiotic sensitivity test (demonstration).	6	4	5

Books for study:

1. James Cappucino, G., and Sherman, N M. B. (1996). A lab manual Benjamin Cummins, New York.1-114.
2. Kannan, N. (1996). Laboratory manual in General Microbiology. Palani Publications. New Delhi.1-316.
3. Sundararaj, T. (2005). Microbiology Lab Manual (1st edition) Pearson publications. New Delhi. 1-544.

Books for References:

1. Atlas, R. (1997). Principles of Microbiology, 2nd Edition, Wm.C.Brown publishers. US. 1-960.
2. Amita, J., Jyotsna, A., and Vimala, V. (2018). Microbiology Practical Manual. (1st Edition). Elsevier India.1-600.
3. Talib, V.H. (2019). Handbook Medical Laboratory Technology. (2nd Edition). CBS. New India. 1-246.
4. Wheeli, M. (2010). Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.US. 1-528.
5. Lim, D. (1998). Microbiology, 2nd Edition, WCB McGraw Hill Publications. US. 1-720.

Web Resources

1. <http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection-methods-and-principles-microbiology/24403>.
2. <https://www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635>
3. https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf
4. <https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology>

Rationale for Nature of the course

Basic understanding on the fundamental aspects of microbiology from historical development of the microbiology.

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 Designer(s):

Mrs.P.Sumathi

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	1	1	3	1	2
CLO-2	1	1	1	2	2
CLO-3	2	1	2	2	3
CLO-4	1	2	2	3	3
CLO-5	1	1	1	2	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	1	1	1	2	1	1
CLO2	2	1	1	3	2	1
CLO3	1	1	1	3	1	1
CLO4	2	1	2	3	2	1
CLO5	1	2	1	2	1	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Assessment SchemeComponents of CIA

Component	Weight / Mark
Continuous Internal Assessment Test, Attendance and Class Participation	25
End Semester Examination	75

DEPARTMENT OF MICROBIOLOGY					CLASS: II-B.Sc., Biotechnology			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
IV	Ancillary Theory II	203U4RGT2	BIOINFORMATICS AND BIOSTATISTICS	4	4	25	75	100

Nature of Course				
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented

Objectives:

- To acquire knowledge about the Developments and Applications of Bioinformatics.
- To gain knowledge about the importance of the bioinformatics, databases, tools and software of bioinformatics and explain different types of Biological Databases.
- To understand the basics of sequence alignment, sequence analysis and Protein structure prediction method.
- To demonstrate the basic methods of data collection, graph construction and sampling techniques and Calculate measures of central tendency
- To correlate and analyze biological data through various statistical methods and interpret biological data via various probabilistic distribution methods.

Unit	Description	Hours	K-level	CLO
I	Introduction to Bioinformatics – Genome, Transcriptome and Proteome, Gene prediction rules and software. Nucleic acid Databases – Primary and Secondary Databases – Structure Database – CATH, SCOP – Data base Searching – BLAST and FASTA, BLOSSUM.	12	K2	1
II	Sequence analysis (Proteins and Nucleic acids), Protein Database: Comparison of Protein sequences and Database searching – methods for protein structure prediction - Homology modeling of proteins, visualization tools (RASMOL).	12	K3	2
III	Multiple Sequences alignment – method of multiple sequences alignment- Evolutionary analysis, clustering methods Phylogenetic trees - Methods to generate phylogenetic tree- Tools for multiple sequences alignment and phylogenetic analysis - History of Drug Discovery, Steps in Drug design - Chemical libraries – Role of molecular docking in drug design.	12	K2	3
IV	Statistics – collection, classification, tabulations of Statistical Data – Diagrammatic representation – Graphs – Sampling method and standard error. Measures of central tendency – measures of dispersion.	12	K3	4

V	Correlations and regression. Probability distribution- Binomial, Negative binomial, multinomial distribution, Poisson distribution. Tests of significance – t tests – F tests – Chi square test. Analysis of variance – Statistical Soft wares.	12	K4	5

Books for study:

1. Pennington, S.R. and Pun, M.J. 2002. Proteomics: from protein sequence to function. Viva books Pvt. Ltd.
2. Shuba G., 2010. Bioinformatics., Tata McGraw Hill publishing. India.
3. Rastogi, S.C, Mendiratta, N, Rastogi, P., 2004. Bioinformatics methods and application. Prentice-Hall of India private limited, New Delhi.

Books for References:

1. Attwood, T.K. and Parry-Smith, D.J. 2008. Introduction to Bioinformatics. Pearson Education.
2. David Mount., Bioinformatics: sequence and genome analysis, second edition, Taylor & Francis, UK; 2009.
3. D.R. Westhead. Instant Notes in Bioinformatics. second edition., Taylor & Francis, UK; 2009.
4. Zar, (J.H. 2010). "Biostatistical Analysis" Fifth Edition, Pearson Education Pvt Ltd, Indian Branch, New Delhi.
5. P.N. Arora and P.K. Malhan. (2013) "Biostatistics" Himalaya publishing House.

Web Resources

1. <https://www.ncbi.nlm.nih.gov/>
2. <https://blast.ncbi.nlm.nih.gov/Blast.cgi>
3. <https://www.ebi.ac.uk/jdispatcher/msa/clustalo>
4. <https://www.phylogeny.fr/index.cgi>

Rationale for Nature of the course

Bioinformatics and biostatistics involve a Biotechnological databases of interacting nucleotide molecules and Proteins that function to recognize and respond to Phylogenetic studies. It deals with sequence alignment, biostatistic tools and physiological characteristics the analysis of components of biological system.

Activities having direct bearing on Skill development / Employability Entrepreneurship

The most important aspect of Bioinformatics and Biostatistics is research because it is the biggest portion of jobs in Information technology. It involves various areas such as biomedical research, healthcare, agriculture and environmental Informatics. A career in scientific research. Bioinformatics and biostatistics has applications in various disciplines of medicine that are Drug designing.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Designer(s):

Mr.M.Rajesh Kannan

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction to Bioinformatics – Genome, Transcriptome and Proteome, Gene prediction rules and software. Nucleic acid Databases	6	Chalk and Talk Lecture, PPT, Discussion, Quiz, Seminar
	Primary and Secondary Databases – Structure Database – CATH, SCOP – Data base Searching – BLAST and FASTA, BLOSSUM	6	
Unit II	Sequence analysis (Proteins and Nucleic acids), Protein Database: Comparison of Protein sequences	6	Chalk and Talk, Lecture, PPT, Discussion, Quiz, Seminar
	Database searching – methods for protein structure prediction - Homology modeling of proteins, visualization tools (RASMOL).	6	
Unit III	Multiple Sequences alignment – method of multiple sequences alignment- Evolutionary analysis, clustering methods Phylogenic trees - Methods to generate phylogenetic tree- Tools for multiple sequences alignment and phylogenetic analysis	6	Chalk and Talk, , PPT, Discussion, Quiz, Seminar
	History of Drug Discovery, Steps in Drug design - Chemical libraries – Role of molecular docking in drug design.	6	
Unit IV	Statistics – collection, classification, tabulations of Statistical Data – Diagrammatic representation – Graphs	6	Chalk and Talk, Lecture, PPT, Quiz, Seminar
	Sampling method and standard error. Measures of central tendency – measures of dispersion.	6	
Unit V	Correlations and regression. Probability distribution- Binomial, Negative binomial, multinomial distribution,	6	Chalk and Talk, PPT, Discussion, Quiz, Assignment
	Poisson distribution. Tests of significance – t tests – F tests – Chi square test. Analysis of variance – Statistical Soft wares.	6	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Define the basic Bioinformatics of tools of databases, tools and software of bioinformatics.	K2
CLO-2	Outline sequence alignment, sequence analysis and Protein structure prediction method.	K3
CLO-3	Interpret the basic methods of data collection, graph construction and sampling techniques.	K2
CLO-4	Perceive the analytics of sampling techniques and Calculate measures of central tendency	K3
CLO-5	Become skilled at the analyze biological data through various statistical methods and interpret biological data via various probabilistic distribution methods.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	1	1	1	1	1
CLO-2	3	2	1	3	3
CLO-3	3	3	2	3	3
CLO-4	3	3	2	3	3
CLO-5	3	3	2	3	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	3	3	3	1
CLO2	3	3	3	3	3	1
CLO3	3	3	3	3	2	1
CLO4	3	3	3	2	3	1
CLO5	3	3	3	3	3	1

Advance application- 3;

Intermediate level-2;

Basic level-1

Summative - Blue – Print – Model
(Mapping with Course 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 & 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 K2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
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	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			1		5		5	3
Marks for each question			10		2		5	10
Total marks for each			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 with choice	Consolidated
K1	5	4	10	-	19	15.83	50%
K2	5	6	10	20	41	34.17	
K3	-	-	20	20	40	33.33	33%
K4	-	-	10	10	20	16.67	17%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF MICROBIOLOGY					CLASS: II-B.Sc., Biotechnology			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	Ancillary Practical II	23U4RGEP2	Ancillary Practical II	1	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To analyse the Biological databases
- To understand and perform BLAST and FASTA
- To represent data in to graphical form
- To test the level of significance of biological data and interpret the results.
- To determine averages of the biological data

Unit	Description	Hours	K-level	CLO
I	Biological databases (NCBI, Swissprot and PDB)	6	K4	1
II	BLAST FASTA	6	K4	2
III	Identification of functional domains in nucleotide binding proteins using a domain analysis server like SMART	6	K4	3
IV	Preparation of bar diagram, line diagram and pie diagram using MS EXCEL. Calculation of Central tendency- mean, geometric mean, median using MS EXCEL	6	K4	4
V	Calculation of dispersion – Mean deviation, quartile deviation and standard deviation using MS EXCEL, Calculation of student's t test using MS EXCEL	6	K4	5

Books for study:

1. Pennington, S.R. and Pun, M.J. 2002. Proteomics: from protein sequence to function. Viva books Pri. Ltd.
2. Maleolm and Goosfship. J. 2001. Genotype to phenotype, 2nd edition. Bios Scientific Publishers Ltd
3. Misener, S. and Krawetz. S.A. 2000. Bioinformatics: Methods and Protocols. Humana press.

Books for References:

1. Durbin, R., Eddy, S., Krogh, A. and Mitchison, G. 1998. Biological sequence analysis. Cambridge University Press.

- Friedman, C.P. and Wyatt, J.C. 1997. Computers and Machine: Evaluation methods in medicinal information. Springer-verlag, New York.

Web Resources

- <https://www.ncbi.nlm.nih.gov/guide/all/>
- <https://flexbooks.ck12.org/cbook/ck-12-cbse-math-class-9/section/14.3/primary/lesson/graphical-representation-of-data/>
- <https://statisticsbyjim.com/basics/measures-central-tendency-mean-median-mode/>

Rationale for Nature of the course

Provides hands on training on basic how bioinformatics tools can be utilized in biomedical research.

Activities having direct bearing on Skill development / Employability Entrepreneurship

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 Designer(s):

Mr.J.Amala Jeyakumar

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Analyse the Biological databases	K4
CLO-2	Able to perform BLAST and FASTA	K4
CLO-3	Represent data in to graphical form	K4
CLO-4	Test the level of significance of biological data and interpret the results.	K4
CLO-5	Determine averages of the biological data	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	2	2
CLO-2	3	3	3	2	1
CLO-3	3	3	3	2	2
CLO-4	3	3	2	2	1
CLO-5	3	2	3	1	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	3	3	3	1
CLO2	3	3	3	3	3	1
CLO3	2	3	2	3	2	1
CLO4	3	3	3	2	3	1
CLO5	3	3	3	3	3	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Assessment SchemeComponents of CIA

Component	Weight / Mark
Continuous Internal Assessment Test, Attendance and Class Participation	25
End Semester Examination	75

DEPARTMENT OF MICROBIOLOGY				CLASS: III B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	ADD ON-1	23U3RAD1	Biostatistics and Bioinformatics	2	2	50	50	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Course Objectives:

- To study the various tools in biostatistics and bioinformatics.
- To represent and interpret the scientific data
- To acquire basic knowledge about the software's involved in biostatistics and bioinformatics
- To learn basics of computer: software and hardware.
- To understand the basic concept of biostatistics and data interpretation

Unit	Description	Hours
I	Introduction to biostatistics: Nature and scope of biostatistics and its application - Sampling and its types – Graphical representation of Data - Data interpretation and tabulation of data. Event and sets – Samples space – Concept of probability – Addition and multiplication theorem on probability – Conditional probability and independence of events.	12Hrs
II	Measures of central tendency: Mean, median and mode, Measures of dispersion - range, mean deviation, standard deviation, coefficient of variation, Skewness and kurtosis - Standard distributions- Binomial poisson and normal distributions.	12Hrs
III	Statistical analysis and Statistical software: Hypothesis testing, Null hypothesis and alternative hypothesis, level of significance. Chi-square test, t-test, F-test, ANOVA-one way and two way classifications. Simple correlation and simple regression – Statistical software and its application in biology.	12Hrs
IV	Basics of computers and bioinformatics: Computer: Basic components-Input and output devices. Memory and storage: software -types-applications: operating systems; internet, computer Networks, Software. WWW, Introduction to Bioinformatics- Role of bioinformatics Nucleic acid sequence databases (Gen Bank, DDBJ). Protein sequence database- Primary, Swiss-Prot, Structure database- RCSB-Databases –Importance – Types –Classification –Sequence format – Database record DBMS –Structure, classification- SCOP,CATH: Secondary databases –PROSITE – Composite databases –NDB.	12Hrs
V	Sequence and structural analysis: Sequence alignment pairwise sequence and multiple alignment. Homology tools BLAST - FASTA and phylogenetic analysis using CLUSTAL W, PHYLIP. Molecular visualizing tools –RASMOL, Docking.	12Hrs

Books for study:

1. S. Palanisamy and M. Manoharan, (2002). Statistical methods for Biologists. Palani Paramount Publication, Anna Nagar, Palani, Tamilnadu.
2. S.C. Gupta and K. Kapoor, (2002). Fundamentals of Applied Statistics. 3rd Edition. Sultan Sons Educational Publisher, New Delhi.
3. N. Gurumani, (2002). An introduction to Biostatistics. MJP Publishers, Chennai.

Course designers

1. **Dr. P. Sasikumar**

DEPARTMENT OF MICROBIOLOGY				CLASS: II B.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	ADD ON-II	23U4RAD2	Introduction to Medical Coding	2	2	50	50	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives:

- To understand Anatomy and Physiology of the human body
- To become familiar with medical definitions and terminology, their pronunciation and use of medical prefixes
- To recognize coding medical procedures like what to code and how to prepare the forms
- To identify differences between ICD-9-CM and ICD-10-CM guidelines
- To apply coding conventions when assigning diagnoses and procedure codes.

Unit	Course Topics	Hours
I	Introduction to Medical Coding -Medical Coding in History - The Black Death - William Farr and the Cholera Studies - International list of causes of death - Beyond death - Modern times.	6hrs
II	Medical Terminology -Definition and Origin of Medical Terms. Components of Medical Terms – Prefixes, Suffixes, Roots and Combining forms. Terms relating to the body as a whole.	6hrs
III	Anatomy and Physiology -The chemical basis of life. Anatomy of cells and tissues. Anatomy and Physiology of skin and appendages, skeleton- muscular, nervous, cardiovascular, respiratory, digestive and urinary systems.	6hrs
IV	Biochemistry -Chemistry of the human body fluids in health and diseases – blood, cerebrospinal fluid and urine. Clotting mechanism of the blood. Enzymes produced in the G.I. Tract. Electrolytes and water balance, acid-base balance. Normal values and ranges of biochemistry investigations	6hrs
V	Procedure Coding -Healthcare Common Procedure Coding System (HCPCS). International Classification of Diseases and Clinical Modification - ICD-9-CM and ICD-10CM coding guidelines. Current Procedural Terminology (CPT) procedure coding. Certified Professional Coder (CPC) exam.	6hrs

Books for Study

1. Carol J Buck. (2021). Step-by-step Medical Coding. 3rd Edition, Saunders, Philadelphia.
2. Patricia Aalseth. (2006). Medical Coding. Jones and Bartlett Publishers, Massachusetts.

Course designers

1.Dr. P. Sasikumar

DEPARTMENT OF MICROBIOLOGY					CLASS: II-B.Sc., Microbiology			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
III & IV	Self-Study	23U4RSST1	BIOENERGY	2	-	50	50	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓	✓

Objectives:

- Acquire knowledge on bioenergy utilizing organic wastes for energy recovery
- Discuss methods and strategies of exploiting microbes for the production technology of biodiesel.
- Describe resources and techniques for the production and estimation of eco-friendly biofuels and the extent of their use potentially
- Gain knowledge for executing biogas plant in communities
- Explain possibility of using microbes for the production of bio-hydrogen as a source of future fuel

Unit	Description	Hours
I	Bioenergy – Introduction and Energy Resources. Bioenergy from microorganisms (Bacteria, fungi, yeast and microalgae) - Bioprospecting of microbes for biofuel production.	6 Hrs
II	Biodiesel – Production of biodiesel from Microorganisms, feed stock for biodiesel production. Lipid extraction methods and conversion to biodiesel. Quality assessment of Biodiesel. Biodiesel production from genetic modified microorganisms.	6 Hrs
III	Alcoholic Fuels – Production of ethanol using microorganisms, Pre-treatment of substrate and fermentation. Microbial enzymes involved in ethanol production. Distillation and estimation of ethanol.	6 Hrs
IV	Biogas – Definition and composition. Biogas plants – types –construction– Bottling Technology and applications in India. Application of Biogas slurry in agriculture.	6 Hrs
V	Biohydrogen – Definition, biohydrogen production from microalgae (<i>Dunaliella</i> and <i>Hematococcus</i>). Microbial fuel cells.	6 Hrs

Books for study:

1. Dahiya A. (2014). Bioenergy- Biomass to Biofuel. (1st Edition). Academic Press Editor.
2. Brown R. C. (2003). Biorenewable Resources: Engineering New Products from Agriculture. (1st Edition). Wiley Blackwell Publishing.
3. Jawaid M., Hakeem K. R. and Rashid U. (2014). Biomass and Bioenergy: Processing and Properties. (1st Edition). Springer Cham.

Books for References:

1. Konur O. (2018). Bioenergy and Biofuels. (1st Edition). CRC Press.
2. Lee J. W.(2012). Advanced Biofuels and Bioproducts. (13th Edition), Springer.
3. Khanal S. (2008). Anaerobic Biotechnology for Bioenergy Production: Principles and Applications. (8th Edition). Wiley-Blackwell Publishing.
4. Pradeep Chaturvedi.(1995). Bioenergy Resources. Concept Publishing Company.
5. Lee S. (2018).Biofuel and Bioenergy. Taylor and Francis

Web Resources

1. <https://www.elsevier.com> Biofuels and Bioenergy
2. <https://www.sciencedirect.com> › book › bioenergy
3. https://www.un.org/en/climatechange/what-is-renewableenergy?gclid=EAIaIQobChMIqriN2 Nao-wIV2HwrCh2pfA5mEAAYASAAEgI-p_D_BwE
4. <https://www.energy.gov/eere/bioenergy/bioenergy-basics>
5. <https://www.iea.org/fuels-and-technologies/bioenergy>

Rationale for Nature of the course

It will give basic insight on foundation of bioenergy production

Activities having direct bearing on Skill development / Employability Entrepreneurship

This course introduces the core concepts and basic principles in Design, execute and extract bio-hydrogen from algae

Pedagogy

Self-study

Course Designer(s):

1.Dr.P.Kiruthika Lakshmi



The Madura College (Autonomous), Madurai – 625 011

Department of MICROBIOLOGY

UG Programme Structure

Semester	Course Code	Title of the Course	Hours	Credits	Nature of Course(Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			% of Syllabus Revision /New
					Empl	Ent	Skill	Local	National	Global	
I	23U1RCCT1	Fundamentals of Microbiology and Microbial Diversity	5	5			✓			✓	-
	23U1RCCP1	Major Practical - I	3	3			✓				
	23U1LGET1	Basic and clinical biochemistry	4	4			✓				-
	23U1LGEP1	Allied Practical - 1	2	1			✓				
	23U1RSED1	Social and Preventive Medicine	2	2	✓	✓	✓	✓	✓	✓	-
	23U1RFCT1	Introduction to Microbial World	2	2			✓	✓	✓	✓	-
			30	23							
II	23U2RCCT2	Microbial Physiology and Metabolism	5	5	✓		✓		✓	✓	-
	23U2RCCP2	Major Practical - II	3	3	✓		✓		✓	✓	-
	23U2LGET2	Clinical Laboratory Technology	4	4	✓		✓	✓	✓	✓	-
	23U2LGEP2	Allied Practical - II	2	1	✓		✓				
	23U2RSED2	Nutrition & Health Hygiene	2	2	✓	✓	✓	✓	✓	✓	-
	23U2RSED3	Sericulture	2	2	✓	✓	✓	✓	✓	✓	-
			30	23							

Semester	Course Code	Title of the Course	Hours	Credits	Nature of Course(Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			% of Syllabus Revision/New
					Empl	Ent	Skill	Local	National	Global	
III	23U3RCCT3	Molecular biology and Microbial genetics	4	4	✓		✓	✓	✓	✓	-
	23U3RCCP3	Major Practical - III	3	3	✓		✓				-
	23U3CGET1	Bioinstrumentation	4	4	✓		✓				-
	23U3CGEP1	Ancillary Practical I	2	1	✓						-
	23U3RSED4	Organic farming and biofertilizer technology	2	2	✓	✓	✓	✓	✓	✓	-
	23U3RSED5	Aquaculture	2	2	✓	✓	✓	✓	✓	✓	-
	23U3EVST1	EVS	1	-			✓	✓	✓	✓	-
			30	22							
IV	23U4RCCT4	Immunology and Immuno technology	4	4	✓		✓				-
	23U4RCCP4	Major Practical - IV	3	3	✓		✓				-
	23U4CGET2	Food processing technology	4	4		✓	✓		✓	✓	-
	23U4CGEP2	Ancillary Practical III	2	1			✓				-

	23U4RSED6	Vaccine technology	2	2	✓	✓	✓	✓	✓		-
	23U4RSED7	Apiculture	2	2	✓	✓	✓	✓	✓		-
	23U4EVST2	EVS	1	2			✓				-
			30	24							
III	23U3RGET1	Fundamentals of microbiology	4	4	✓		✓				-
	23U3RGEP1	Ancillary Practical I	2	1	✓		✓				-
IV	23U4RGET2	Bioinformatics and Biostatistics	4	4	✓		✓				-
	23U4RGEP2	Ancillary Practical II	2	1	✓		✓				-
III	23U3RAD1	Biostatistics and Bioinformatics	2	2	✓		✓				-
IV	23U4RAD2	Introduction to Medical Coding	2	2	✓	✓	✓				New
	23U4RSST1	Bioenergy	-	2	✓	✓	✓				New

Emp- Employability; Ent- Entrepreneurship; Skill- Skill Development

Department of Microbiology
The Madura College
Madurai
M.Sc., Microbiology

Semester	Subject code	Course	Course Title	Credit	No. of Hours
I	23P1RCCT1	Core I	General Microbiology and Microbial Diversity	5	6
	23P1RCCT2	Core II	Microbial Physiology	5	6
	23P1RCCP1	Core Practical I	Practical-I – General Microbiology, Microbial Diversity and Microbial Physiology	4	6
	23P1RECT1	Elective I	Forensic Science/ Nanobiotechnology/ Microalgal Technology (Among the three choices anyone can be chosen by the student)	3	5
	23P1RECT2	Elective II	Bioinstrumentation/ Herbal Technology and Cosmetic Microbiology / Essentials of Laboratory Management and Biosafety (Among the three choices anyone can be chosen by the student)	3	5
	23P1RSED1	Skill Enhancement Course I	Microbial Cultivation and Growth	2	2
			Total	22	30

Semester	Subject code	Course	Course Title	Credit	No. of Hours
II	23P2RCCT3	Core III	Medical Bacteriology and Mycology	5	6
	23P2RCCT4	Core IV	Medical Virology and Parasitology	5	6
	23P2RCCP2	Core Practical II	Practical-II - Medical Microbiology	4	6
	23P2RECT3	Elective III	Epidemiology/ Clinical Diagnostic Microbiology/ Bioremediation (Among the three choices anyone can be chosen by the student)	3	5
	23P2RECT4	Elective IV	Bioinformatics / Biosafety, Bioethics and IPR / Clinical Research and Clinical Trials (Among the three choices anyone can be chosen by the student)	3	5
	23P2RSEN1	Skill Enhancement Course II (NME)	Vermitechnology	2	2
	23P3RINTR	Internship/ Industrial Activity	Internship* / Industrial Activity	-	-
			Total	22	30

*** Internship during summer vacation. The credits shall be awarded in Semester – III**

Statement of Marks

Semester	Subject code	Course	Course Title	Credit	No. of Hours
III	23P3RCCT5	Core-V	Immunology and Microbial Genetics	5	6
	23P3RCCT6	Core-VI	Molecular Biology and Recombinant DNA Technology	5	6
	23P3RCCP3	Core Practical III	Practical III- Immunology, Microbial Genetics and Molecular Biology	4	6
	23P3RECT5	Elective – V Discipline Centric	Fermentation Technology and Pharmaceutical Microbiology	3	5
	23P2RMDC1	MDC	Computer Aided Drug Discovery and Design	3	5
	23P3RSEN2	Skill Enhancement II (NME)	Organic Farming and Biofertiliser Technology	2	2
	23P3RINTR	Internship/ Industrial Activity	Internship/Industrial Activity	2	-
			Total	24	30
IV	23P4RCCT7	Core - VII	Food and Environmental Microbiology	5	6
	23P4RCCP4	Core Practical - VIII	Practical IV-Applied Microbiology	4	6
	23P4RPROV	Project	Project with Viva-Voce	8	8
	23P4RECT6	Elective-VI (Industry/ Entrepreneurship) 20%Theory 80%Practical	Bioenergy/ Marine Microbiology/ Life Science for Competitive Examinations (Among the three choices any one can be chosen by the student)	3	6
	23P4RSED2	Skill Enhancement course/Professional Competency Skill	Research Methodology and Biostatistics	2	4
	23P4REXTN	Extension Activity	Microbial Quality Control and Testing	1	-
			Total	23	30

Credit Distribution for PG Course

S.No	Course Details	Credit
1	Core Course [12 Courses X 4 Credits]	48
2	Elective Course [6 Courses X 3 Credits]	18
3	Skill Enhancement Course [3 Courses X 2 Credits]	6
4A	Professional Competency Course & Industry Module	4
4B	Project Work VIVA VOCE	4
5	Ability Enhancement Compulsory Course [4 Courses X 2]	8
6	Internship	2
7	Extension Activity	1
		91

Programme:	M.Sc. MICROBIOLOGY
Programme code:	22PGMB
Duration:	2 Years [PG]
Programme Outcomes:	PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study. PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real-life situations. PO4: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints. PO5: Scientific Reasoning: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open-minded and reasoned perspective. PO6: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.
Programme Specific Outcomes	PSO-1: Placement Prepare the students in varied disciplines like agriculture, industry - medical, pharma, dairy, hotel, food and food processing, immunological, cosmetics, vermitechology and water treatment for effective and respectful placement.

	PSO-2: Entrepreneurship To create effective entrepreneur by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. PSO-3: Research and Development Design and implement HR systems that comply with good laboratory practices, following ethical values, leading the organization towards growth and development. . PSO-4: Contribution to Society To contribute to the development of society and produce microbiological products, by collaborating with stake holders, related to the betterment of environment and mankind at the national and global level. PSO 5 Communication skills To 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.

Assessment Scheme

Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations.

DEPARTMENT OF MICROBIOLOGY					CLASS: II M.Sc			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
III	Core Course V	23P3RCCT5	IMMUNOLOGY AND MICROBIAL GENETICS	5	6	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To discuss immunity, organs and cells involved in immunity. Compare the types of antigens and their properties.
- To describe immunoglobulin and its types. Categorize MHC and understand its significance.
- To elucidate the mechanisms of different hypersensitivity reactions. List out the Vaccines and discuss their development.
- To acquire knowledge the structure DNA in prokaryotes and eukaryotes
- To explain about gene transfer studies in microbes.

Unit	Description	Hours	K-level	CLO
I	Introduction to biology of the immune system – Cells and organs of Immune System. T and B lymphocytes – Origin, development, differentiation, lymphocyte subpopulation in humans. Innate immunity- Complement, Toll-like receptors and other components. Acquired immunity – Active and Passive immunity. Antigens - features associated with antigenicity and immunogenicity. Basis of antigen specificity. MHC genes and products, Structure of MHC molecules, Genetics of HLA Systems – Antigens and HLA typing. Antigen processing and presentation to T- lymphocytes.	18	K2	CLO–1
II	Immunoglobulins. Theories of antibody production. Class switching and generation of antibody diversity. Monoclonal and polyclonal antibodies. Complement system – mode of activation- Classical, Alternate and Lectin pathways, biological functions. Antigen recognition – TCR, Diversity of TCR, T cell surface alloantigens, lymphocyte activation, clonal proliferation and differentiation. Physiology of acquired immune response – various phases of HI, CMI – Cell mediated cytotoxicity, DTH response	18	K3	CLO–2

III	Hypersensitivity – Types and mechanisms, Autoimmunity, Tumor Immunity and Transplantation immunology. Immunodeficiency-Primary immunodeficiency and Secondary immunodeficiencies. Genetics of Immunohematology – Genetic basis and significance of ABO and other minor blood groups in humans, Bombay blood group, Secretors and Non-secretors, Rh System and genetic basis of D- antigens. Diagnostic Immunology - Precipitation reaction, Immunodiffusion methods - SRID, ODD. Immuno-electrophoresis - Rocket and Counter current electrophoresis. Agglutination - Hemagglutination - Hemagglutination inhibition. Labeled Assay-Immunofluorescence assay, Radio immunoassay, FISH, ELISA. Flow cytometry. Immune regulation mechanisms – immuno-induction, immuno- suppression, immuno-tolerance, immuno-potential, Immunomodulation. Role of cytokines, lymphokines and chemokines. Introduction to Vaccines and Adjuvants - Types of vaccines. Development of vaccines and antibodies in plants. Immunomics - Introduction and Applications. Antigen engineering for better immunogenicity and use for vaccine development-multiepitope vaccines. Reverse vaccinology.	18	K4	CLO–3
IV	Structural of prokaryotic and eukaryotic genome. Introduction to prokaryotic genomic structure, Eukaryotic Genome - Structure of chromatin, chromosome, centromere, telomere, nucleosome. Modifications- methylation, acetylation, phosphorylation and its effect on structure and function of chromatin, DNA methylation and gene imprinting, organelle genome.	18	K4	CLO–4
V	Gene Transfer Mechanisms- Conjugation and its uses. Transduction, Generalized and Specialized, Transformation– Natural Competence and Transformation. Transposition and Types of Transposition reactions. Insertion sequences, complex and compound transposons – T10, T5, and Retroposon. Mechanism – Transposons of <i>E. coli</i>, Bacteriophage and Yeast. Importance of transposable elements in horizontal transfer of genes and evolution.	18	K4	CLO–5

Books for study:

1. Coico R., Sunshine G. and Benjamini E. (2003). Immunology – A Short Course. (5th Edition). Wiley-Blackwell, New York.
2. Owen J. A., Punt J., Stranford S. A. and Kubly J. (2013). Immunology, (7th Edition). W. H. Freeman and Company, New York.
3. Abbas A. K., Lichtman A. H. and Pillai S. (2021). Cellular and Molecular Immunology. (10th Edition). Elsevier.

Books for References:

1. Travers J. (1997). Immunobiology - The Immune System in Health and Disease. (3rd Edition). Current Biology Ltd. New York.
2. Delves P.J., Martin S., Burton D. R. and Roitt I. M. (2006). Roitt's Essential Immunology. (11th Edition). Wiley-Blackwell.
3. Hay F. C. and Westwood O. M. R. (2002). Practical Immunology (4th Edition). Wiley-Blackwell.
4. Glick B. R. and Patten C.L. (2018). Molecular Biotechnology – Principles and Applications of Recombinant DNA. (5th Edition). ASM Press.
5. Russell P.J. (2010). Genetics - A Molecular Approach. (3rd Edition). Pearson New International Edition.

Web Resources

1. <https://www.ncbi.nlm.nih.gov/books/NBK279395/>
2. <https://med.stanford.edu/immunol/phd-program/ebook.html>
3. <https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall-2005/pages/lecture-notes/>
4. <https://microbenotes.com/gene-cloning-requirements-principle-steps-applications/>

Rationale for Nature of the course

Immunology deals with physiological functioning of the immune system in states of both health and disease as well as malfunctions of the immune system in immunological disorders like allergies, hypersensitivities, immune deficiency, transplant rejection and autoimmune disorders. It deals with physical, chemical and physiological characteristics of the components of immune system in vitro, and in vivo. Immunology has a vast array of uses in several disciplines of science and medical sciences. This course introduces the basic concepts of bacterial genetics to understand genetic makeup, gene transfer and mutation. It explores the importance of phage genetics and to gain knowledge about transposable elements and their roles. The mechanisms of gene expression in bacteria can also be used for constructing genetic map.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Identifying immunology related diseases and developing research initiatives for early detection. Providing skills to work with professional regulatory bodies regarding clinical research. Hands-on training for designing drugs and to perform serological diagnosis. Isolation and identification of mutants in bacteria. Construct genetic makeup. Induce mutation and understand repair systems in living organisms.

Pedagogy

Chalk and talk, PPT, Group discussion, Assignment, Seminar, Screening of educational videos and quiz

Course Designer(s):

1. Dr. K. Rajeswari

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction to biology of the immune system – Cells and organs of Immune System. T and B lymphocytes – Origin, development, differentiation, lymphocyte subpopulation in humans.	9	Chalk and Talk, Group discussion Assignment, Quiz, Seminar , PPT presentation
	Innate immunity- Complement, Toll-like receptors and other components. Acquired immunity – Active and Passive immunity.	9	
	Antigens - features associated with antigenicity and immunogenicity. Basis of antigen specificity. MHC genes and products, Structure of MHC molecules, Genetics of HLA Systems – Antigens and HLA typing. Antigen processing and presentation to T- lymphocytes.	9	
Unit II	Immunoglobulins. Theories of antibody production. Class switching and generation of antibody diversity. Monoclonal and polyclonal antibodies. Complement system – mode of activation- Classical, Alternate and Lectin pathways, biological functions.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Antigen recognition – TCR, Diversity of TCR, T cell surface alloantigens, lymphocyte activation, clonal proliferation and differentiation. Physiology of acquired immune response – various phases of HI, CMI – Cell mediated cytotoxicity, DTH response.	9	

Unit III	Hypersensitivity – Types and mechanisms, Autoimmunity, Tumor Immunity and Transplantation immunology. Immunodeficiency-Primary immunodeficiency and Secondary immunodeficiencies.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Genetics of Immunohematology – Genetic basis and significance of ABO and other minor blood groups in humans, Bombay blood group, Secretors and Non-secretors, Rh System and genetic basis of D- antigens.	9	
	Diagnostic Immunology - Precipitation reaction, Immunodiffusion methods - SRID, ODD. Immuno-electrophoresis - Rocket and Counter current electrophoresis. Agglutination - Hemagglutination - Hemagglutination inhibition.	9	
	Labeled Assay- Immunofluorescence assay, Radio immunoassay, FISH, ELISA. Flow cytometry. Immune regulation mechanisms – immuno-induction, immuno-suppression, immuno-tolerance, immuno-potentiation, Immunomodulation. Role of cytokines, lymphokines and chemokines.	9	
	Introduction to Vaccines and Adjuvants - Types of vaccines. Development of vaccines and antibodies in plants. Immunomics - Introduction and Applications. Antigen engineering for better immunogenicity and use for vaccine development-multipitope vaccines. Reverse vaccinology.	9	
Unit IV	Structural of prokaryotic and eukaryotic genome. Introduction to prokaryotic genomic structure, Eukaryotic Genome - Structure of chromatin, chromosome, centromere, telomere, nucleosome.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Modifications- methylation, acetylation, phosphorylation and its effect on structure and function of chromatin, DNA methylation and gene imprinting, organelle genome.	9	
Unit V	Gene Transfer Mechanisms- Conjugation and its uses. Transduction, Generalized and Specialized, Transformation– Natural Competence and Transformation.	9	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Transposition and Types of Transposition reactions. Insertion sequences, complex and compound transposons – T10, T5, and Retroposon. Mechanism – Transposons of <i>E. coli</i> , Bacteriophage and Yeast. Importance of transposable elements in horizontal transfer of genes and evolution.	9	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Categorize the immune response to a variety of antigens. Identify different immune cells involved in immunity.	K2
CLO-2	Justify the significance of MHC molecules in immune response and antibody production.	K3
CLO-3	Design antibodies and evaluate immunological assays in patient samples.	K4
CLO-4	Analyze genomic DNA of prokaryotes and eukaryotes.	K4
CLO-5	Summarize gene transfer mechanisms for experimental study.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	1	2	1
CLO-2	2	1	2	1	1
CLO-3	2	3	2	1	1
CLO-4	2	2	1	1	1
CLO-5	2	1	2	3	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	2	1	1	2
CLO2	2	2	2	2	2	3
CLO3	3	2	2	1	2	3
CLO4	2	1	2	1	1	3
CLO5	2	1	2	1	1	3

Advance application– 3;

Intermediate level–2;

Basic level–1

Summative - Blue – Print – Model
(Mapping with Course 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 K-2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K-3	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(K4)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K2&K2)	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			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 with choice	Consolidated
K1	5	4	0	-	9	7.5	42%
K2	5	6	20	10	41	34.17	
K3	-	-	20	10	30	25	25%
K4	-	-	10	30	40	33.33	33%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF MICROBIOLOGY					CLASS: II M.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
III	Core Course VI	23P3RCCT6	MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY	5	6	25	75	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented		

Objectives:

- To provide knowledge on the structure, replication and repair mechanisms of DNA. Illustrate the structure, functions and significance of RNA.
- To discuss the gene regulatory mechanisms in prokaryotes and eukaryotes and importance of mutations.
- To provide in depth knowledge about artificial gene transfer mechanisms and selection of Recombinants.
- To impart knowledge on various molecular techniques and their importance in biotechnology.
- To explain the applications of genetic engineering in various fields.

Unit	Description	Hours	K-level	CLO
I	DNA replication – modes and enzymes involved. Detailed mechanism of semi-conservative replication. Prokaryotic and eukaryotic transcription. Structure and processing of m-RNA, r-RNA and t-RNA. Ribosomes. Genetic Code and Wobble hypothesis, Translation in prokaryotes and eukaryotes, post translational modifications.	18	K2	CLO1
II	Gene regulation and expression – Lac operon, arabinose and tryptophan operons. Gene regulation in eukaryotic systems - repetitive DNA, gene rearrangement, promoters, enhancer elements. Molecular basis of gene mutation - Types of mutations - base substitutions, frame shift, deletion insertion, duplication, inversion. Silent, conditional and lethal mutation. Chemical mutagenesis. Repair of DNA damage. Photoreactivation. SOS repair	18	K3	CLO2

	mechanism. Base excision repair. Nucleotide excision repair. Detection and analysis of mutations (Replica plating, Antibiotic enrichment, Ames test).			
III	Tools and methods in gene cloning. Restriction endonucleases – nomenclature, classification and characteristics - DNA methylases, DNA polymerases, Ligases. Adapters, linkers and homopolymer tailing. Artificial gene transfer techniques - electroporation, microinjection, protoplast fusion and microparticle bombardment. Screening for recombinants. Gene cloning vectors for prokaryotes and eukaryotes - cloning properties and types of plasmids vectors (pBR322 and derivatives, pUC vectors and pGEM3Z) - Phage Vectors(M13 and Lambda), cosmids, phasmids, phagemids and BACs - Eukaryotic vectors - Yeast vectors – Animal and plant vectors – expression vectors. Shuttle vectors - Expression of foreign genes in bacteria, animal, plant, algae and fungi – merits and demerits.	18	K4	CLO3
IV	Genomic DNA and cDNA library - Construction and Screening. Substrative hybridization for tissue specific DNA libraries. Techniques in genetic engineering Characterization of cloned DNA: Hybrid arrested translation (HAT) - Restriction mapping - restriction fragment length polymorphism (RFLP) - Polymerase chain reaction (PCR) – Principles, types and their applications. DNA sequencing - Primer walking, Sanger’s method and automated sequencing methods. Pyrosequencing – DNA chips and micro array. Protein engineering and techniques Site directed mutagenesis – methods - Design and construction of novel proteins and enzymes, Basic concepts in enzyme engineering, engineering for kinetic properties of enzymes. protein folding, protein sequencing, protein crystallization. Applications of protein engineering.	18	K4	CLO4
V	Plant biotechnology - constituents and concepts of sterilization - preparation, isolation and selection of explant. Suspension cell culture, callus culture, protoplast isolation, culture & fusion. Anther and pollen culture for production. Animal biotechnology – equipment and media used for animal cell culture technology. Primary and established cell line culture and culture media. Applications of animal cell cultures. Serum protein media viability and	18	K4	CLO5

	cytotoxicity. Applications of Genetic Engineering - transgenic animals, Recombinant Cytokines and their use in the treatment of animal infections. Monoclonal Antibodies in Therapy- Vaccines and their Applications in Animal Infections - Human Gene Therapy - Germline and Somatic Cell Therapy - Ex-vivo Gene Therapy. In-vivo Gene Therapy. Vectors in Gene Therapy-Viral and Non-Viral Vectors. Transgenic Plants.			

Books for study:

1. Malacinski G.M. (2008). Freifelder's Essentials of Molecular Biology. (4th Edition). Narosa Publishing House, New Delhi.
2. Snusted D.P. and Simmons M. J. (2019). Principles of Genetics. (7th Edition). John Wiley and Sons, Inc.
3. Dale J. W., Schantz M.V. and Plant N. (2012). From Gene to Genomes – Concepts and Applications of DNA Technology. (3rd Edition). John Wileys and Sons Ltd.

Books for References:

1. Brown T. A. (2016). Gene Cloning and DNA Analysis- An Introduction. (7th Edition). John Wiley and Sons, Ltd.
2. Glick B. R. and Patten C.L. (2018). Molecular Biotechnology – Principles and Applications of Recombinant DNA. (5th Edition). ASM Press.
3. Russell P.J. (2010). Genetics - A Molecular Approach. (3rd Edition). Pearson New International Edition.
4. Synder L., Peters J. E., Henkin T.M. and Champness W. (2013). Molecular Genetics of Bacteria. (4th Edition). ASM Press Washington-D.C. ASM Press.
5. Dale J. W., Schantz M.V. and Plant N. (2012). From Gene to Genomes – Concepts and Applications of DNA Technology. (3rd Edition). John Wileys and Sons Ltd.

Web Resources

1. <https://microbenotes.com/gene-cloning-requirements-principle-steps-applications/>
2. <https://geneticeducation.co.in/what-is-transcriptomics>
3. <https://www.molbiotools.com/usefullinks.html>
4. <https://geneticeducation.co.in/what-is-transcriptomics>
5. <https://courses.lumenlearning.com/boundless-biology/chapter/dna-replication/>

Rationale for Nature of the course

Cell and molecular biology course will help to understand the structure and function of the basic unit of life. This field explores the relationships between cell processes and reactions, macromolecules and gene control pathway. The study of molecular cell biology enables students to understand how cell programs and reactions function normally as well as the relationships between those processes and gene expression.

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

Students will be able to understand and integrate knowledge of chemical and biological principles of living systems. Students will develop quantitative skills in order to collect, analyse and interpret experimental data. Understanding how genes are inherited through meiosis and fertilization.

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 and quiz

Course Designer(s):

1. Dr.K.Rajeswari

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	DNA replication – modes and enzymes involved. Detailed mechanism of semi-conservative replication. Prokaryotic and eukaryotic transcription.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Structure and processing of m-RNA, r-RNA and t-RNA. Ribosomes. Genetic Code and Wobble hypothesis, Translation in prokaryotes and eukaryotes, post translational modifications.	9	
Unit II	Gene regulation and expression – Lac operon, arabinose and tryptophan operons. Gene regulation in eukaryotic systems - repetitive DNA, gene rearrangement, promoters, enhancer elements.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	. Molecular basis of gene mutation - Types of mutations - base substitutions, frame shift, deletion insertion, duplication, inversion. Silent, conditional and lethal mutation. Chemical mutagenesis. Repair of DNA damage. Photoreactivation. SOS repair mechanism. Base excision repair. Nucleotide excision repair. Detection and analysis of mutations (Replica plating, Antibiotic enrichment, Ames test).	9	

Unit III	Tools and methods in gene cloning. Restriction endonucleases – nomenclature, classification and characteristics - DNA methylases, DNA polymerases, Ligases. Adapters, linkers and homopolymer tailing.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Artificial gene transfer techniques - electroporation, microinjection, protoplast fusion and microparticle bombardment. Screening for recombinants. Gene cloning vectors for prokaryotes and eukaryotes - cloning properties and types of plasmids vectors (pBR322 and derivatives, pUC vectors and pGEM3Z) - Phage Vectors(M13 and Lambda), cosmids, phasmids, phagemids and BACs - Eukaryotic vectors - Yeast vectors – Animal and plant vectors – expression vectors. Shuttle vectors - Expression of foreign genes in bacteria, animal, plant, algae and fungi – merits and demerits.	9	
Unit IV	Genomic DNA and cDNA library - Construction and Screening. Substrative hybridization for tissue specific DNA libraries. Techniques in genetic engineering Characterization of cloned DNA: Hybrid arrested translation (HAT) - Restriction mapping - restriction fragment length polymorphism (RFLP) - Polymerase chain reaction (PCR) – Principles, types and their applications.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	DNA sequencing - Primer walking, Sanger’s method and automated sequencing methods. Pyrosequencing – DNA chips and micro array. Protein engineering and techniques Site directed mutagenesis – methods - Design and construction of novel proteins and enzymes, Basic concepts in enzyme engineering, engineering for kinetic properties of enzymes. protein folding, protein sequencing, protein crystallization. Applications of protein engineering.	9	
Unit V	Plant biotechnology - constituents and concepts of sterilization - preparation, isolation and selection of explant. Suspension cell culture, callus culture, protoplast isolation, culture & fusion. Anther and pollen culture for production. Animal biotechnology – equipment and media used for animal cell culture technology. Primary and established cell line culture and culture media. Applications of animal cell cultures. Serum protein media viability and cytotoxicity.	9	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation

	Applications of Genetic Engineering - transgenic animals, Recombinant Cytokines and their use in the treatment of animal infections. Monoclonal Antibodies in Therapy- Vaccines and their Applications in Animal Infections - Human Gene Therapy - Germline and Somatic Cell Therapy - Ex-vivo Gene Therapy. In-vivo Gene Therapy. Vectors in Gene Therapy-Viral and Non-Viral Vectors. Transgenic Plants.	9	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Analyze, demonstrate and appreciate DNA replication and protein synthesis.	K2
CLO-2	Investigate the types of mutation and its impact on microbes. Illustrate various strategies on gene cloning.	K3
CLO-3	Analyze, modify and characterize DNA modifying enzymes.	K3
CLO-4	Illustratively assess the molecular techniques for DNA and protein analysis.	K4
CLO-5	Adopt the applications of Genetic Engineering in the field of agriculture and medicine towards scientific research.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	1	1
CLO-2	2	3	1	1	1
CLO-3	2	2	1	2	1
CLO-4	2	2	1	2	1
CLO-5	2	3	1	1	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	2	2	1	1	3
CLO2	2	2	1	1	1	3
CLO3	3	2	1	1	1	3
CLO4	1	2	2	1	1	3
CLO5	2	1	1	1	1	3

Advance application- 3;

Intermediate level-2;

Basic level-1

Summative - Blue – Print – Model
(Mapping with Course 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 K-2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K-3	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(K4)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K2&K2)	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			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 with choice	Consolidated
K1	5	4	0	-	9	7.5	42%
K2	5	6	20	10	41	34.17	
K3	-	-	20	10	30	25	25%
K4	-	-	10	30	40	33.33	33%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF MICROBIOLOGY					CLASS: II M.Sc			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
III	CORE PRACTICAL III	23P3RCCP3	MAJOR PRACTICAL - III	4	6	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- To acquire adequate skills to perform blood grouping and serological reactions.
- To provide fundamental skills in preparation, separation and purification of immunoglobulin
- To illustrate the significance of artificial transformation and mutations.
- To familiarize with routine molecular biological techniques.
- To discuss blotting techniques and PCR.

Unit	Description
I	Hematological reactions - Blood Grouping – forward and reverse, Rh Typing Identification of various immune cells by morphology – Leishman staining, Giemsa staining. Agglutination Reactions- Latex Agglutination reactions- RF, ASO, CRP.Detection of HBs Ag by ELISA. Precipitation reactions in gels– Ouchterlony double immunodiffusion (ODD) and Mancini's single radial immunodiffusion (SRID) Immuno-electrophoresis and staining of precipitin lines- Rocket immuno electrophoresis and counter current immuno electrophoresis.
II	Preparation of lymphocytes from peripheral blood by density gradient centrifugation. Purification of immunoglobulin– Ammonium Sulphate Precipitation. Separation of IgG by chromatography using DEAE cellulose or Sephadex.
III	Artificial Transformation. Detection of Antibiotic resistant mutants.Identification of mutants by replica plating method.
IV	Isolation of genomic DNA from <i>E. coli</i> and analysis by agarose gel electrophoresis Separation of proteins by polyacrylamide gel electrophoresis (SDS-PAGE) Plasmid DNA isolation from <i>E.coli</i> .
V	Amplification of DNA by PCR Western blotting – Demonstration .Southern blotting – Demonstration

Books for study:

1. Roitt R.I.M (2001). Essential Immunology. 10th Edn. Blackwell Scientific Publishers
2. Glick B. R. and Patten C. L. (2018). Molecular Biotechnology – Principles and Applications of Recombinant DNA (5th Edition). ASM Press.
3. Gunasekaran P. (2007). Laboratory Manual in Microbiology. New Age International.

Books for References:

1. Stites D.P., Abba I.Terr, Parslow T.G.(1997). Medical Immunology. 9thedn, Prentice-Hall Inc
2. Tizard, R.I.(2000) Immunology- An Introduction. 4thedn. Saunders College Publishing, Philadelphia.
3. Dale J. W., Schantz M. V. and Plant N. (2012). From Gene to Genomes – Concepts and Applications of DNA Technology. (3rd Edition). John Wileys and Sons Ltd.
4. Sambrook J. and Russell D.W. (2001). Molecular Cloning: A Laboratory Manual. (7th Edition). Cold Spring Harbor, N.Y: Cold Spring Harbor Laboratory Press.
5. Brown T.A. (2016). Gene Cloning and DNA Analysis. (7th Edition). John Wiley and Jones, Ltd.

Web Resources

1. <https://www.molbiotools.com/usefullinks.html>
2. <https://geneticgenie.org3>.
3. <https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5>
4. <https://vlab.amrita.edu/index.php?sub=3&brch=27>
5. <https://nptel.ac.in/courses/102105087>

Rationale for Nature of the course

Understanding the genetic principles and molecular mechanisms used by microorganisms to cause disease and the immune system to prevent disease is key to our ability to developing future therapies to combat infectious disease, autoimmunity, and cancer.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Lab Demo, Practicals, Training

Pedagogy

Lab Demo, Practicals

Course Designer(s):

1. **Dr.P.N.Rajarajan**

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Hematological reactions - Blood Grouping – forward and reverse, Rh Typing Identification of various immune cells by morphology – Leishman staining, Giemsa staining. Agglutination Reactions- Latex Agglutination reactions- RF, ASO, CRP.Detection of HBs Ag by ELISA.	9	Lab Demo, Practicals
	Precipitation reactions in gels– Ouchterlony double immunodiffusion (ODD) and Mancini's single radial immunodiffusion (SRID) Immuno-electrophoresis and staining of precipitin lines- Rocket immuno electrophoresis and counter current immuno electrophoresis.	9	
Unit II	Preparation of lymphocytes from peripheral blood by density gradient centrifugation. Purification of immunoglobulin– Ammonium Sulphate Precipitation.	9	Lab Demo, Practicals
	Separation of IgG by chromatography using DEAE cellulose or Sephadex.	9	
Unit III	Artificial Transformation	9	Lab Demo, Practicals
	Detection of Antibiotic resistant mutants Identification of mutants by replica plating method.	9	
Unit IV	Isolation of genomic DNA from <i>E. coli</i> and analysis by agarose gel electrophoresis	9	Lab Demo, Practicals
	Separation of proteins by polyacrylamide gel electrophoresis (SDS-PAGE) Plasmid DNA isolation from <i>E.coli</i> .	9	
Unit V	Amplification of DNA by PCR	9	Lab Demo, Practicals
	Western blotting - Demonstration Southern blotting – Demonstration	9	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Perform and evaluate immunological reactions to aid diagnosis.	K4
CLO-2	Assess the level of lymphocytes in a blood sample and purify immunoglobulin employing appropriate techniques.	K4
CLO-3	Perform DNA extraction and gene transfer mechanisms, analyze and identify by gel electrophoresis	K4
CLO-4	Utilize various molecular techniques for gene manipulation and detection of mutants.	K4
CLO-5	Undertake novel research with techniques like PCR and blotting analysis.	K4

EVALUATION (PRACTICAL)

Internal (Formative) : 25 marks

External (Summative) : 75 marks

Total : 100 marks

Question Paper Pattern for Internal Practical Examination (Major): 25 Marks

	Components	Marks	Total Marks
Internal [Formative]	Continuous assessment	10	25
	Test (Major 10, Minor 5, Spotters 5 and Record 5marks) scaled down to 15	15	
External [Summative]		75	75
Total Marks			100

Question Paper Pattern for External Practical Examination (Major): 75 Marks

Components	Marks
I – Major question	25
II – Minor question	15
III – Spotters (5 x 4)	20
IV –Record book	05
Viva-voce	10
Total	75

DEPARTMENT OF MICROBIOLOGY					CLASS: II.M.Sc			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
III	Discipline Elective Course	23P3RECT5	FERMENTATION TECHNOLOGY	3	5	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To discuss about fermentation and its types, sensitize on methods of strain development for improved yield.
- To impart knowledge on the fermenter design and types.
- To acquire knowledge on the effective recovery and purification of the products.
- To explain the importance of pharmaceutical microbiology.
- To illustrate methods for production products using microorganisms and their quality control.

Unit	Description	Hours	K-level	CLO
I	Bioprocesses - concepts and design. Industrially important microorganisms – Isolation, primary and secondary screening, preservation and improvement of industrially important strains. Upstream processing - Development of inoculums for fermentation process. Media for industrial fermentation - Formulation, optimization. Sterilization. Stages of upstream - Growth of inoculums, fermenter pre-culture and production fermentation. Types of fermentation - Batch, continuous, dual or multiple, surface, submerged, aerobic and anaerobic.	15	K2	CLO1
II	Fermenter – Design, types and construction, Instrumentation and control. Productivity. Yield coefficients. Heat production. Aeration and agitation. Gas exchange and mass transfer. Computer Applications in fermentation technology. Fermentation Economics.	15	K3	CLO2
III	Downstream Processing - Recovery and purification of intracellular and extracellular products. Biomass separation by centrifugation, filtration, flocculation and	15	K4	CLO3

	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.			
IV	Overview of pharmaceutical microbiology - Ecology of microorganisms - Atmosphere, water, skin, respiratory flora of workers, raw materials, packaging, building equipment and their control measures. Design and layout of sterile manufacturing unit. Contamination and Spoilage of Pharmaceutical products - sterile injectable and non-injectable, ophthalmologic preparation, implants.	15	K4	CLO4
V	Production of pharmaceutical products and quality assurance – Vaccines, immunodiagnostics, immunosera, immunoglobulin. Antibiotics - Penicillin, Griseofulvin, Metronidazole. Enzymes - Streptokinase, Streptodornase. Quality assurance and quality management in pharmaceuticals – In-Process, Final-Product Control and sterility tests. Regulatory aspects - BIS (IS), ISI, ISO, WHO and US certification.	15	K4	CLO5

Books for study:

1. Patel A. H. (2016). Industrial Microbiology. (2nd Edition). Laxmi Publications, New Delhi.
2. Casida L. E. J. R. (2019). Industrial Microbiology. New Age International Publishers.
3. Sathyanarayana U. (2005). Biotechnology. (1st Edition). Books and Allied (P) Ltd.

Books for References:

1. Stanbury P. T. and Whitaker. (2016). Principles of Fermentation Technology. (3rd Edition). Pergamon Press. NY.
2. Handa S. S. and Kapoor V. K. (2022). Pharamcognosy, (4th Edition). Vallabh Prakashan Publishers, New Delhi.
3. Kokate C. K., Durohit A. P. and Gokhale S. R. Pharmacognosy. (2002). (12th Edition). Nirali Prakasham Publishers, Pune.
4. Hugo W. B. and Russell A. D. (2004). Pharmaceutical Microbiology. (7th Edition). Blackwell Scientific Publication, Oxford
5. Wallis, T.E. (2005). Text book of Pharmacognosy. (5th Edition). CBS publishers and distributors, New Delhi.

Web Resources

1. [https://ib.bioninja.com.au/options/untitled/b1-microbiology organisms/fermenters.html](https://ib.bioninja.com.au/options/untitled/b1-microbiology%20organisms/fermenters.html)
2. <https://www.acs.org/content/acs/en/education/whatischemistry/landmarks/penicillin.html>
3. <https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/ethanol-fermentation>
4. https://www.usp.org/sites/default/files/usp/document/harmonization/genmethod/q05b_pf_ira_34_6_2008.pdf
5. <http://www.simbhq.org/>

Rationale for Nature of the course

This course discusses the use of microorganisms in fermentation technology which cover microbial metabolisms and regulation, strain improvement, microbial isolation and screening, culture preservation, fermentation technique.

Activities having direct bearing on Skill development / Employability Entrepreneurship

To acquaint students with technical and biological aspect of microbial utilisation for production of metabolites.

Pedagogy

Chalk and talk, Group discussion

Course Designer(s):

1. Mrs.N.SUMATHY

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Bioprocesses - concepts and design. Industrially important microorganisms	3	Chalk and Talk, Group discussion, Seminar , PPT presentation
	Isolation, primary and secondary screening, preservation and improvement of industrially important strains.	3	
	Upstream processing - Development of inoculums for fermentation process. Media for industrial fermentation - Formulation, optimization. Sterilization	3	
	Stages of upstream - Growth of inoculums, fermenter pre-culture and production fermentation.	3	
	Types of fermentation - Batch, continuous, dual or multiple, surface, submerged, aerobic and anaerobic.	3	

Unit II	Fermenter – Design, types and construction, Instrumentation and control. Productivity. Yield coefficients. Heat production.	5	Chalk and Talk, Group discussion, Quiz, Seminar, PPT presentation
	Aeration and agitation. Gas exchange and mass transfer.	5	
	Computer Applications in fermentation technology. Fermentation Economics.	5	
Unit III	Downstream Processing - Recovery and purification of intracellular and extracellular products.	3	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Biomass separation by centrifugation, filtration, flocculation and other recent developments. Cell disintegration - Physical, chemical and enzymatic methods.	4	
	Extraction - Solvent, two phase, liquid extraction, whole broth, aqueous multiphase extraction. Purification by different methods.	4	
	Concentration by precipitation, ultra-filtration, reverse osmosis. Drying and crystallization.	4	
Unit IV	Overview of pharmaceutical microbiology - Ecology of microorganisms -	4	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Atmosphere, water, skin, respiratory flora of workers, raw materials, packaging, building equipment and their control measures.	4	
	Design and layout of sterile manufacturing unit. Contamination and Spoilage of Pharmaceutical products	4	
	Sterile injectable and non-injectable, ophthalmologic preparation, implants.	3	
Unit V	Production of pharmaceutical products and quality assurance	3	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Quality assurance and quality management in pharmaceuticals	3	
	Vaccines, immunodiagnostics, immuno-sera, immunoglobulin.	3	
	Antibiotics - Penicillin, Griseofulvin, Metronidazole. Enzymes - Streptokinase, Streptodornase.	2	
	In-Process, Final-Product Control and sterility tests.	1	
	Regulatory aspects - BIS (IS), ISI, ISO, WHO and US certification.	3	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Develop microbial strains, carry out fermentation and recover the products of the process. Products of the process.	K2
CLO-2	Design fermenters according to needs for various products.	K3
CLO-3	Recover the end products of the fermentation process economically.	K4
CLO-4	Utilize the knowledge on pharmaceutical microbiology for industrial production of products.	K4
CLO-5	Produce therapeutic products from microbes employing technology and analyze the quality the products.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	1	1	3
CLO-2	3	1	3	1	3
CLO-3	3	2	3	2	3
CLO-4	3	2	3	2	3
CLO-5	3	2	3	2	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	3	3	3	1
CLO2	3	3	3	3	3	1
CLO3	3	3	3	3	3	1
CLO4	3	3	3	3	3	1
CLO5	3	3	3	3	3	1

Advance application- 3;

Intermediate level-2;

Basic level-1

Summative - Blue – Print – Model
(Mapping with Course 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 K-2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K-3	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(K4)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K2&K2)	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			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 with choice	Consolidated
K1	5	4	0	-	9	7.5	42%
K2	5	6	20	10	41	34.17	
K3	-	-	20	10	30	25	25%
K4	-	-	10	30	40	33.33	33%
Total Marks	10	10	50	50	120	100.00	100%

DEPARTMENT OF MICROBIOLOGY					CLASS: II M.Sc			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
III	MDC	23P3RMDC1	COMPUTER AIDED DRUG DESIGN AND DISCOVERY	3	5	25	75	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓	

Objectives:

- To know the most recent developments of drug design and can illustrate drug action through examples
- To explore the basic principles of Drug design and development and the sequence of events necessary to bring a drug to market
- To understand how modern drugs were developed by using pharmacophore modelling and docking technique
- To understand Eigen values and Eigen vectors to solve problems in Molecular modelling.
- To impact the knowledge of fundamentals of artificial intelligence.

Unit	Description	Hours	K-level	CLO
I	Concept of drugs, receptors, agonists, antagonists and its types. Drug receptor interaction, therapeutic index, EC50, ED50, LD50, MIC, MEC. Pharmacokinetic properties-ADME parameters, factors affecting ADME, Lipinski rule of 5.	15	K2	CLO 1
II	Drug discovery process-traditional and rational approaches. Phases of drug discovery, pharmacovigilance. Computer Aided Drug Discovery-importance and significance. Databases-KEGG, PubChem. Structure drawing software-ChenDraw, Chems sketch. Homology modelling- Modeller, Swissmodel. Docking- Arguslab, Autodock. ADMET-PreADME, ADMETox.	15	K2	CLO 2
III	Structure based drug designing: Target identification, constructing protein model, validation, binding site identification, energy minimization, lead optimization, identification of bioactive conformation. Molecular docking-rigid and flexible docking. Ligand based drug	15	K2	CLO 3

	designing: Structure-activity relation, pharmacophore identification, model building and screening. QSAR parameters-lipophilicity, electronic and steric factors. Validation of QSAR model.			
IV	Matrix Algebra: Introduction – Types of Matrices - Rank of a matrix, Echelon form - Matrix polynomials - Eigen values and Eigen vectors – Properties - Relation between Eigen values and Eigen vectors - Algebraic and Geometric multiplicity - Cayley- Hamilton theorem	15	K2	CLO 4
V	Introduction to Artificial Intelligence – Brain Science and Problem Solving-the Turing Test and Chatter bots - The History of AI-The First Beginnings -Logic Solves (Almost) All Problems - The New Connectionism - Reasoning Under Uncertainty – AI Grows Up - The AI Revolution- AI and Society - AI Destroy Jobs - AI and Transportation - Service Robotics-Phases of drug design-Applications of AI in drug design.	15	K2	CLO 5

Books for study:

1. V. K. Ahluwalia and Madhu Chopra, Medicinal Chemistry, Anes Student Edition, 2008
2. S. K. Gupta, Drug screening methods, New Delhi: Jaypee Brothers Medical Publishers (P) Ltd; 2004.
3. R.B. Silverman, The Organic Chemistry of Drug Design and Drug Action, Academic Press. 3rd edn., 2014

Books for References:

1. Graham L. Patrick, An Introduction to Medicinal Chemistry, Oxford University Press, 1995.
2. Gringuage, Introduction to Medicinal Chemistry, Wiley-VCH, 1997.
3. E. Stevens, Medicinal Chemistry-The Modern Drug Discovery Process, Pearson, 2014.
4. P. Bhatia, Data Mining and Data Warehousing: Principles and Practical Techniques, Cambridge, 2019.
5. David C. Young. Computational Drug Design–A guide for Computational and Medicinal Chemists, Wiley Publications, 2009.
6. A Text Book of Matrices, Shanti Narayan, S. Chand Co., Pvt. Ltd, New Delhi

Web Resources

1. <https://www.click2drug.org/>
2. <https://microbenotes.com/computer-aided-drug-design-cadd/>
3. <https://www.computabio.com/computer-aided-drug-design-service.html>
4. https://www.click2drug.org/directory_PharmacophoreBasedLigandDesign.php

5. <https://www.learntoupgrade.com/courses/Computer-Aided-Drug-DesignDiscovery-5fcdcaf50cf2286e34636f20?redirectToMicroFE=false>
6. <http://www.javapoint.com/artificial-intelligence-tutorial>

Rationale for Nature of the course

Computer-Aided Drug Design (CADD) has emerged as an efficient means of developing candidate drugs for the treatment of many disease types. Applications of CADD approach to drug discovery are progressing day by day. The recent tendency in drug design is to rationally design potent therapeutics with multi-targeting effects, higher efficacies, and fewer side effects, especially in terms of toxicity.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Case study, Model Making and Mini-project

Pedagogy

Chalk and talk, Group discussion, Role play

Course Designer(s):

1. **Dr. P. Kiruthika Lakshmi**
2. **Prof. Raja Saravana Kumar**
3. **Dr. Meenakshi**

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Concept of drugs, receptors	1	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Agonists, antagonists and its types.	1	
	Drug receptor interaction, therapeutic index,	1	
	EC ₅₀ , ED ₅₀ , LD ₅₀ , MIC, MEC.	1	
	Pharmacokinetic properties-ADME parameters	1	
	Factors affecting ADME, Lipinski rule of 5.	1	
Unit II	Drug discovery process-traditional and rational approaches.	1	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Phases of drug discovery, pharmacovigilance.	1	
	Computer Aided Drug Discovery-importance and significance.	1	
	Databases-KEGG, PubChem. Structure drawing software-ChenDraw, Chems sketch.	1	
	Homology modelling- Modeller, Swissmodel.	1	
	Docking- Arguslab, Autodock. ADMET-PreADME, ADMETox.	1	

Unit III	Structure based drug designing - Target identification, constructing protein model, validation	1	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Binding site identification, energy minimization, lead optimization, identification of bioactive conformation	1	
	Molecular docking-rigid and flexible docking.	1	
	Ligand based drug designing: Structure-activity relation, pharmacophore identification, model building and screening.	1	
	QSAR parameters-lipophilicity,	1	
	Electronic and steric factors. Validation of QSAR model.	1	
Unit IV	Matrix Algebra: Introduction	1	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Types of Matrices - Rank of a matrix, Echelon form	1	
	Matrix polynomials - Eigen values and Eigen vectors	1	
	Properties - Relation between Eigen values and Eigen vectors	1	
	Algebraic and Geometric multiplicity	1	
	Cayley- Hamilton theorem	1	
Unit V	Introduction to Artificial Intelligence	1	Chalk and Talk, Group discussion, Quiz, Assignment, Seminar , PPT presentation
	Brain Science and Problem Solving-the Turing Test and Chatter bots	1	
	The History of AI-The First Beginnings -Logic Solves (Almost)	1	
	All Problems - The New Connectionism - Reasoning Under Uncertainty – AI Grows Up	1	
	The AI Revolution- AI and Society - AI Destroy Jobs	1	
	AI and Transportation - Service Robotics-Phases of drug design-Applications of AI in drug design.	1	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Demonstrate knowledge on the most recent developments of drug design and can illustrate drug action through examples	K2
CLO-2	Understand the basic principles of Drug design and development and the sequence of events necessary to bring a drug to market	K2
CLO-3	Understand how modern drugs were developed by using pharmacophore modelling and docking technique	K2
CLO-4	Compute Eigen values and Eigen vectors to solve problems in Molecular modelling.	K2
CLO-5	Discuss the core components of artificial intelligence.	K2

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	1	1	1	3
CLO-2	2	1	1	1	1
CLO-3	3	3	2	1	1
CLO-4	3	2	1	1	1
CLO-5	3	3	3	2	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	1	2	1	1
CLO2	1	1	1	3	1	1
CLO3	1	1	1	1	2	1
CLO4	2	2	3	3	1	1
CLO5	2	2	1	1	3	1

Advance application- 3;

Intermediate level-2;

Basic level-1

Blueprint for Semester Examination
Learning Outcome Based Education & Assessment (LOBE)
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		
1	CLO 1	Up to K2	1	K1	2(K2 & K2)	1(K1)
2	CLO 2	Up to K2	1	K1	2(K2 & K2)	1(K1)
3	CLO 3	Up to K2	1	K1	2(K2 & K2)	1(K1)
4	CLO 4	Up to K2	1	K1	2(K2 & K2)	1(K1)
5	CLO 5	Up to K2	1	K1	2(K2 & K2)	1(K1)
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

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/ or)	Total marks	% of marks without choice	Consolidated
K1	10	-	50	60	46.15	46%
K2	-	70	-	70	53.84	54%

DEPARTMENT OF MICROBIOLOGY					CLASS: II.M.Sc			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
III	Skill Enhancement Course II (NME)	23P3RSEN2	ORGANIC FARMING AND BIOFERTILIZER TECHNOLOGY	2	2	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- To impart knowledge on the importance, types and advantages of organic farming thereby creating awareness on conserving environment and natural resources, encouraging sustainable agriculture.
- To familiarize with the basic concepts of farm development and relate the development of organic farming in their countries to meet global trends.
- To explain the various types of biofertilizer and the scope in its production.
- To discuss about biofertilizer production and its field application, promoting economy.
- To develop the skill to analyze the quality of packaging, storage, assess the shelf life and bioefficacy of biofertilizers

Unit	Description	Hours	K-level	CLO
I	Organic farming – Definition, relevance. Biological nutrient management - Organic manures, vermicompost, green manure, organic residue, biofertilizer soil amendments. Integrated pest and weed management - Use of biocontrol agents, bio pesticides etc. Organic and Conventional farming. Organic and Chemical farming – Comparison.	6	K2	CLO 1
II	Certification and Schemes - Certification and Schemes. Organic certification in brief. Integrated farming system-definition, goal, components. Factors affecting ecological balance. Land degradation. Soil health management. Models of IFS for rainfed and irrigated conditions and different categories of farmers. Government schemes - NPOF, NPOF, NHM, HMNEH, NPMSH&F and RKVY.	6	K2	CLO 2

III	Biofertilizers - Introduction, types, advantages and future perspective. Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- <i>Azospirillum</i> , <i>Azotobacter</i> , <i>Bacillus</i> , <i>Pseudomonas</i> , <i>Rhizobium</i> and <i>Frankia</i> .	6	K2	CLO 3
IV	Cyanobacterial biofertilizers- <i>Anabaena</i> , <i>Nostoc</i> , <i>Hapalosiphon</i> and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, potassium solubilization	6	K2	CLO 4
V	Production technology - Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid bio-fertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers. Biofertilizers - Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.	6	K2	CLO 5

Books for study:

1. Sharma A. K. (2001). Hand book of Organic Farming. Agrobios.
2. Gaur A. C. (2006). Hand book of Organic Farming and Biofertilizers. Ambika Book Agency.
3. Subba Rao N.S. (2017). Bio-fertilizers in Agriculture and Forestry. (4th Edition). Med Tech publisher.

Books for References:

1. Rakshit A. and Singh H. B. (2015). ABC of Organic Farming. (1st Edition). Jain Brothers.
2. Dubey R. C. (2008). A Textbook of Biotechnology. S. Chand & Co., New Delhi.
3. Bansal M. (2019). Basics of Organic Farming. CBS Publisher.
4. Bhoopander G., Ram Prasad., (2019) Biofertilizer for sustainable agriculture and Environment, Springer
5. Niir Board., (2012) (1st Edition) Biofertiliser and organic farming

Web Resources

1. https://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html
2. <https://www.fao.org/organicag/oa-faq/oa-faq6/en/>
3. <https://www.india.gov.in/topics/agriculture/organic-farming>
4. <https://agriculture.nagaland.gov.in/bio-fertilizer/>
5. https://www.ccd.ngo/sustainable-agriculture.html?gclid=EAIaIQobChMI5a-KndCo-wIV2ZZLBR1ozQj9EAAYAiAAEgJW2_D_BwE

Rationale for Nature of the course

This course provides knowledge on promotion of biodiversity, biological cycles and organic matter recycling to maintain and improve soil fertility and environmental sustainability.

Activities having direct bearing on Skill development / Employability Entrepreneurship

To gain knowledge on technical skills to understand and use machinery and tools to maintain organic farm.

Pedagogy

Chalk and talk, Group discussion

Course Designer(s):

1. Mrs.N.SUMAHY

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Organic farming – Definition, relevance. Biological nutrient management -	1	Chalk and Talk, Group discussion, Seminar , Quiz, PPT presentation
	Organic manures, vermicompost, green manure, organic residue, biofertilizer soil amendments.	1	
	Integrated pest and weed management - Use of biocontrol agents, bio pesticides etc.	2	
	Organic and Conventional farming. Organic and Chemical farming – Comparison.	2	
Unit II	Certification and Schemes - Certification and Schemes.	1	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Organic certification in brief. Integrated farming system- definition, goal, and components.	1	
	Factors affecting ecological balance. Land degradation. Soil health management.	2	
	Models of IFS for rainfed and irrigated conditions and different categories of farmers. Government schemes - NPOF, NPOF, NHM, HMNEH, NPMSH&F and RKVY.	2	
Unit III	Biofertilizers - Introduction, types, advantages and future perspective.	1	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- <i>Azospirillum</i> ,	1	
	Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- <i>Bacillus</i> , <i>Pseudomonas</i> , <i>Rhizobium</i> and <i>Frankia</i> .	2	

Unit IV	Cyanobacterial biofertilizers- <i>Anabaena</i> , <i>Nostoc</i> , <i>Hapalosiphon</i> and	1	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Fungal biofertilizers- AM mycorrhiza and ectomycorrhiza.	1	
	Nitrogen fixation -Free living and symbiotic nitrogen fixation.	2	
	Mechanism of phosphate solubilization and phosphate mobilization, potassium solubilization.	2	
Unit V	Production technology - Strain selection, sterilization, growth and fermentation,	1	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Mass production of carrier based and liquid bio-fertilizers.	1	
	FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers.	2	
	Biofertilizers - Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.	2	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Produce biofertilizers and distinguish between organic and conventional farming.	K2
CLO-2	Plan a Complete Farm Business including marketing, operation and financial outline.	K2
CLO-3	Practice the application of microbial bio-fertilizers in large scales, thereby increasing soil fertility.	K2
CLO-4	Develop integrated farming for sustainable agriculture.	K2
CLO-5	Promote the quality of packaging, storage, increase shelf life, accelerate the bio efficacy of bio fertilizers as per BIS standards	K2

Mapping of CLOs with PSOs

_#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	2	2	2
CLO-2	3	2	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	2	1	1	1	3
CLO2	3	2	2	2	2	2
CLO3	3	3	3	3	3	3
CLO4	3	3	3	3	3	2
CLO5	3	3	3	3	3	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Blueprint for Semester Examination

Learning Outcome Based Education & Assessment (LOBE)

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		
1	CLO 1	Up to K2	1	K1	2(K2 & K2)	1(K1)
2	CLO 2	Up to K2	1	K1	2(K2 & K2)	1(K1)
3	CLO 3	Up to K2	1	K1	2(K2 & K2)	1(K1)
4	CLO 4	Up to K2	1	K1	2(K2 & K2)	1(K1)
5	CLO 5	Up to K2	1	K1	2(K2 & K2)	1(K1)
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

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/ or)	Total marks	% of marks without choice	Consolidated
K1	10	-	50	60	46.15	46%
K2	-	70	-	70	53.84	54%

DEPARTMENT OF MICROBIOLOGY					CLASS: II M.Sc			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
IV	Core Course 7	23P4RCCT7	FOOD AND ENVIRONMENTAL MICROBIOLOGY	5	6	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To discuss microorganisms involved in food spoilage.
- To illustrate bacterial and nonbacterial food borne infections important in public health
- To familiarize various national and international aspects of food safety and quality assurance.
- To create awareness about components of environment, environmental pollution, and detection methods.
- To acquire in depth knowledge about solid and liquid waste treatments.
- To develop knowledge about organic matter degradation, bioremediation, and the environment risk assessment.

Unit	Description	Hours	K-level	CLO
I	Microorganisms of food- Scope of food Microbiology. Contamination and spoilage of food –vegetables, fruits, poultry, fish, eggs, meat and milk products and canned foods. Food Preservation - Temperature (low and high), drying, radiation and chemicals.	18	K3	CLO1
II	Food microbiology and public health. Food hazards. Food Bacterial infections. Nonbacterial food borne illness - Helminthes, nematodes, protozoa, toxigenic fungi and food borne virus. Microbiological quality standards for food. Government regulatory practices and policies - FDA, HACCP, BIS (IS), FSSAI-2014. Food adulteration and common food additives.	18	K4	CLO2
III	Components of Environment: Hydrosphere, lithosphere, atmosphere, and biosphere – definitions with examples; Energy flow in the ecosystem- Carbon, Nitrogen, Sulfur and Phosphorous cycles. Physical factors affecting distribution of microorganisms in various environments. Predisposing	18	K3	CLO3

	factors for Environmental diseases – infectious (water and air borne) and pollution related, spread and control of these diseases. Treatment and safety of drinking (potable) water, methods to detect potability of water samples. Space microbiology - Microbiological research in space environment.			
IV	Waste management – Solid waste - Types - management - Factors affecting solid waste generation rates. Industrial effluent treatment, primary, secondary, tertiary, and advanced treatment process. Quality assessment of decontaminated matters and other biological effluents. Biological reference standards. Utilization of Solid Waste as Food, Feed and Fuel- Composting, Vermicomposting, Bio manure and Biogas production. E waste management.	18	K4	CLO4
V	Degradation of organic matter - lignin, cellulose, hemicellulose, pectin, common pesticides- herbicides (2,4-D) and pesticides (DDT), heavy metals. Biodegradation of Xenobiotics - Recalcitrant Halocarbons, Recalcitrant TNTs, PCBs and Synthetic polymers. Biodegradation of Hydrocarbons. Biodeterioration of Textiles and Leather. Pollution Control Bodies and Environmental laws in India. Environmental impact assessment, EIA guidelines, US Environment protection Agency norms.	18	K2	CLO5

Books for study:

1. Adams M. R. and Moss M. O. (1996). Food Microbiology, New Age International (P) Limited
2. Publishers, New Delhi.
3. Frazier W.C., Westhoff. D. C. and Vanitha K.N. (2013). Food Microbiology. (6th Edition). McGraw Hill Education.

Books for References:

1. Robinson R. K. (2000). Dairy Microbiology 3rd Edn, Elsevier Applied Science, London.
2. Hobbs, B.C. and Roberts, D, (1968), Food Poisoning and Food Hygiene 7th Edn. Edward Arnold: London..
3. Banwarst. G.J. (2003). Basic Food Microbiology 2nd Edn, CBS Publishers and distributors.
4. Bitton, G. (2011). Wastewater Microbiology. (4th Edition). Wiley-Blackwell.
5. Bridgewater L. (2012). Standard Methods for the Examination of Water and Wastewater. American Public Health Association.

Web Resources

1. <https://www.fssai.gov.in>
2. <https://www.who.int/news-room/fact-sheets/detail/food-safety>
3. <https://egyankosh.ac.in>

Rationale for Nature of the course

The course content provides the foundation of food and environmental microbiology necessary for students who are interested in becoming an entrepreneurs.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Group discussion, Model Making and Mini-project

Pedagogy

Chalk and Talk. Group discussion Seminar ,PPT presentation

Course Designer(s):

1. Dr.A.P ASHA KANNAN

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Microorganisms of food- Scope of food Microbiology. Contamination and spoilage of food –vegetables, fruits, poultry, fish, eggs, meat and milk products and canned foods.	10	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Food Preservation - Temperature (low and high), drying, radiation and chemicals.	8	
Unit II	Food microbiology and public health. Food hazards. Food Bacterial infections. Nonbacterial food borne illness - Helminthes, nematodes, protozoa, toxigenic fungi and food borne virus.	10	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Microbiological quality standards for food. Government regulatory practices and policies - FDA, HACCP, BIS (IS), FSSAI-2014. Food adulteration and common food additives.	8	

Unit III	Components of Environment: Hydrosphere, lithosphere, atmosphere, and biosphere – definitions with examples; Energy flow in the ecosystem- Carbon, Nitrogen, Sulfur and Phosphorous cycles. Physical factors affecting distribution of microorganisms in various environments.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Predisposing factors for Environmental diseases – infectious (water and air borne) and pollution related, spread and control of these diseases. Treatment and safety of drinking (potable) water, methods to detect potability of water samples. Space microbiology - Microbiological research in space environment.	9	
Unit IV	Waste management – Solid waste - Types - management - Factors affecting solid waste generation rates. Industrial effluent treatment, primary, secondary, tertiary, and advanced treatment process.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Quality assessment of decontaminated matters and other biological effluents. Biological reference standards. Utilization of Solid Waste as Food, Feed and Fuel- Composting, Vermicomposting, Bio manure and Biogas production. E waste management.	9	
Unit V	Degradation of organic matter - lignin, cellulose, hemicellulose, pectin, common pesticides- herbicides (2,4-D) and pesticides (DDT), heavy metals. Biodegradation of Xenobiotics - Recalcitrant Halocarbons, Recalcitrant TNTs, PCBs and Synthetic polymers.	9	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Biodegradation of Hydrocarbons. Biodeterioration of Textiles and Leather. Pollution Control Bodies and Environmental laws in India. Environmental impact assessment, EIA guidelines, US Environment protection Agency norms.	9	

COURSE OUTCOMES

At the end of the course, the student will be able to

#	CLOs	K-level
CLO1	Utilize the knowledge on process of food contamination and spoilage to preserve food.	K3
CLO2	Use the knowledge on food borne disease to protect public health.	K4
CLO3	Identify and cultivate the algae understanding their habitat. Analyze the morphology, classify and propagate depending on its economic importance.	K3
CLO4	Differentiate and appreciate the anatomy of various microbes. Plan the growth of microbes for different environmental conditions.	K4
CLO5	Categorize and cultivate a variety of extremophiles following standard protocols for industrial applications.	K2

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	1	1	1	3
CLO-2	2	1	1	1	1
CLO-3	3	3	2	1	1
CLO-4	3	2	1	1	1
CLO-5	3	3	3	2	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	1	2	1	1
CLO2	1	1	1	3	1	1
CLO3	1	1	1	1	2	1
CLO4	2	2	3	3	1	1
CLO5	2	2	1	1	3	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Summative - Blue – Print – Model
(Mapping 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	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

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 MICROBIOLOGY				CLASS: II M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Core Practical-IV	23P4RCCP4	Major Practical-IV	4	6	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Course Objectives:

- To enumerate bacteria in milk for quality analysis.
- To analyze methods for microbes from spoiled food.
- To gain knowledge on microbes present in water.
- To identification and characterization of nitrogen fixers.
- To gain knowledge on biofertilizer production and field application.

S. No.	Experiments
1	Qualitative analysis of milk -Breed count, Direct microscopic count and Standard plate count
2	Qualitative analysis of milk -Methylene blue reductase test, Resazurin test and alkaline phosphatase test.
3	Isolation of bacteria, fungi and yeast from spoiled and canned food.
4	Production and detection of aflatoxins from spoiled food.
5	Microbial Analysis of water – MPN, Membrane filtration. Chemical Analysis of water - BOD.
6	Enumeration of bacteria and fungi from air – Air sampler
7	Isolation of free-living nitrogen fixers from soil Isolation of <i>Rhizobium</i> from root nodules of leguminous plants..
8	Isolation and enumeration of phosphate-solubilizing bacteria from soil
9	Separation of Biofertilizers and testing the efficiency of prepared biofertilizers, R:S ratio of soil microbes
10	Study of phylloplane microflora by leaf impression method Isolation of cellulose degrading bacteria
11	Isolation of plant pathogen – <i>Alternaria</i> , <i>Curvularia</i>
12	Cultivation of mushroom from solid waste

Books for study

1. Ray B. and Bhunia A. (2013). Fundamentals of Food Microbiology. (5th Edition). CRC Press.
2. Garg N., Garg K. and Mukerji K. G. (2013). Laboratory Manual Food Microbiology. I K. International Pvt. Ltd.
3. Pepper I., Gerba C. and Bredecker J. (2004). Environmental Microbiology – A Laboratory Manual. (2nd Edition). Academic Press, Elsevier.

Books for Reference

1. Hobbs, B.C. and Roberts, D, (1968), Food Poisoning and Food Hygiene 7th Edition Edward Arnold: London
2. Vijaya R K, (2004). Food Microbiology 1st Edition. MJP Publishers, Chennai.
3. Banwarst. G.J. (2003). Basic Food Microbiology 2nd Edition, CBS Publishers and distributors.
4. James G Cappuccino. and Natalie Sherman. (2016). Microbiology – A laboratory manual. (5th Edition). The Benjamin publishing company. New York.
5. Hurst, C.J., Crawford R.L., Garland J.L., Lipson D.A., Mills A.L. and Stetzenbach L.D. (2007). Manual of Environmental Microbiology. (3rd Edition). American Society for Microbiology.

Web Resources

1. <https://www.fssai.gov.in>
2. <https://www.who.int/news-room/fact-sheets/detail/food-safety>
3. <https://academic.oup.com/bioscience/article/65/8/758/240222>
4. <https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5>
5. <https://vlab.amrita.edu/index.php?sub=3&brch=272>

Rationale for Nature of the course

Hands on training on food microbiology 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 to solve agricultural problems and to analyze the microbes in spoiled food such as milk and canned food.

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 biofertilizers. Imparting knowledge on various Cultivation of mushroom using various substratum

Pedagogy

Demonstration and practical session

Course designers:

1. **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	Check the quality of milk.	K4
CLO2	Identify bacteria and fungi in spoiled food	K4
CLO3	Analyze potability of water.	K4
CLO4	Check the microbial population in air.	K4
CLO5	Prepare, apply and check the efficiency of biofertilizers	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	PO6
CLO1	2	1	3	1	3	1
CLO2	2	2	3	3	3	1
CLO3	2	3	3	3	2	1
CLO4	2	3	3	2	3	1
CLO5	2	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	3	1	1	3	2
CLO2	3	2	1	2	2
CLO3	3	1	2	3	2
CLO4	2	1	1	3	2
CLO5	3	3	2	3	2

Advance application – 3,

Intermediate level – 2,

Basic level – 1.

EVALUATION (PRACTICAL)**Internal (Formative) : 25 marks****External (Summative) : 75 marks****Total : 100 marks****Question Paper Pattern for Internal Practical Examination (Major): 25 Marks**

	Components	Marks	Total Marks
Internal [Formative]	Continuous assessment	10	25
	Test (Major 10, Minor 5, Spotters 5 and Record 5marks) scaled down to 15	15	
External [Summative]		75	75
Total Marks			100

Question Paper Pattern for External Practical Examination (Major): 75 Marks

Components	Marks
I – Major question	25
II – Minor question	15
III – Spotters (5 x 4)	20
IV –Record book	05
Viva-voce	10
Total	75

DEPARTMENT OF MICROBIOLOGY					CLASS: II M.Sc			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	Elective Course VI (Choice 1)	23P4RECT6	BIOENERGY	3	6	25	75	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓	

Objectives:

- To acquire knowledge on bioenergy utilizing organic wastes for energy recovery.
- To discuss methods and strategies of exploiting microbes for the production technology of biodiesel.
- To describe resources and techniques for the production and estimation of eco-friendly biofuels and the extent of their use potentially
- To gain knowledge for executing biogas plant in communities.
- To explain possibility of using microbes for the production of bio-hydrogen as a source of future fuel.

Unit	Description	Hours	K-level	CLO
I	Bioenergy – Biomass Energy Resources. Biomass conversion methods. Microbes as bioresources for bioenergy products (Bacteria, fungi, yeast and microalgae) - Bioprospecting of microbial strains for biofuel production.	18	K3	CLO 1
II	Biodiesel – Microbes and Biodiesel. Production and feed stock. Techniques of lipid extraction and conversion to biodiesel. Biodiesel quality and its assessment. Strategies of genetic engineering of organisms for biodiesel production. Biodiesel production from single cell organisms (<i>Cryptococcus</i> , <i>Cunninghamella</i> , <i>Mortierella</i>).	18	K4	CLO 2
III	Alcoholic Fuels from microorganisms: Biochemical conversion to ethanol: Biomass pre-treatment, Starch to sucrose conversion and Sucrose to ethanol fermentation. Role of enzymes and their applications in ethanol production. Distillation and Quantification of ethanol. Production and Estimation of biobutanol, biomethanol, biopropanol and bioglycerol.	18	K3	CLO 3

IV	Biogas - Microbes and Biogas production, Biogas plants – types – design – construction– Biogas Bottling Technology and Development in India, Biogas appliances – burner, luminaries and power generation – effect on engine performance. Application of Biogas slurry in agriculture.	18	K4	CLO 4
V	Biohydrogen– Production from bacteria and algae. Commercialized microalgae (<i>Spirulina</i> , <i>Dunaliella</i> , <i>Hematococcus</i> and <i>Chlorella</i>) and their production. Economics of microalgae production. Cultivation of seaweeds. Microbial fuel cells.	18	K2	CLO 5

Books for study:

1. Dahiya A. (2014). Bioenergy- Biomass to Biofuel. (1st Edition). Academic Press Editor.
2. Brown R. C. (2003). Biorenewable Resources: Engineering New Products from Agriculture. (1st Edition). Wiley Blackwell Publishing.
3. Jawaid M., Hakeem K. R. and Rashid U. (2014). Biomass and Bioenergy: Processing and Properties. (1st Edition). Springer Cham.

Books for References:

1. Konur O. (2018). Bioenergy and Biofuels. (1st Edition). CRC Press.
2. Lee J. W.(2012). Advanced Biofuels and Bioproducts. (13th Edition), Springer.
3. Khanal S. (2008). Anaerobic Biotechnology for Bioenergy Production: Principles and Applications. (8th Edition). Wiley-Blackwell Publishing.
4. Pradeep Chaturvedi.(1995). Bioenergy Resources. Concept Publishing Company.
5. Lee S. (2018).Biofuel and Bioenergy. Taylor and Francis

Web Resources

1. <https://www.elsevier.com> Biofuels and Bioenergy
2. <https://www.sciencedirect.com> › book › bioenergy
3. https://www.un.org/en/climatechange/what-is-renewable-energy?gclid=EAIaIQobChMIqriN2Nao-wIV2HwrCh2pfA5mEAAYASAAEgI-p_D_BwE
4. <https://www.energy.gov/eere/bioenergy/bioenergy-basics>
5. <https://www.iea.org/fuels-and-technologies/bioenergy>

Rationale for Nature of the course

This course introduces the core concepts and basic principles in Design, execute and extract bio hydrogen from algae

Activities having direct bearing on Skill development / Employability Entrepreneurship

Case study, Model Making and Mini-project

Pedagogy

Chalk and talk, Group discussion, Role play

Course Designer(s):

1. Dr. Asha Kannan A.P

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Biomass Energy Resources. Biomass conversion methods.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Microbes as bioresources for bioenergy products (Bacteria, fungi, yeast and microalgae) - Bioprospecting of microbial strains for biofuel production.	9	
Unit II	Biodiesel – Microbes and Biodiesel. Production and feed stock. Techniques of lipid extraction and conversion to biodiesel. Biodiesel quality and its assessment.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Strategies of genetic engineering of organisms for biodiesel production. Biodiesel production from single cell organisms (<i>Cryptococcus</i> , <i>Cunninghamella</i> , <i>Mortierella</i>).	9	
Unit III	Alcoholic Fuels from microorganisms: Biochemical conversion to ethanol: Biomass pre-treatment, Starch to sucrose conversion and Sucrose to ethanol fermentation. Role of enzymes and their applications in ethanol production.	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Distillation and Quantification of ethanol. Production and Estimation of biobutanol, biomethanol, biopropanol and bioglycerol.	9	
Unit IV	Biogas - Microbes and Biogas production, Biogas plants – types – design – construction– Biogas Bottling Technology and Development in India,	9	Chalk and Talk, Group discussion, Quiz, Seminar , PPT presentation
	Biogas appliances – burner, luminaries and power generation – effect on engine performance. Application of Biogas slurry in agriculture.	9	
Unit V	Biohydrogen– Production from bacteria and algae. Commercialized microalgae (<i>Spirulina</i> , <i>Dunaliella</i> , <i>Hematococcus</i> and <i>Chlorella</i>) and their production.	9	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Economics of microalgae production. Cultivation of seaweeds. Microbial fuel cells.	9	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Evaluate the various aspects of biomass production and their implementation.	K3
CLO-2	Design and construct a biodiesel plant.	K4
CLO-3	Carry out the process of fermentation for bio – alcohol fuels.	K3
CLO-4	Identify the nature of biogas as a biofuel and their technologies and applications.	K4
CLO-5	Design, execute and extract bio-hydrogen from algae.	K2

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	1	1	1	3
CLO-2	2	1	1	1	1
CLO-3	3	3	2	1	1
CLO-4	3	2	1	1	1
CLO-5	3	3	3	2	1

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	1	2	1	3
CLO2	1	1	1	3	1	1
CLO3	1	1	1	1	2	1
CLO4	2	2	3	3	1	1
CLO5	2	2	1	1	3	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Blueprint for Semester Examination

Learning Outcome Based Education & Assessment (LOBE) 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

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 MICROBIOLOGY					CLASS: II M.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
IV	Elective course VI (Choice 2)	23P4RECT6	MARINE MICROBIOLOGY	3	4	25	75	100

Nature of course	Skill oriented	√	Employability oriented	√	Entrepreneurship Oriented	

Objectives:

- To gain fundamental knowledge of marine environment and the microbial communities inhabiting the oceans.
- To discuss the metabolic diversity of marine microorganisms and their interrelationships.
- To explain the survival of microorganisms in extreme environments.
- To illustrate pathogens and contaminants in sea foods.
- To describe the applications of marine biotechnological products and their future role in a rapidly changing planet.

Unit	Description	Hours	K-level	CLO
I	Marine microbial environment - Benthic & littoral zone, salt pan, mangroves and estuarine microbes, microbial loop. Marine microbial communities – Bacteria, fungi, protozoa. Microbial interactions – Endosymbionts and Ectosymbionts.	12	K2	CLO 1
II	Dynamics of Marine Microbes - Carbon cycle: Phototrophic microbes, the oceanic carbonate system and global warming – Nitrogen cycle: Nitrogen fixers – Iron limitation – ocean fertilization – phosphorus cycle. Decomposition of organic matter. Bioleaching and biodeterioration of natural and synthetic materials.	12	K3	CLO 2
III	Marine extremophiles: Mechanism of survival at extreme environments – Adaptive mechanisms in thermophilic, alkalophilic, osmophilic, barophilic, psychrophilic hyperthermophilic and halophilic microorganisms – Importance in biotechnology.	12	K4	CLO 3

IV	Marine Microbial Diseases: Aqua culture pathogens & Water borne pathogens - <i>Aeromonas</i> , <i>Vibrio</i> , <i>Salmonella</i> , <i>Pseudomonas</i> , <i>Leptospira</i> , <i>Corynebacteria</i> and viral diseases. Rapid diagnosis of contamination in sea foods and aquaculture products.	12	K4	CLO 4
V	Applications of Marine Microbial Biotechnology: Production and applications of marine microbial products – Enzymes, Antibiotics, Organic acids, Toxins, Biosurfactants and Pigments. Sea food preservation methods. Probiotic bacteria and their importance in aquaculture.	12	K4	CLO 5

Books for study:

1. Munn C. B. (2019). Marine Microbiology: Ecology and Applications. (3rd Edition). CRC Press. ISBN:9780367183561.
2. Bhakuni, D.S. and Rawat D. S. (2005). Bioactive Marine Natural Products. Anamaya Publishers, New Delhi. ISBN:1-4020-3472-5.
3. Brock T. D. (2011). Thermophilic Microorganisms and Life at High Temperatures. Springer. ISBN-13:978-1461262862 / ISBN-10:1461262860.

Books for References:

1. Maier R. M., Pepper I. L. and Gerba C. P. (2006). Environmental Microbiology. (2nd Edition). Academic Press. ISBN:978-0-12-370519-8.
2. Belkin S. and Colwell R. R. (2005). Oceans and Health: Pathogens in the Marine Environment. Springer. ISBN:978-0-387-23708-4.
3. Scheper T. (2009). Advances in Biochemical Engineering/Biotechnology-Marine Biotechnology. Springer. ISBN:978-3-540-69356-7. E-ISBN:978-3-540-69357-4.
4. Gasol J. M. and Kirchman D. L. (Eds.). (2018). Microbial Ecology of the Oceans. (3rd Edition). Wiley-Blackwell. ISBN:978-1-119-10718-7.
5. Kim S. K. (2019). Essentials of Marine Biotechnology. Springer.

Web Resources

1. <https://link.springer.com/content/pdf/bfm%3A978-0-387-23709-1%2F1>
2. https://www.researchgate.net/publication/285931262_Bioactive_Marine_Natural_Products
3. <http://link.springer.com/content/pdf/bfm%3A978-3-642-03470-1%2F1.pdf>
4. <https://link.springer.com/book/10.1007/b102184>
5. <https://www.wiley.com/en-bs/Microbial+Ecology+of+the+Oceans%2C+3rd+Edition-p-9781119107187>

Rationale for Nature of the course

Microorganisms (bacteria, fungi, viruses and archaea) mediate key ecosystem processes in marine systems and account for a majority of the biodiversity.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Case study, Model Making and Mini-project

Pedagogy

Chalk and Talk, PPT presentation, Assignment, Quiz, Group discussion

Course Designer(s):

1. Dr. P. Sasikumar

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Marine microbial environment - Benthic & littoral zone	2	Chalk and Talk, Group discussion, Seminar , PPT presentation
	Salt pan, mangroves and estuarine microbes, microbial loop.	2	
	Marine microbial communities – Bacteria, fungi, protozoa.	2	
	Microbial interactions	2	
	Endosymbionts	2	
	Ectosymbionts.	2	
Unit II	Dynamics of Marine Microbes	2	Chalk and Talk, Group discussion, Seminar , PPT presentation
	Carbon cycle: Phototrophic microbes, the oceanic carbonate system and global warming	2	
	Nitrogen cycle: Nitrogen fixers	2	
	Iron limitation – ocean fertilization – phosphorus cycle	2	
	Decomposition of organic matter.	2	
	Bioleaching and biodeterioration of natural and synthetic materials.	2	
Unit III	Marine extremophiles	2	Chalk and Talk, Group discussion, Seminar , PPT presentation
	Mechanism of survival at extreme environments	2	
	Adaptive mechanisms in thermophilic, alkalophilic, osmophilic microbes	2	
	Barophilic, psychrophilic and halophilic microorganisms	2	
	Hyperthermophilic microorganisms	2	
	Importance of marine microbes in biotechnology.	2	
Unit IV	Marine Microbial Diseases	2	Chalk and Talk, Group discussion, Seminar , PPT presentation
	Aqua culture pathogens & Water borne pathogens	2	
	<i>Aeromonas, Vibrio, Salmonella</i>	2	
	<i>Pseudomonas, Leptospira, Corynebacteria</i>	2	
	Viral diseases.	2	
	Rapid diagnosis of contamination in sea foods and aquaculture products.	2	

Unit V	Applications of Marine Microbial Biotechnology	2	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Production and applications of marine microbial products – Enzymes, Antibiotics	2	
	Production and applications of marine microbial products – Organic acids, Toxins	2	
	Biosurfactants and Pigments	2	
	Sea food preservation methods	2	
	Probiotic bacteria and their importance in aquaculture.	2	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Apply the knowledge on marine microbial communities and their interactions.	K2
CLO-2	Illustrate the role of marine microorganisms in biogeochemical cycles.	K3
CLO-3	Categorize the extreme environments in the oceans and the survival mechanisms adapted by the microorganisms living in these environments.	K4
CLO-4	Identify the diseases affecting marine organisms and its diagnosis.	K4
CLO-5	Evaluate the marine microorganisms as a resource for novel microbial products.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	3	2	2
CLO-2	3	2	3	2	2
CLO-3	3	1	3	2	2
CLO-4	3	1	3	2	2
CLO-5	3	2	3	2	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	2	1	1	1
CLO2	1	1	2	1	2	1
CLO3	2	2	2	1	1	1
CLO4	1	1	2	1	2	1
CLO5	2	2	2	1	2	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Assessment Scheme

Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
Total	25

BLUE PRINT FOR TEST COMPONENT OF CIA

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 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

BLUE PRINT FOR TEST COMPONENT OF CIA
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 1	Up to K 2	1	K1	2 (K2&K2)	1(K3)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

Blueprint for Semester Examination
Learning Outcome Based Education & Assessment (LOBE)
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 (K2&K2)	1(K2)
2	CLO 2	Up to K-3	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(K4)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K2&K2)	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

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	0	-	9	7.5	42%
K2	5	6	20	10	41	34.17	
K3	-	-	20	10	30	25	25%
K4	-	-	10	30	40	33.33	33%
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 (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 (K4 Level)
		2 Questions from Unit-V (K2 Level)	1 Question from Unit-V (K4 Level)

DEPARTMENT OF MICROBIOLOGY					CLASS: II M.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
IV	Elective course VI (Choice 3)	23P4RECT6	LIFE SCIENCES FOR COMPETITIVE EXAMINATIONS	3	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	

Objectives:

- To impart knowledge on structure, metabolism and function of biomolecules.
- To understand the importance of inheritance biology.
- To discuss in-depth about the different types of ecosystems and their importance.
- To outline the major drivers in biodiversity and various conservation approaches.
- To introduce basic concepts of evolution and biological clock.

Unit	Description	Hours	K-level	CLO
I	Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA). Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins. Structure of atoms, molecules and chemical bonds. Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Bioenergetics.	12	K2	CLO 1
II	Cellular Organisation, Cell division and cell cycle, Membrane structure and function, Organization of genes and chromosomes, Structural organization and function of intracellular organelles, DNA replication, repair and recombination, Protein synthesis and processing.	12	K3	CLO 2
III	Inheritance Biology, Mendelian principles- Dominance, segregation, independent assortment, Linkage and Gene mapping, Karyotyping, Extrachromosomal inheritance - Inheritance of Mitochondrial and chloroplast genes, maternal	12	K4	CLO 3

	inheritance. Human genetics-Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.			
IV	Ecology- Habitat and Niche, biotic and abiotic interactions, Biome- biogeographical zones of India. Ecological Succession, Population Ecology- Characteristics of a population; population growth curves, Environmental pollution-global environmental change, Biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Biodiversity Management approaches. Indian case studies on Conservation/Management strategy (Project Tiger, Biosphere Reserves).	12	K4	CLO 4
V	Evolution and Behaviour- Evolution - Theories- Darwin's, Lamarck's, Oparin Haldane. Paleontological, Embryological and Molecular evidences. Hardy Weinberg's Law. Speciation; Allopatricity and Sympatricity. Adaptive radiation and Convergent evolution; Sexual selection; Co-evolution. Altruism, Biological clocks, Migration and Parental care. Molecular Evolution- Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny.	12	K4	CLO 5

Books for study:

1. Nelson D. L. and Cox M. M. (2008). Lehningers Principles of Biochemistry. (5th Edition). W.H. Freeman and Company.
2. Chapman J. L. (1998). Ecology: Principles and Applications. (2nd Edition). Cambridge University Press.
3. Krishnamurthy V. K. (2003). Textbook of Biodiversity. Science Publishers.

Books for References:

1. Pontarotti P. (2018). Origin and Evolution of biodiversity. (1st Edition). Springer.
2. Verma P. S. and Agarwal V. K. (2004). Cell biology, Genetics, Molecular Biology, Evolution and Ecology. (2nd Edition). S Chand publication.
3. Lewin R. and Foley R. (2004). Principles of Human Evolution. (2nd Edition). Black well Publishing Company.
4. Boyer R.F. (2002) Modern Experimental Biochemistry 3rd Edition. Pearson Education.

5. Wilson K., Walker J., Clokie S and Hofmann A. (2018) Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology 8th Edition. Cambridge University Press.

Web Resources

1. https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_
2. <https://www.livescience.com/474-controversy-evolution-works.html>.
3. <https://www.examrace.com/Study-Material/Life-Sciences/>
4. <https://www.kopykitab.com/Methods-In-Biology-Life-Science-Study-Material-For-CSIR-NET-Exam-by-Panel-Of-Experts>
5. <https://www.erforum.net/2017/01/life-science-biology-handwritten-notes-for-competitive-exams.html>

Rationale for Nature of the course

It is aimed explicitly at subjects related to life sciences and is considered one of the most competitive exams in the country.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Case study, Model Making and Mini-project

Pedagogy

Chalk and Talk, PPT presentation, Assignment, Quiz, Group discussion

Course Designer(s):

1. Dr. P. Sasikumar

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).	2	Chalk and talk
	Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA).	2	
	Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins	3	
	Structure of atoms, molecules and chemical bonds.	1	
	Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.).	2	
	Bioenergetics.	2	

Unit II	Cellular Organisation	2	Chalk and talk
	Cell division and cell cycle, Membrane structure and function	2	
	Organization of genes and chromosomes	2	
	Structural organization and function of intracellular organelles	2	
	DNA replication, repair and recombination	2	
	Protein synthesis and processing.	2	
Unit III	Inheritance Biology	2	Chalk and talk PPT/video presentation
	Mendelian principles- Dominance, segregation, independent assortment	2	
	Linkage and Gene mapping, Karyotyping, Extrachromosomal inheritance - Inheritance of Mitochondrial and chloroplast genes	2	
	maternal inheritance	2	
	Human genetics-Pedigree analysis	2	
	lod score for linkage testing, karyotypes, genetic disorders.	2	
Unit IV	Ecology- Habitat and Niche, biotic and abiotic interactions	2	Chalk and talk Group discussion
	Biome- biogeographical zones of India. Ecological Succession	2	
	Population Ecology- Characteristics of a population; population growth curves	2	
	Environmental pollution-global environmental change, Biodiversity: status, monitoring and documentation	2	
	Major drivers of biodiversity change; biodiversity management approaches. Biodiversity Management approaches	2	
	Indian case studies on Conservation/Management strategy (Project Tiger, Biosphere Reserves).	2	
Unit V	Evolution and Behaviour- Evolution - Theories- Darwin's, Lamarck's, Oparin Haldane	2	Chalk and talk PPT/video presentation
	Paleontological, Embryological and Molecular evidences. Hardy Weinberg's Law	2	
	Speciation; Allopatricity and Sympatricity	2	
	Adaptive radiation and Convergent evolution; Sexual selection; Co-evolution. Altruism	2	
	Biological clocks, Migration and Parental care. Molecular Evolution- Concepts of neutral evolution	2	
	Molecular divergence and molecular clocks; Molecular tools in phylogeny.	2	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Define, classify and assess the structure, biological functions and interactions of Biomolecules.	K2
CLO-2	Validate the knowledge of collective and progressive notions of cellular organization.	K3
CLO-3	Assess and describe the importance of inheritance biology.	K4
CLO-4	Establish acquaintance and understanding of ecology & Biodiversity in a broader sense.	K4
CLO-5	Understand the processes of evolution, relate with natural selection, adaptation and speciation.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	3	2	2
CLO-2	3	2	3	3	2
CLO-3	3	1	3	2	2
CLO-4	2	1	3	2	3
CLO-5	3	2	3	2	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	1	1	2	3	1	1
CLO2	1	1	2	3	2	1
CLO3	1	2	2	3	1	1
CLO4	1	1	2	3	2	1
CLO5	1	2	2	3	2	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Assessment Scheme
Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
Total	25

Blueprint for Semester Examination

Learning Outcome Based Education & Assessment (LOBE)

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 (K2&K2)	1(K2)
2	CLO 2	Up to K-3	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(K4)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K2&K2)	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

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	0	-	9	7.5	42%
K2	5	6	20	10	41	34.17	
K3	-	-	20	10	30	25	25%
K4	-	-	10	30	40	33.33	33%
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 (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 (K4 Level)
		2 Questions from Unit-V (K2 Level)	1 Question from Unit-V (K4 Level)

DEPARTMENT OF MICROBIOLOGY					CLASS: II M.Sc.			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
IV	Skill Enhancement Course (SEC)	23P4RSED2	RESEARCH METHODOLOGY AND BIOSTATISTICS	2	4	25	75	100

Nature of Course					
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Objectives:

- To discuss the methods and techniques of data collection.
- To explain sampling methods, write research reports and articles.
- To discuss the basic concepts of Biostatistics.
- To describe statistical software for analysis.
- To explain the tests of significance.

Unit	Description	Hours	K-level	CLO
I	Introduction to Research Methodology - Meaning and importance. Statement, Constraints. Review of literature - Review and synopsis presentation. Types of research, Research tools. Methods and techniques of data collection - types of data, methods of primary data collection (observation/ experimentation/ questionnaire/ interviewing/ case/pilot study, methods), methods of secondary data collection.	12	K2	CLO 1
II	Sampling and sampling distributions. Sampling frame, importance of probability sampling, sampling - simple random, systematic, stratified random and cluster. Variables - nominal, ordinal, discontinuous, continuous, derived. Research process, designs and Report writing - types of research reports, guidelines for writing an article and report, report format, appendices, Ethical issues related to publishing, Plagiarism and Self-Plagiarism.	12	K3	CLO 2
III	Introduction to Biostatistics - Basic concepts, Measurement and measurement scales, Sampling and data collection, Data presentation. Measures of central tendency: Mean, Median, Mode. Measures of variability - Standard deviation, standard error, range, mean deviation and coefficient of variation.	12	K4	CLO 3

	Frequency table of single discrete variable, bubble plot, computation of mean, variance and standard Deviations, t test, correlation coefficient.			
IV	Correlation and regression - Positive, negative, calculation of Karl-Pearsons co-efficient of correlation. Linear regression and multiple linear regression, ANOVA, one and two way classification. Calculation of an unknown variable using regression equation. Tests of significance - Tests of significance: Small sample test (Chi-square t test, F test), large sample test (Z test) and standard error.	12	K4	CLO 4
V	Probability and distributions - Introduction to probability theory and distributions, (concept without deviation) binomial, poisson and normal (only definitions and problems) Computer oriented statistical techniques. RSM: methods for process optimization set up CCD, Box Behnken, optimal RSM design, regression models FDS curves, surface contours, multi linear constraints and categoric factors to optimal design.	12	K4	CLO 5

Books for study:

1. Sharma K. R. (2002) Research methodology. National Publishing House, New Delhi.
2. Daniel W.W. (2005). Biostatistics; A foundation for analysis in the health sciences. (7th Edition). Jhon Wiley & sons Inc, New York.
3. Rao P. S. S. and Richard J. (2006). Introduction to Biostatistics & Research methods. Prentice-Hall, New Delhi.

Books for References:

1. Zar J. H. (2006). Biostatistical Analysis. (4th Edition). Pearson Education Inc. New Jersey.
2. Beins B. C. and McCarthy M.A. (2011). Research Methods and Statistics. Pearson Education Inc. New Jersey.
3. Adams K. A. and Lawrence E. M. K. (2014). Research Methods, Statistics, and Applications. SAGE Publications, Inc., New Delhi.
4. Anderson J.B. and Poole M. (2011). Assignment and Thesis Writing. 4th edn. Wiley India Private Limited.
5. Kothari C.R. and Garg G (2004) Research Methodology: Methods and Techniques. 2nd Edition. New Age International Publishers

Web Resources

1. <https://www.studocu.com/en-ca/document/mount-royal-university/quantitative-research-methods-and-data-analysis/lecture-notes-all-lectures/344093>
2. <https://www.khanacademy.org/math/statistics-probability/sampling-distributions-library>

3. <https://testbook.com/learn/maths-mean-median-mode/>
4. <https://rcub.ac.in/econtent/ug/bcom/sem4/Business%20Statistics%20Unit%204%20Correlation%20and%20Regression.pdf>
5. https://www.cse.iitk.ac.in/users/piyush/courses/pml_fall17/material/probabilty_tutorial.pdf

Rationale for Nature of the course

It focuses on collecting, testing and measuring numerical data, usually from a large sample of participants.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Case study, Model Making and Mini-project

Pedagogy

Chalk and Talk, PPT presentation, Assignment, Quiz, Group discussion

Course Designer(s):

1. Dr. P. Sasikumar

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Introduction to Research Methodology - Meaning and importance. Statement, Constraints	2	Chalk and Talk, Group discussion, Seminar , PPT presentation
	Review of literature - Review and synopsis presentation	2	
	Types of research, Research tools.	2	
	Methods and techniques of data collection - types of data	2	
	Methods of primary data collection (observation/ experimentation/ questionnaire/ interviewing/ case/pilot study, methods),	2	
	Methods of secondary data collection.	2	
Unit II	Sampling and sampling distributions	2	Chalk and Talk, Group discussion, Seminar , PPT presentation
	Sampling frame, importance of probability sampling, sampling - simple random, systematic, stratified random and cluster	2	
	Variables - nominal, ordinal, discontinuous, continuous, derived	2	
	Research process, designs and Report writing - types of research reports, guidelines for writing an article and report	2	
	Report format, appendices, Ethical issues related to publishing	2	
	Plagiarism and Self-Plagiarism.	2	

Unit III	Introduction to Biostatistics	2	Chalk and Talk, Group discussion, Seminar, PPT presentation, quiz
	Basic concepts, Measurement and measurement scales, Sampling and data collection	2	
	Data presentation. Measures of central tendency: Mean, Median, Mode	2	
	Measures of variability - Standard deviation, standard error, range, mean deviation and coefficient of variation	2	
	Frequency table of single discrete variable, bubble plot, computation of mean, variance and standard Deviation	2	
	s, t test, correlation coefficient.	2	
Unit IV	Correlation and regression - Positive, negative	2	Chalk and Talk, Group discussion, Seminar , PPT presentation
	Calculation of Karl-Pearsons co-efficient of correlation	2	
	Linear regression and multiple linear regression, ANOVA, one and two way classification	2	
	Calculation of an unknown variable using regression equation	2	
	Tests of significance - Tests of significance: Small sample test (Chi-square t test, F test)	2	
	Large sample test (Z test) and standard error.	2	
Unit V	Probability and distributions - Introduction to probability theory and distributions, (concept without deviation)	2	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Binomial, poison and normal (only definitions and problems) Computer oriented statistical techniques	2	
	RSM: methods for process optimization set up CCD, Box Behnken	2	
	Optimal RSM design, regression models FDS curves	2	
	Surface contours, multi linear constraints	2	
	Categoric factors to optimal design.	2	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Collect and present data suitable to the research design.	K2
CLO-2	Write research manuscripts and articles for journals.	K3
CLO-3	Recommend the utilization of biostatistics tools for analysis of biological data.	K4
CLO-4	Prove and justify hypothesis for a particular research.	K4
CLO-5	Apply software tools for interpretation of biological data.	K4

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	1	3	2	2
CLO-2	2	2	2	2	2
CLO-3	3	3	3	2	2
CLO-4	3	3	3	2	2
CLO-5	3	2	3	2	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	1	1	2	1	1	1
CLO2	2	2	2	2	2	2
CLO3	2	2	2	3	3	3
CLO4	1	2	2	3	2	1
CLO5	2	2	2	2	2	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Assessment Scheme

Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
Total	25

Blueprint for Semester Examination
Learning Outcome Based Education & Assessment (LOBE)
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 (K2&K2)	1(K2)
2	CLO 2	Up to K-3	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(K4)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K2&K2)	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

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	0	-	9	7.5	42%
K2	5	6	20	10	41	34.17	
K3	-	-	20	10	30	25	25%
K4	-	-	10	30	40	33.33	33%
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 (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 (K4 Level)
		2 Questions from Unit-V (K2 Level)	1 Question from Unit-V (K4 Level)

DEPARTMENT OF MICROBIOLOGY					CLASS: II M.Sc			
Sem.	Course type	Course code	Course title	Credits	Contact hours/ Week	CIA	Ext	Total
IV	Skill Enhancement Course III	23P4REXTN	MICROBIAL QUALITY CONTROL AND TESTING	2	2	25	75	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓	

Objectives:

- To apply knowledge in quality analysis techniques suitable for industries.
- To perform water managements, water harvesting and treat sewage, water pollutions and remedies.
- To detect portability of water. Test water quality.
- To impart knowledge on bioaerosols, impact and prevention
- To apply quality control techniques for food and pharma products

Unit	Description	Hours	K-level	CLO
I	Concepts of quality control techniques - quality assurance, Total Quality Management (TQM) Continuous Quality Improvement (CQI) Quality Assurance (QA) pre analytical and post analytical techniques, ATCC, MTCC, microbial based assay.	6	K2	CLO 1
II	Waste water microbiology – types and sources of contamination, prevention of water borne diseases. Water management, water harvesting, water recycling. Characteristics of waste water from industries - Sugar factory, Pulp & Paper mill, Distillery, Textile, Engineering, Food Industry, Domestic waste. Waste water treatment plant types and quality control. Water pollution causes and remedies.	6	K2	CLO 2
III	Microflora of water. Microbiological analysis of water sample. Microbiological analysis of water sample collection, drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive/MPN tests, confirmed and	6	K2	CLO 3

	completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests Control of microbes in water: Water borne pathogens, water borne diseases. Control of water borne pathogens - Precipitation, chemical disinfection, filtration, high temperature, UV light.			
IV	Microflora of air - Bioaerosols, Air borne microorganisms (bacteria, Viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres. Collection of air samples and analysis. Bioaerosol sampling, air samplers, methods of analysis, CFU, culture media for bacteria and fungi, isolation and Identification. Control Measures of Bioaerosols - UV light, HEPA filters, desiccation, Incineration.	6	K2	CLO 4
V	Quality control in food - Food X ray inspection, PPE Equipment, IoT sensors, preventive quality control and reality quality control. Quality control of pharma products. Quality assurance framework, assessment of pharmaceutical quality, determinants of pharmaceutical quality, practical approaches to quality assurance.	6	K2	CLO 5

Books for study:

1. Aneja R. P., Mathur B.N., Chandan R. C. and Banerjee, A. K. (2002). Experiments in Microbiology.
2. Adams M. R. and Moss M. O. (2006). Food Microbiology. (2nd Edition). Royal Society of Chemistry.
3. Dubey R.C. and Maheshwari D. K. (2010). Practical Microbiology. S. Chand.

Books for References:

1. Cullimore D. R. (2010). Practical Atlas for Bacterial Identification. (2nd Edition). -Taylor & Francis.
2. Sundararaj T. (2003). Microbiology Laboratory Manual. (2nd Edition). Published by A. Sundararaj
3. Hogen N. A., Denyer S P. and Baird R.M. (2003). Handbook of microbiological quality control. Microbial Quality Assurance in Pharmaceuticals, cosmetics & Toiletries. by Sally F. Bloomfield
4. Amitava Mitra. Fundamentals of Quality control and Improvement. (3rd Edition). Wiley Publications
5. David Roesti, Marcel Goverde (2019). Pharmaceutical Microbiological Quality Assurance and control: Practical guide for non- sterile Manufacturing. Wiley Publishers.

Web Resources

1. <https://www.researchgate.net/publication/320730681>
2. <https://www.fssai.gov.in>
3. <https://mofpi.nic.in/Schemes/implementation-haccp-iso-22000-iso-9000-ghp-gmp-etc>
4. <https://www.who.int/news-room/fact-sheets/detail/food-safety>
5. <https://www.fda.gov/food/hazard-analysis-critical-control-point-haccp/haccp-principles-application-guidelines>

Rationale for Nature of the course

Quality control allows microbiologists to monitor and protect against microbial impurities in biomanufacturing production systems. Protocols must be adhered to in order to control the environmental factors in production and maintain a sterile environment throughout the process.

Activities having direct bearing on Skill development / Employability Entrepreneurship

Case study, Model Making and Mini-project

Pedagogy

Chalk and talk, Group discussion

Course Designer(s):

1. **Prof. N. Sumathy**

Course Schedule

Unit	Topics	Hrs	Mode
Unit I	Concepts of quality control techniques - quality assurance	1	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Total Quality Management (TQM)	1	
	Continuous Quality Improvement (CQI)	1	
	Quality Assurance (QA)	1	
	pre analytical and post analytical techniques	1	
	ATCC, MTCC, microbial based assay.	1	
Unit II	Waste water microbiology – types and sources of contamination, prevention of water borne diseases	1	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Water management, water harvesting, water recycling	1	
	Characteristics of waste water from industries - Sugar factory, Pulp & Paper mill, Distillery	1	
	Textile, Engineering, Food Industry, Domestic waste	1	
	Waste water treatment plant types and quality control	1	
	Water pollution causes and remedies.	1	

Unit III	Microflora of water. Microbiological analysis of water sample.	1	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Microbiological analysis of water sample collection, drinking (potable) water,	1	
	methods to detect potability of water samples: (a) standard qualitative procedure: presumptive/MPN tests, confirmed and completed tests for faecal coliforms	1	
	(b) Membrane filter technique and (c) Presence/absence tests	1	
	Control of microbes in water: Water borne pathogens, water borne diseases.	1	
	Control of water borne pathogens - Precipitation, chemical disinfection, filtration, high temperature, UV light.	1	
Unit IV	Microflora of air - Bioaerosols, Air borne microorganisms (bacteria, Viruses, fungi) and their impact on human health and environment	1	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	significance in food and pharma industries and operation theatres	1	
	Collection of air samples and analysis. Bioaerosol sampling, air samplers, methods of analysis	1	
	CFU, culture media for bacteria and fungi, isolation and Identification.	1	
	Control Measures of Bioaerosols	1	
	UV light, HEPA filters, desiccation, Incineration.	1	
Unit V	Quality control in food	1	Chalk and Talk, Group discussion, Assignment, Seminar , PPT presentation
	Food X ray inspection, PPE Equipment, IoT sensors,	1	
	Preventive quality control and reality quality control	1	
	Quality control of pharma products. Quality assurance framework, assessment of pharmaceutical quality	1	
	Determinants of pharmaceutical quality	1	
	Practical approaches to quality assurance.	1	

Course Learning Outcomes:

On completion of this course the students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO-1	Explain various microbiological quality standards for food, water and air regulatory practices and policies.	K2
CLO-2	Discuss collection, processing and preservation of water samples from industries in different areas.	K2
CLO-3	Enumeration and isolation of microorganism from the water samples.	K2
CLO-4	Enumeration and isolation of microorganism from the air samples.	K2
CLO-5	Gain knowledge on sterility testing of different components in industries and quality control techniques.	K2

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	2	1	1	2	2
CLO-2	2	1	1	2	2
CLO-3	3	3	2	3	2
CLO-4	3	2	1	3	2
CLO-5	3	3	3	3	2

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	2	1	2	2	1	1
CLO2	1	2	1	3	1	1
CLO3	2	1	2	1	2	1
CLO4	2	2	3	3	1	1
CLO5	2	2	1	1	3	1

Advance application– 3;

Intermediate level–2;

Basic level–1

Blueprint for Semester Examination
Learning Outcome Based Education & Assessment (LOBE)
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		
1	CLO 1	Up to K2	1	K1	2(K2 & K2)	1(K1)
2	CLO 2	Up to K2	1	K1	2(K2 & K2)	1(K1)
3	CLO 3	Up to K2	1	K1	2(K2 & K2)	1(K1)
4	CLO 4	Up to K2	1	K1	2(K2 & K2)	1(K1)
5	CLO 5	Up to K2	1	K1	2(K2 & K2)	1(K1)
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

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/ or)	Total marks	% of marks without choice	Consolidated
K1	10	-	50	60	46.15	46%
K2	-	70	-	70	53.84	54%

DEPARTMENT OF MICROBIOLOGY					CLASS: ILM.Sc			
Sem.	Course type	Course code	Course title	Credits	Contact hours/Week	CIA	Ext	Total
IV	Project	23P4RPROV	Project	8	8	25	75	100

Nature of Course						
Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓	

Objectives:

- To motivate students in research methodology
- To promote the experimental and analytical knowledge
- To enhance the knowledge of preparation of project report
- During the fourth semester, students shall undertake a project work and submit the project report.

Course Learning Outcomes:

CLOs	Course Learning Outcomes	Knowledge Level
CLO 1	Survey scientific literature available and identify gaps in existing studies	K4
CLO 2	Design a scientific study taking practical constraints into account	K5
CLO 3	Perform the scientific study taking practical constraints into account	K3
CLO 4	Analyze the results	K4
CLO 5	Communicate the findings based on ethical standards of reporting.	K3

Mapping of CLOs with POs

#	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	3	3	3	3
CLO2	3	3	3	3	3	3
CLO3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3
CLO5	3	3	3	3	3	3

Mapping of CLOs with PSOs

#	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	3	3	3
CLO-2	3	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

Advance application– 3;

Intermediate level–2;

Basic level–1

EVALUATION (PRACTICAL)

Internal (Formative) : 25 marks

External (Summative) : 75 marks

Total : 100 marks

Question Paper Pattern for Internal practical examination (Major): 40 marks and External Practical Examination (Major):60 Marks

Item	Internal	External
Project	25	75
Project	25 Marks by Department and 25 Marks by Guide / 2	75 =>
	Dept Evaluation: (Min (No.) 50% of faculty must be present) 15 Marks for Presentation using ICT tools 10 Marks for Quality and Publication/presentation in seminar/conferences Guide Evaluation: 10 Marks for Student's ability and interest 5 Marks for Regularity and Punctuality 10 Marks for Quality of the work and Presentation	External Evaluation : 10 Marks for the Report 15 Marks for Presentation 30 Quality of work 20 Viva-voce



The Madura College (Autonomous), Madurai – 625 011

Department of MICROBIOLOGY

PG Programme Structure

Sem	Course Code	Title of the Course	Hours	Credits	Nature of Course(Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			% of Syllabus Revision/ New
					Empl	Ent	Skill	Local	National	Global	
I	23P1RCCT1	General Microbiology and Microbial Diversity	6	5			✓	✓	✓		-
	23P1RCCT2	Microbial Physiology	6	5			✓	✓	✓		-
	23P1RCCP1	Practical-I – General Microbiology, Microbial Diversity and Microbial Physiology	6	4	✓		✓	✓	✓		-
	23P1RECT1	Forensic Science	5	3			✓	✓	✓	✓	-
	23P1RECT2	Bioinstrumentation	5	3			✓	✓	✓	✓	-
	23P1RSED1	Microbial Cultivation and Growth	2	2			✓	✓	✓		-
			30	22							

II	23P2RCCT3	Medical Bacteriology and Mycology	6	5	✓		✓	✓	✓	✓	-
	23P2RCCT4	Medical Virology and Parasitology	6	5	✓		✓	✓	✓	✓	-
	23P2RCCP2	Practical-II - Medical Microbiology	6	4	✓		✓		✓	✓	-
	23P2RECT3	Bioremediation	5	3			✓		✓	✓	-
	23P2RECT4	Bioinformatics	5	3			✓	✓	✓	✓	-
	23P2RSEN1	Vermitechnology	2	2	✓	✓	✓	✓	✓		-
			30	22							
III	23P3RCCT5	Immunology and Microbial Genetics	6	5	✓		✓	✓	✓	✓	-
	23P3RCCT6	Molecular Biology and Recombinant DNA Technology	6	5	✓		✓	✓	✓	✓	-
	23P3RCCP3	Practical III- Immunology, Microbial Genetics and Molecular Biology	6	4	✓	✓	✓				-
	23P3RECT5	Fermentation Technology and Pharmaceutical Microbiology	5	3	✓		✓				-

	23P3RSEN2	Organic Farming and Biofertiliser Technology	2	2	✓	✓	✓	✓	✓		-
	23P2RMDC1	Computer Aided Drug Discovery and Design	5	3	✓	✓	✓	✓	✓	✓	New
		Internship	-	2							-
			30	24							
IV	23P4RCCT7	Food and Environmental Microbiology	6	5	✓		✓	✓	✓	✓	-
	23P4RCCP4	Practical IV-Applied Microbiology	6	4	✓		✓	✓	✓	✓	-
	23P4RECT6	Life Science for Competitive Examinations	6	3	✓	✓		✓	✓		-
	23P4RSED2	Research Methodology and Biostatistics	4	2	✓	✓	✓		✓	✓	-
	23P4REXTN	Microbial Quality Control and Testing	-	1	✓	✓	✓	✓	✓		-
	23P4RPROV	Project with Viva-Voce	8	8	✓	✓	✓	✓	✓		-
			30	23							

Emp- Employability; Ent- Entrepreneurship; Skill- Skill Development



DEPARTMENT OF BIOTECHNOLOGY

**Revised Curriculum
TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION (TANSCHE)
(Choice Based Credit system with Outcome Based Education)**

Academic Year 2023-2024 onwards

**II semester and II year (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 Outcomes (defined by TANSCHÉ):

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real-life situations.

PO4: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.

PO5: Scientific Reasoning: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open-minded and reasoned perspective.

PO6: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

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

Programme structure for B.Sc., Biotechnology (2023 -2024 onwards)

Semester	Subject Code	Course	Title of the Course	H	C
I	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	Language - I	Tamil / Hindi / Sanskrit	6	3
	23U1NENG1	Language - II	English	6	3
	23U1LCCT1	Core Course - 1 (CC1)	Cell and Molecular Developmental Biology	5	5
	23U1LCCP1	Core Course - 2 (CC2)	Major Practicals-I	3	3
	23U1CGET1	Generic Elective - 1 (EC1)	Biological Chemistry	4	4
	23U1CGEP1	Generic Elective - 1 (EC1-P)	Allied Practicals-I	2	1
	23U1LSED1	Skill Enhancement Course-I (SEC-1)	Food Chemistry	2	2
	23U1LFCT1	Foundation course (FC)	Basics of Biotechnology	2	2
				30	23
II	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	Language - I	Tamil / Hindi / Sanskrit	6	3
	23U2NENG2	Language - II	English	6	3
	23U2LCCT2	Core Course - 1 (CC3)	Genetics	5	5
	23U2LCCP2	Core Course - 2 (CC4)	Major Practicals-II	3	3
	23U2CGET2	Generic Elective - 1 (EC1)	Bioinstrumentation	4	4
	23U2CGEP2	Generic Elective - 1 (EC1-P)	Allied Practicals-II	2	1
	23U2LSED2	Skill Enhancement Course-II (SEC-2)	Mushroom Cultivation	2	2
	23U2LSED3	SEC - Major (SEC-3)	Clinical Nutrition and Dietary Management	2	2
				30	23
III	23U3TLAN3/ 23U3HLAN3/ 23U3SLAN3	Language - I	Tamil / Hindi / Sanskrit	6	3
	23U3NENG3	Language - II	English	6	3
	23U3LCCT3	Core Course - 1 (CC5)	Immunology and Immunotechnology	4	4

	23U3LCCP3	Core Course - 2 (CC6)	Major Practicals-III	3	3
	23U3RGET3	Generic Elective – 2 (EC-2)	Fundamentals of Microbiology	4	4
	23U3RGEP3	Generic Elective – 2 (EC2-P)	Allied Practicals-III	2	1
	23U3LSED4	Skill Enhancement Course-IV (SEC-4)	Food and Bioprocess Technology	2	2
	23U3LSED5	Skill Enhancement Course-V (SEC-5)	Vermitechnology	2	2
		EVS		1	-
				30	22
IV	23U4TLAN4/ 23U4HLAN4/ 23U4SLAN4	Language - I	Tamil / Hindi / Sanskrit	6	3
	23U4NENG4	Language - II	English	6	3
	23U4LCCT2	Core Course - 1 (CC7)	Genetic Engineering and rDNA Technology	4	4
	23U4LCCP2	Core Course - 2 (CC8)	Major Practicals-II	3	3
	23U4RGET4	Generic Elective - 2 (EC1)	Bioinformatics and Biostatistics	4	4
	23U4RGEP4	Generic Elective - 2 (EC1-P)	Allied Practicals-IV	2	1
	23U4LSED6	Skill Enhancement Course –VI (SEC-6)	Poultry Science and Management	2	2
	23U4LSED7	SEC - Major (SEC-7)	Aquaculture	2	2
		EVS		1	2
				30	24

Ancillary Biotechnology Papers for B.Sc., Microbiology

Semester	Subject Code	Course	Title of the Course	H	C
I	23U1LGET1	Generic Elective - 1 (EC1)	Basic and Clinical Biochemistry	4	4
II	23U1LGEP1	Generic Elective - 1 (EC1-P)	Allied Practicals-I	2	1
III	23U2LGET2	Generic Elective - 2 (EC2)	Clinical Laboratory Technology	4	4
IV	23U2LGEP2	Generic Elective - 1 (EC2-P)	Allied Practicals-II	2	1

Evaluation pattern**Theory**

	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	Question type	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

Practicals

	Components	Marks	Total Marks
Internal [Formative]	Continuous assessment	10	25
	Observation	5	
	Test	10	
External [Summative]		75	75
Total Marks			100

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

Section		Marks
I	Major Question (1 X 25 Marks)	25
II	Minor Question (1 X 20 Marks)	20
III	Spotters (4 X 5 marks)	20
IV	Record Notebook	10
	Total	75

Add-on courses for B.Sc. Biotechnology

Semester	Subject Code	Title of the paper	H	C
III	23U3LAD1	Forensic Biotechnology	2	2
IV	23U4LAD2	Herbal Medicine	2	2

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 courses for B.Sc. Biotechnology

Semester	Subject Code	Title of the paper	H	C
IV		Good Laboratory Practices	--	2

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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Core Course	23U2LCCT2	Genetics	5	5	25	75	100

Nature of Course					
Skill	✓	Employability		Entrepreneurship oriented	

Course Objectives

- To explain the laws and concepts of Mendelian inheritance.
- To understand the principles of deviation from Mendelian inheritance with examples.
- To understand the mechanism of sex determination in different organisms.
- To solve the problems related to population genetics

Unit	Description	Hours	K-level	CLO
I	Mendel's experiments, Monohybrid cross, Dihybrid cross, Backcross or Testcross, Mendel's laws. Incomplete dominance. Co-dominance. Interaction of Genes- Epistasis - lethal genes. Multiple alleles – In Drosophila, Rabbit and Blood group inheritance in man.	15	2	1
II	Linkage - linkage in Drosophila- Morgan's experiments, factors affecting linkage. Crossing over- types, mechanism, significance of crossing over. Mapping of Chromosomes, interference and coincidence. Cytoplasmic inheritance -Carbon dioxide sensitivity in Drosophila and milk factor in mice. Sex –Linked Inheritance and Sex- Determination in Man.	15	3	2
III	Fine structure of the gene and gene concept, Operon Concept. Identification of the DNA as the genetic material- Griffith experiments, Avery, McLeod, McCarty and Hershey Chase experiment. Microbial Genetics- bacterial recombination, Conjugation, Transformation, Transduction and sexduction.	15	4	3
IV	Mutation – types of mutation, mutagens, DNA damage and Repair Mechanism. Chromosomal aberrations- Numerical and Structural, Pedigree Analysis-Mendelian inheritance in human. (Cystic Fibrosis, Muscular Dystrophy)	15	3	4
V	Population Genetics– Hardy Weinberg principle, gene frequency, genotype frequency and factors affecting gene frequency. Eugenics, Euphenics and Euthenics.	15	4	5

Books for Study

1. Veer Bala Rastogi. 2020. Elements of Genetics. 11th Revised & Enlarged Edition, KNRN Publications, Meerut.
2. Verma PS and Agarwal VK. 1995. Genetics, 8th edition, S. Chand & Co., New Delhi.
3. Griffiths JF et al. 2004. An Introduction to Genetic Analysis. 8th Edition. W. H. Freeman.

Books for Reference

1. Gardener EJ, Simmons MJ and Snustad DP. 2006. Principles of Genetics. 8th Edition. Wiley.
2. Lewis R. 2001. Human Genetics - Concepts and application. 4th Edition. McGraw Hill.
3. Winter PC, Hickey GJ and Fletcher HL. 2000. Instant notes in Genetics. Viva books Ltd.

Web resources

1. <https://nptel.ac.in/courses/102/106/102106025/>
2. <http://www.ocw.mit.edu>
3. <https://www.acpsd.net>

Rationale for nature of the course

The course focuses on the gene inheritance pattern, the structure and concept of gene. The Students will gain experience in analysing and interpreting data from genetics experiments.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Solving problems related to the genetics
- Observing traits ,Collecting and analysing genetic data.
- Group discussion

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

1. Dr P Vimal
2. Dr N Kamala Dhasan

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Mendel's experiments, Monohybrid cross, Dihybrid cross, Backcross or Testcross, Mendel's laws. Incomplete dominance, Co dominance	6	Chalk and Talk, PPT Quiz Problem solving Test
	Interaction of Genes- Epistasis -lethal genes.	6	
	Multiple alleles – In Drosophila, Rabbit and Blood group inheritance in man	3	
II	Linkage - linkage in Drosophila- Morgan's experiments, factors affecting linkage.	5	Chalk and Talk, PPT Quiz Problem solving Test
	Crossing over- types, mechanism, significance of crossing over. Mapping of Chromosomes, interference and coincidence	5	
	Cytoplasmic inheritance -Carbon dioxide sensitivity in Drosophila and milk factor in mice. Sex –Linked Inheritance and Sex- Determination in Man.	5	
III	Fine structure of the gene and gene concept, Operon Concept.	5	Chalk and Talk, PPT, Quiz Test
	Identification of the DNA as the genetic material- Griffith experiments, Avery, McLeod, McCarty and Hershey Chase experiment.	5	
	Microbial Genetics- bacterial recombination, Conjugation, Transformation, Transduction and sexduction	5	
IV	Mutation – types of mutation, mutagens,	5	Chalk and Talk, PPT Quiz Test
	DNA damage and Repair Mechanism. Chromosomal aberrations- Numerical and Structural	5	
	Pedigree Analysis-Mendelian inheritance in human. (Cystic Fibrosis, Muscular Dystrophy)	5	
V	Population Genetics– Hardy Weinberg principle,	5	Chalk and Talk, PPT , group discussion, Assignment
	gene frequency, genotype frequency and factors affecting gene frequency.	5	
	Eugenics, Euphenics and Euthenic	5	

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe the Laws of Mendelian genetics	Up to K2
CLO-2	Illustrate the linkage pattern in gene inheritance	Up to K3
CLO-3	Explain the Gene concept	Up to K4
CLO-4	Solve problems related to mutational studies	Up to K3
CLO-5	Analyse the problems related to population genetics	Up to K4

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	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

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	PO-6
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

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

Learning Outcome Based Education and Assessment (LOBE)
Blue Print – Genetics
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 K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
II	Skill Enhancement	23U2LSED2	Mushroom Cultivation	2	2	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	✓

Course Objectives

- To provide knowledge to the students on Mushroom life cycle, cultivation, production , disease management
- To enable the students to identify edible and poisonous mushroom
- To provide an insight knowledge on post-harvest technology

Unit	Description	Hours	K-level	CLO
I	Introduction: Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms.	6	2	1
II	Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry,	6	3	2
III	Life cycle of <i>Pleurotus</i> spp and <i>Agaricus</i> spp.	6	4	3
IV	Spawn production, growth media, spawn running and harvesting of mushrooms and marketing.	6	3	4
V	Diseases and post-harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases., Value added products	6	4	5

Books for Study

- Marimuthu T, Krishnamoorthy AS, Sivaprakasam K and Jayarajan R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University,
- Nita Bahl. 2002. Handbook on Mushroom 4th Edition. Oxford & IBH publishing Co., Pvt., Ltd., New Delhi.
- Suman. 2005. Mushroom Cultivation Processing and Uses. IBD Publishers and Distributors,

Books for Reference

- Sing. 2005. Modern Mushroom Cultivation, International Book Distributors, Dehradun.
- Sharma VP. 2006. Diseases and Pests of Mushrooms, M/s. IBD Publishers and Distributors, New Delhi.
- Tewari P and Kapoor SC. 1988. Mushroom cultivation, Mittal Publications New Delhi.

Web resources

- [PPP 221: Introduction to Mushrooms \(iasri.res.in\)](http://iasri.res.in)
- [TNAU Agritech Portal :: Mushroom](#)

Rationale for nature of the course

The course focuses on the Identification of edible mushroom and to gain knowledge on cultivation of different types of edible mushrooms .This course is focussed on self-employability for the students.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Collection of Edible mushroom,
- Preparing album for non- edible mushroom
- Spawn preparation,
- Compost formulation for mushroom cultivation
- Post-harvest processing of mushroom.

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving.

Course content designers

Dt N Kamaladhasan

Dr N Vidhyalakshmi

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Introduction: Morphology	2	Chalk and Talk, PPT Quiz, Test
	Types of Mushroom, identification of edible and poisonous mushroom,	2	
	Nutritive values, life cycle of common edible mushrooms.	2	
II	Mushroom cultivation.	2	Chalk and Talk, PPT Quiz, Test
	Prospects of mushroom cultivation	2	
	scope of Mushroom cultivation in small scale Industry.	2	
III	Life cycle of <i>Pleurotus</i> spp	3	Chalk and Talk, PPT Quiz, Test
	Life cycle of <i>Agaricus</i> spp.	3	
IV	Spawn production, growth media,	3	Chalk and Talk, PPT Quiz, Test
	spawn running and harvesting of mushrooms and marketing.	3	

V	Diseases and post-harvest technology Value added products	2	Chalk and Talk, PPT , group discussion, Quiz, Assignment
	Insect pests, nematodes, mites, viruses	2	
	fungal competitors and other important diseases.	2	

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe the structure and types of edible mushrooms	Up to K2
CLO-2	Illustrate the methods to cultivate edible mushrooms	Up to K3
CLO-3	Explain the life cycle of edible mushrooms	Up to K4
CLO-4	Illustrate the methods of spawn production and mushroom harvest	Up to K3
CLO-5	Explain the disease management and control in mushroom cultivation	Up to K4

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	3
CLO-2	3	2	3	3	3
CLO-3	3	2	3	3	3
CLO-4	3	2	3	3	3
CLO-5	3	2	3	3	3

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	PO-6
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

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

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Mushroom Cultivation
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 K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Skill Enhancement	23U2LSED3	Clinical Nutrition and Dietary Management	2	2	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	

Course Objectives

- To gain knowledge on balanced diet
- To enable the students to gain knowledge on food allergies and food tolerance
- To provide an insight knowledge dietary management

Unit	Description	Hours	K-level	CLO
I	Definition of Nutrition, Overview of Balanced diet, Collecting and analysing Nutritional information – Physical examination methods, Anthropometric measurements in Nutritional Assessment. Therapeutic diet- types of diet	6	2	1
II	Common food allergies, food intolerance – lactose intolerance. Cardiovascular diseases-atherosclerosis, and myocardial infarction, role of Sodium based foods in cardiac diseases, Foods that decreases LDL and increases HDL.-with lifestyle management	6	3	2
III	Bulimia and Anorexia Nervosa. Dietary management with reference to Constipation, Diarrhoea, Dehydration, Peptic Ulcer, Hepatitis, Gall bladder diseases and Renal failure.	6	4	3
IV	Dietary management with reference to Hypertension, Diabetes Mellitus, AIDS and Cancer, Surgery and Nutritional support, outline of Enteral Nutrition and Parenteral Nutrition.	6	3	4
V	Fevers (acute & chronic) -types, causes, clinical symptoms and dietary management; Dietary management with reference to tuberculosis, asthma, chronic bronchitis and emphysema.	6	4	5

Books for Study

1. Sumati R. Mudambi And M.V. Rajagopal 2006 . Fundamentals of Foods, Nutrition And Diet Therapy New Age International, Publishers
2. Swaminathan M. 2014. Handbook of Food and Nutrition. Bappco Publisher.
3. Srilakshmi B. 2017. Nutrition Science. 7th Edition, New age International Publisher

Books for Reference

1. Staci Nix McIntosh. 2016. William's Basic Nutrition and Diet Therapy. First South Asian Edition, Elsevier Publisher, 2016.
2. Packerpaugh. 2009. Nutrition essentials and diet therapy. 11th Edition, Saunders Publishers.
3. Stanley Davidson. 2010. Davidson's Principles and Practice of Medicine. 21st Edition, Elsevier Publishers.

Web resources

- [NPTEL :: Agriculture - NOC:Nutrition, Therapeutics and Health \(NM\)](#)

Rationale for nature of the course

The course focuses on various aspects of dietetics, assessment of nutritional needs, planning and implementation of therapeutic diets.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

To discuss about recent health and nutrition, to prepare posters related to the relationship between diet and the development of disease, to discuss about how the consumption of additives affects the health of an individual.

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr N Krithiga

Dr N Vidhyalakshmi

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Definition of Nutrition, Overview of Balanced diet,	2	Chalk and Talk, PPT Quiz, Test
	Collecting and analysing Nutritional information –	2	
	Physical examination, Anthropometric measurements, in Nutritional Assessment ,Therapeutic diet- types of diet	2	
II	Common food allergies, food intolerance – lactose intolerance.	2	Chalk and Talk, PPT Quiz, Test
	Cardiovascular diseases-atherosclerosis,	2	
	myocardial infarction, foods that increase LDL and HDL.	2	

III	Bulimia and Anorexia Nervosa.	2	Chalk and Talk, PPT Quiz, Test
	Dietary management with reference to Constipation, Diarrhoea, Dehydration, Peptic Ulcer,	2	
	Dietary management with reference to Hepatitis, Gall bladder diseases and Renal failure.	2	
IV	Dietary management with reference to Hypertension, Diabetes Mellitus, AIDS	2	Chalk and Talk, PPT Quiz, Test
	Dietary management with reference Cancer, Surgery and Nutritional support,	2	
	outline of Enteral Nutrition and Parenteral Nutrition	2	
V	Fevers (acute & chronic) -types, causes, clinical symptoms and dietary management; ,	2	Chalk and Talk, PPT group discussion, Test, Assignment
	Dietary management with reference to tuberculosis,	2	
	Dietary management with reference to asthma chronic bronchitis and emphysema.	2	

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe about balanced diets.	Up to K2
CLO-2	Illustrate about food allergies, food tolerance and diseases associated with food rich in LDLs	Up to K3
CLO-3	Explain about food disorders	Up to K4
CLO-4	Illustrate the various Dietary management in different diseased conditions	Up to K3
CLO-5	Explain the dietary management in fever.	Up to K4

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	3
CLO-2	3	2	3	3	3
CLO-3	3	2	3	3	3
CLO-4	3	2	3	3	3
CLO-5	3	2	3	3	3

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	PO-6
CLO-1	3	2	3	3	3	3
CLO-2	3	2	3	3	3	3
CLO-3	3	2	3	3	3	3
CLO-4	3	2	3	3	3	3
CLO-5	3	2	3	3	3	3

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

Learning Outcome Based Education and Assessment (LOBE)

Blue Print – Clinical Nutrition and Dietary Management

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 K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Core Practicals	23U2LCCP2	Major Practicals-II	3	3	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	

Course Objectives

- To make the students to solve the problems related to gene inheritance.
- To identify the various stages of mitosis and meiosis.

	Experiments
1	Verification of Mendelian law using beads
2	Mitotic stages of onion (<i>Allium cepa</i>) root tip
3	Meiotic stages of cockroach testes/ Flower bud
4	Giant chromosomes from Chironomus larvae/ Drosophila salivary glands
5	Identification of Barr bodies from buccal smear
6	Preparations of culture medium and culture of Drosophila – methods of maintenance
7	Identifications of mutants of Drosophila
8	Gene Mapping – Problem based
9	Human karyotyping (Demo)
10	Simple Mendelian traits in humans and pedigree analysis.
Spotters: Monohybrid cross, Dihybrid cross, Test cross, Complementary gene, Supplementary gene, Chromosome, Giant chromosome, Agaricus, Pleurotus, Balanced diet.	

Books for study

- Abhijit Dutta. 2011. Experimental Biology: A laboratory Manual. Narosa publications.
- Practical Manual on "Fundamentals of Genetics" (PBG-121). 2019, Edition: First Publisher: Odisha University of Agriculture & Technology. Editor: Kaushik Kumar Panigrahi

Course content designers

- Dr P Vimal
- Dr N Kamala Dhasan

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K –Level
CLO-1	Demonstrate the basic principles of important techniques in Molecular biology and Genetics.	Upto K2
CLO-2	Analyse the polytene chromosome of the organisms	Upto K3
CLO-3	Identify Barr bodies from buccal smear	Upto K4
CLO-4	Demonstrate the Preparations and maintenance of culture medium	Upto K3
CLO-5	Demonstrate Human karyotyping	Upto K4

Rationale for nature of the course

The course focuses on the students ability to solve the problems related to inheritance and identify the various stages in cell division.

Activities having direct bearing on Skill development /Employability /Entrepreneurship

- Individual experimental activity to the students.
- Analysis and interpretation of results.

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	3	3	3	3	2	3
CLO-2	3	3	3	3	2	3
CLO-3	3	3	3	3	2	3
CLO-4	3	3	3	3	2	3
CLO-5	3	3	3	3	2	3

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	3
CLO-2	3	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

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

DEPARTMENT OF BIOTECHNOLOGY				CLASS: II B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours /week	CIA	Ext	Total
III	Major Core	23L3LCCT3	Immunology and Immunotechnology	4	5	25	75	100

Nature of Course					
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 system
- Emphasize on the association between diseases progression and response of immune system.

Unit	Description	Hours	K-level	CLO
I	Introduction to Immunology. Cells involved in immune response. Primary and Secondary lymphoid organs – Thymus, Bone marrow, Lymph nodes and Spleen. Haematopoiesis – development of B and T lymphocytes. Types of immunity – Innate and acquired.	15	2	1
II	Antigen: Characteristics and types. Antibody – Structure, Types, Properties and their Biological Function. Production of antibodies- Hybridoma technology: Applications of Monoclonal antibodies in biomedical research.	15	3	2
III	The complement system and activation and regulation. Types – Classical, alternative and Lectin pathway. Biological function of C' proteins. Cytokines- Structure and Function. Vaccines – Types, Production and application.	15	4	3
IV	Hypersensitivity Reactions and Types. Major Histocompatibility Complex – MHC genes, MHC in immune responsiveness, Structure and function of Class I and Class II MHC molecules. HLA tissue typing.	15	3	4
V	Antigen – Antibody interactions, Immunodiffusion and Immuno electrophoresis. Principle and application of ELISA and RIA and Fluorescent antibody technique and Western Blotting. Purification of antibodies.	15	4	5

Books for Study

1. Kindt TJ, Osborne BA and Goldsby RA. 2006. Kuby Immunology. 6th Edition, W. H. Freeman and company.
2. Kannan I. 2010. Immunology. MJP Publishers.
3. Nandini Shetty. 1996, Immunology: Introductory Textbook – I. New Age International, New Delhi.

Books for Reference

1. Delves PJ, Martin SJ, Burton DR, Roitt IM. 2011. Roitt's Essential Immunology, 12th Edition, Wiley- Blackwell.
2. Travers J. 1997. Immunobiology-the immune system in health and disease. 3rd Edition. Current Biology Ltd. London.
3. Clark WR. 1991. The Experimental Foundations of Modern Immunology. 3rd Edition. John Wiley and Sons Inc.
4. Rose NR, Friedman H and Fahey JL. 1986. Manual of Clinical Laboratory Immunology. 3rd Edition. ASM.

Web resources

- <https://www.ncbi.nlm.nih.gov/books/NBK279395/>
- <https://med.stanford.edu/immunol/phd-program/ebook.html>
- https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall-2005/pages/Chalk_and_Talk,_PPT-notes/

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

- To prepare a poster for types of antigen and allergens,
- To perform immunodiffusion and agglutination
- .To prepare chart of vaccination schedule.

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

R Suguna

Dr P Vimal

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Introduction to Immunology. Cells involved in immune response..	5	Chalk and Talk, PPT, Quiz Test
	Primary and Secondary lymphoid organs – Thymus, Bone marrow, Lymph nodes and Spleen	5	
	Haematopoiesis – development of B and T lymphocytes. Types of immunity – Innate and acquired	5	
II	Antigen: Characteristics and types.	3	Chalk and Talk, PPT, Quiz Test
	Antibody – Structure, Types, Properties and their Biological Function.	5	
	Production of antibodies- Hybridoma technology:	4	
	Applications of Monoclonal antibodies in biomedical research	3	
III	The complement system and activation and regulation. Types – Classical, alternative and Lectin pathway. Biological function of C' proteins.	5	Chalk and Talk, PPT Quiz Test
	Cytokines- Structure and Function.	5	
	Vaccines – Types, Production and application.	5	
IV	Hypersensitivity Reactions and Types.	5	Chalk and Talk, PPT Quiz, Test
	Major Histocompatibility Complex – MHC genes, MHC in immune responsiveness	5	
	, Structure and function of Class I and Class II MHC molecules. HLA tissue typing.	5	
V	Antigen – Antibody interactions,	5	Chalk and Talk, PPT Quiz, assignments
	Immunodiffusion and Immuno electrophoresis. Principle and application of ELISA and RIA .	5	
	Fluorescent antibody technique and Western Blotting. Purification of antibodies	5	

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 K2
CLO-2	Illustrate the structure, properties and functions of immunoglobulin	Up to K3
CLO-3	Analyse the importance of MHC, and hypersensitivity reactions	Up to K4
CLO-4	Describe various complement system and vaccines.	Up to K3
CLO-5	Use the immunological concepts to understand the diagnostic techniques	Up to K4

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	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

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	PO-6
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

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

Learning Outcome Based Education and Assessment (LOBE)
Blue Print – Immunology and Immunotechnology
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 K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: II B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Skill Enhancement	23U3LSED4	Food and Bioprocess Technology	2	2	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	

Course Objectives

- To introduce the students about the bioprocess technology
- To train the students about microbial enzyme production by fermentation technology.
- To gain in-depth knowledge on Probiotics

Unit	Description	Hours	K-level	CLO
I	Introduction to Bioprocess Technology: History and Scope- Bioreactor: Design, parts and accessories, functions- Modes of Operation of fermenter – Batch & continuous - Types of reactors - Bubble column, Fluidized bed reactor, plug flow reactor.	6	2	1
II	Fermentation media design, sterilization and media requirement for industrial fermentation, Main parameters to be monitored and controlled in fermentation processes, aerobic and anaerobic fermentation processes. Development and scale up of bioreactors for production of biological products. Immobilization – Types of immobilization, various methods - Applications of immobilized enzyme technology.	6	3	2
III	Downstream processing: Cell disruption methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods. Enrichment operations: Membrane – based separations. Product finishing: precipitation/crystallization, mixing, dialysis, distillation and drying.	6	4	3
IV	Production of microbial enzymes (Amylase, protease and pectinase) applications, production of organic solvents (Ethanol, Methanol) – production of organic acids (Citric acid, Acetic acid) - Single cell protein production – Spirulina, Yeast, Actinomycetes protein. Beverages production – Beer and Wine.	6	3	4

V	Processing of Milk – Pasteurization and homogenization - Modifying milk composition – Production of milk products – Curd, cheese, yogurt, and flavoured milk. Bakery products – Bread making. Probiotics and Role of Food technology in bio- defense programs.	6	4	5

Books for Study

1. Shuler ML and Kargi F. 2008. Bioprocess engineering – Basic concepts. Pearson Education.
2. Srivastava ML. 2010. Fermentation Technology, Narosa Publications.
3. Doran PM. 2009. Bioprocess Engineering Principles. Academic Press Inc.,

Books for Reference

1. Peter F. Stanbury, Allan Whitaker, Stephen J. Hall. 2016. Principles of Fermentation Technology. 3rd Edn. Elsevier Science Ltd. Netherlands.
2. Peppler H. J. and Perlman. D. 2014. Microbial Technology. Vol. 1&2. 2nd Edn Academic Press. United States
3. Casida L. E. and John Jr. 2015. Industrial Microbiology. 2 th Edn Wiley and Sons Inc. United States

Web resources

- [NPTEL :: Biotechnology - NOC:Industrial Biotechnology](#)
- [e-PGPathshala \(infliibnet.ac.in\)](#)

Rationale for nature of the course

The discipline specific elective course focuses on the bioprocess technology, bioreactor design and fermentation technology in food processing

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Fermentation with yeast,
- Alcohol fermentation with fruit peel wastes,
- Probiotics analysis,
- Value added products with Spirulina.

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr N Krithiga

Dr N Vidhyalakshmi

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Introduction to Bioprocess Technology: History and Scope- Bioreactor: Design, parts and accessories, functions-	3	Chalk and Talk, PPT, Quiz Test
	Modes of Operation of fermenter – Batch & continuous - Types of reactors - Bubble column, Fluidized bed reactor, plug flow reactor.	3	
II	Fermentation media design, sterilization and media requirement for industrial fermentation,.	2	Chalk and Talk, PPT, Quiz Test
	Main parameters to be monitored and controlled in fermentation processes, aerobic and anaerobic fermentation processes. Development and scale up of bioreactors for production of biological products.	2	
	Immobilization – Types of immobilization, various methods - Applications of immobilized enzyme technology	2	
III	Downstream processing: Cell disruption methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques,	2	Chalk and Talk, PPT, Quiz Test
	Flocculation and sedimentation, centrifugation and filtration methods. Enrichment operations: Membrane – based separations.	2	
	Product finishing: precipitation/crystallization, mixing, dialysis, distillation and drying	2	
IV	Production of microbial enzymes (Amylase, protease and pectinase) applications, -	2	Chalk and Talk, PPT, Quiz Test
	production of organic solvents (Ethanol, Methanol) – production of organic acids (Citric acid, Acetic acid)	2	
	Single cell protein production – Spirulina, Yeast, Actinomycetes protein. Beverages production – Beer and Wine.	2	
V	Processing of Milk – Pasteurization and homogenization -.	2	Chalk and Talk, PPT, Quiz Assignment
	Modifying milk composition – Production of milk products – Curd, cheese, yogurt, and flavoured milk	2	
	Bakery products – Bread making. Probiotics and Role of Food technology in bio-defense programs.	2	

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe the historical perspective of bioprocess technology and types of bioreactors	Up to K2
CLO-2	Illustrate the methods of media preparation and upstream process	Up to K3
CLO-3	Explain the various methods of downstream processing	Up to K4
CLO-4	Illustrate various microbial fermentation products	Up to K3
CLO-5	Explain the milk processing and bakery products production	Up to K4

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	3
CLO-2	3	3	2	3	3
CLO-3	3	3	2	3	3
CLO-4	3	3	2	3	3
CLO-5	3	3	2	3	3

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	PO-6
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

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

Learning Outcome Based Education and Assessment (LOBE)
Blue Print Food and Bioprocess 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 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 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: II B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
III	Skill Enhancement	23U3LSED5	Vermitechnology	2	2	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	✓

Course Objectives

- To understand the role of microbes in increasing the soil fertility by the action of earthworms.
- To gain knowledge on the role of microbes in worms and in decomposition
- To study about Vermiculture products and their benefits in agriculture practice.

Unit	Description	Hours	K-level	CLO
I	Types, Collection and Preservation of earthworms - Types and basic characteristics of species suitable for vermicomposting; Role of earth worms in soil fertility, Biology of <i>Lampito maruitti</i> ; Collection and Preservation of Earthworms; Flow sheet for vermi technology.	6	2	1
II	Culturing techniques of earthworms and composting materials General method; Pot method; Wooden box method; Propagation; Factor affecting culturing of earthworm; Vermicomposting materials; Preliminary treatment of composting materials.	6	3	2
III	Small scale techniques of Vermicomposting - Indoor dual bin method; Bed method; Pit method; Heap method; Expandable worm tower assembly method; Hanging basket method; Physical, chemical and biological properties of vermicompost.	6	4	3
IV	Large scale techniques of Vermicomposting Outdoor dual bin; Raised cage; Dual pit; Commercial model; Trickling filter vermicomposting; Keep it simple and save plan.	6	3	4
V	Vermiwash and Economics - Chemical composition of vermiwash; Techniques of vermiwash production: Advantages of Vermicomposting; Prospects of vermi-culture as self-employment venture.	6	4	5

Books for Study

1. Ismail SS. 2005. The Earthworm book. 2nd Revised Edition. Other India Press.
2. Somani LL. 2008. Vermicomposting and Vermiwash. Agrotech Publishing Academy, Udaipur.
3. Talashilkar and Dosani. 2005. Earthworm in Agriculture. Agrobios (India), Jodhpur.

Books for Reference

1. National Institute of Industrial Research, (2010): The Complete Technology Book on Vermiculture and Vermicompost, Published by National Institute of Industrial Research, Delhi- India.
2. Sharma S. et .al, (2009) Earthworm and Vermitechnology –Review, Dynamic Soil and Dynamic Plant, Global Science Books.
3. Ranganathan LS. 2006. Vermibiotechnology - from soil health to human health-Agrobios, India.

Web resources

- [ORGANIC FARMING :: Special technologies :: Coir compost \(tnau.ac.in\)](http://tnau.ac.in)
- [Kumar Anand Research Paper-6.pdf \(vbu.ac.in\)](http://vbu.ac.in)

Rationale for nature of the course

The discipline specific elective course focuses on the entrepreneurial skill on the role of earthworm microbes in increasing the soil and benefits . Vermiculture products in agriculture practice

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- A visit to Vermicompost unit,
- Maintaining a model Vermicompost unit ,
- a project to test the effect of vermicompost on germination , chlorophyll content etc

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr P Vimal

Dr N Vidhyalakshmi

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Types, Collection and Preservation of earthworms - Types and basic characteristics of species suitable for vermicomposting;	2	Chalk and Talk, PPT, Quiz Test
	Role of earth worms in soil fertility,	2	
	Biology of Lampito maruitti; Collection and Preservation of Earthworms; Flow sheet for vermi technology	2	
II	Culturing techniques of earthworms and composting materials	2	Chalk and Talk, PPT, Quiz Test
	General method; Pot method; Wooden box method; Propagation;	2	
	Factor affecting culturing of earthworm; Vermicomposting materials; Preliminary treatment of composting materials	2	
III	Small scale techniques of Vermicomposting - Indoor dual bin method; Bed method; Pit method; Heap method;	2	Chalk and Talk, PPT, Quiz Test
	Expandable worm tower assembly method; Hanging basket method;	2	
	Physical, chemical and biological properties of vermicompost.	2	
IV	Large scale techniques of Vermicomposting Outdoor dual bin;;	2	Chalk and Talk, PPT, Quiz Test
	Raised cage; Dual pit	2	
	Commercial model; Trickling filter vermicomposting; Keep it simple and save plan	2	
V	Vermiwash and Economics - Chemical composition of vermiwash;	2	Chalk and Talk, PPT, Quiz Test Assignment
	Techniques of vermiwash production:	2	
	Advantages of Vermicomposting; Prospects of vermiculture as self-employment venture.	2	

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe about the Types, Collection and Preservation of earthworms	Up to K2
CLO-2	Illustrate culturing techniques of earthworms and composting materials	Up to K3
CLO-3	Explain the techniques of Vermicomposting	Up to K4
CLO-4	Illustrate large scale techniques of Vermicomposting	Up to K3
CLO-5	Explain about Vermiwash production	Up to K4

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	3
CLO-2	3	2	2	3	3
CLO-3	3	2	2	3	3
CLO-4	3	2	2	3	3
CLO-5	3	2	2	3	3

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	PO-6
CLO-1	3	3	2	3	3	3
CLO-2	3	3	2	3	3	3
CLO-3	3	3	2	3	3	3
CLO-4	3	3	2	3	3	3
CLO-5	3	3	2	3	3	3

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

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Vermitechnology 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 K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: II B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Core Practicals	23U3LCCP3	Major Practicals- III	3	3	25	75	100
Nature of Course								
Skill oriented		✓	Employability oriented		✓	Entrepreneurship oriented		

Course Objectives

- To separate serum and plasma
- To perform experiments with Immunodiffusion
- To understand the principle and procedure for blood grouping

	Experiments
1	Separation of Serum and Plasma
2	Double Immunodiffusion
3	Single Radial Immunodiffusion
4	ELISA – Demonstration
5	Handling of Laboratory animals - Demonstration
6	Blood grouping and Rh typing
7	WBC counting
8	RBC counting
9	Differential count
10	WIDAL Slide test
11	ASO test
12	Skin test - Demonstration
Spotters- Neutrophils, Macrophage, Spleen, lymph node, Ig G, Ig M, Lampito maruitti, Bioreactor, Downstream process, Spirulina	

Books for study

1. Talwar. 2006. Hand Book of Practical and Clinical Immunology, Vol. I, 2nd Edition, CBS.
2. Roy AK. 2019. Immunology Theory and Practical, Kalyani Publications.

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	Prepare the serum and plasma	K2
CLO-2	Experiment with diffusion techniques	K3
CLO-3	Distinguish various immune cells	K4
CLO-4	Experiment and interpret the results of Immunotechniques	K3
CLO-5	Identify the various antigens / allergens by skin test	K4

Rationale for nature of the course

The major core Practicals focuses on basic understanding on the methods and techniques in immunology

Activities having direct bearing on Skill development /Employability /Entrepreneurship

- Individual experimental activity to the students.
- Hands on training on 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	PO-6
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

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	3
CLO-2	3	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

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

DEPARTMENT OF BIOTECHNOLOGY				CLASS: II B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Core Course	23U4LCCT4	Genetic Engineering and rDNA Technology	4	4	25	75	100

Nature of Course					
Skill	✓	Employability oriented	✓	Entrepreneurship oriented	

Course Objectives

- To provide 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	Genetic Engineering – Introduction. Tools in recombinant DNA technology – recombinant DNA – cloning strategies (enzymes, vectors, host) – introduction of rDNA into host cells.	15	2	1
II	Identification of recombinants, selection and screening for Recombinants. DNA sequencing – Construction of Genomic DNA library and cDNA library), Chromosome walking. Human Genome Project. Polymerase Chain reaction- Methodology and its Types.	15	3	2
III	Gene transfer techniques – Viral mediated gene transfer, Selectable markers and reporter genes - Non viral mediated gene transfer - Physical methods: Microinjection - Electroporation - Particle Bombardment, Chemical methods: Calcium phosphate - DEAE dextran - Liposomes.	15	4	3
IV	Gene Expression – Expression system and their applications - protein based products – Protein engineering– production of protein from cloned genes. Site directed Mutagenesis, Restriction Fragment Length Polymorphism (RFLP).	15	3	4
V	Application of Recombinant DNA technology in medicine-tPA,Hepatitis B vaccine, industry- Insulin, hGH, -, agriculture – delaying of fruit ripening, viral resistant transgenic- NPV and r-DNA technology - merits and demerits.	15	4	5

Books for Study

1. Brown TA. 2015. Gene Cloning and DNA Analysis: An Introduction, 7th Edition, Wiley - Blackwell.
2. Nicholl D. 2008. An Introduction to Genetic Engineering, 3rd Edition, Cambridge University Press.
3. Old RW & Primrose SB. 2001. Principles of Gene Manipulation, 5th Edition, Blackwell Science.

Books for Reference

1. Clark DP and Pazdernik NJ. 2015. Biotechnology. 2nd Edition. Academic Cell.
2. Monika Jain. 2012. Recombinant DNA technology, First Edition, Alpha Science International.
3. Keya Chaudhuri. 2012. Recombinant DNA Technology. The Energy and Resources Institute, TERI.

Web resources

- <https://www.britannica.com/recombinant-DNA-technology>
- <https://www.le.ac.uk/recombinant-dna-and-genetic-techniques>

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

Preparing a cloning protocol for cloning a gene of interest, Restriction digestion and mapping, transformation and Blue-White selection. Experiment with PCR

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

R Suguna
N Krithiga

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Genetic Engineering – Introduction. Tools in recombinant DNA technology – recombinant DNA	5	Chalk and Talk, PPT Quiz, Test
	Cloning strategies (enzymes, vectors, host) –	5	
	introduction of rDNA into host cells.	5	
II	Identification of recombinants, selection and screening for Recombinants.)	5	Chalk and Talk, PPT Quiz, Test
	DNA sequencing – Construction of Genomic DNA library and cDNA library	5	
	Chromosome walking. Human Genome Project. Polymerase Chain reaction- Methodology and its Types.	5	
III	Gene transfer techniques – Viral mediated gene transfer,	5	Chalk and Talk, PPT Quiz, Test
	Selectable markers and reporter genes - Non viral mediated gene transfer	5	
	Physical methods: Microinjection - Electroporation - Particle Bombardment, Chemical methods: Calcium phosphate - DEAE dextran - Liposomes.	5	
IV	Gene Expression – Expression system and their applications - protein based products	5	Chalk and Talk, PPT Quiz, Test
	Protein engineering– production of protein from cloned genes.	5	
	Site directed Mutagenesis, Restriction Fragment Length Polymorphism (RFLP).	5	
V	Application of Recombinant DNA technology in medicine, tPA, Hepatitis B vaccine	5	Chalk and Talk, PPT Quiz, Group discussion Assignment
	Application of Recombinant DNA technology industry Insulin, hGH,	5	
	Application of Recombinant DNA technology in agriculture delaying of fruit ripening, viral resistant transgenic- NPV r-DNA technology - merits and demerits.	5	

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 K2
CLO-2	Illustrate the gene cloning strategies	Up to K3
CLO-3	Analyse the various gene transfer techniques	Up to K4
CLO-4	Relate site directed mutagenesis with protein engineering	Up to K3
CLO-5	Explain the various production of recombinant products	Up to K4

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	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

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	PO-6
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

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

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Genetic Engineering and rDNA 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 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 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: II B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	SEC	23U4LSED6	Poultry Science and Management	2	2	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	✓

Course Objectives

- To understand the domestication of fowls, techniques of rearing and management of various breed.
- To acquire knowledge on the diseases of poultry and the prophylactic measures.

Unit	Description	Hours	K-level	CLO
I	External features of fowls – skeletal system – digestive system – endocrine system – feathers – Respiratory system – reproductive system. Genetics of fowls: Breeds of fowls – inheritance of morphological characters (List of autosomal and sex linked character – breeding methods – systems of breeding – modern method of breeding.	6	2	1
II	Poultry industry in India– choosing commercial layers and broilers – Poultry housing – deep litter and cage system-merits and demerits.	6	3	2
III	Practical aspects of chick rearing –brooding management-grower and layers – management of broilers – lighting, summer winter management – debunking.	6	4	3
IV	Poultry Nutrition: Energy – protein and aminoacids – Vitamins – essential organic elements – Non – nutrition feed additives – feed stuffs for poultry – feed formation.	6	3	4
V	Diseases: Viral, bacterial, fungal and parasitic disease. Vaccines and vaccination programmes.	6	4	5

Books for Study

- Gopalakrishnan CA and Mohan Lal GM. 1997. Livestock and Poultry enterprises for rural development. Vikash, New Delhi.
- Gnaanamani MR. 1998 Modern aspects of commercial poultry keeping, Giri.
- Banarjee GC. 1992. Poultry, Oxford and IBH, New Delhi.

Books for Reference

1. Chauhan HVS and Roy S. 1996. Poultry diseases, diagnosis and treatment New Age International.
2. John William. 2003. Poultry for sustainable Food Production and livelihood. Loyola Publication, Chennai.

Web resources

[Poultry :: Chicken :: System Of Poultry Rearing \(tnau.ac.in\)](http://tnau.ac.in)
[eGyanKosh: OLP-001 Introduction to Poultry Farming](#)

Rationale for nature of the course

The discipline specific course Poultry Science and Management focuses on the types of fowls, rearing and disease management that enables the student to be an Entrepreneur

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- A visit to Poultry unit,
- Preparing a chart on poultry nutrition, disease and pathogen .

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr P Vimal

Dr N Kamaladhasan

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	External features of fowls – skeletal system – digestive system – endocrine system – feathers – Respiratory system – reproductive system.	2	Chalk and Talk, PPT Test
	Genetics of fowls: Breeds of fowls – inheritance of morphological characters (List of autosomal and sex linked character	2	
	breeding methods – systems of breeding – modern method of breeding.	2	
II	Poultry industry in India	1	Chalk and Talk, PPT Test
	choosing commercial layers and broilers	2	
	Poultry housing – deep litter and cage system-merits and demerits.	3	

III	Practical aspects of chick rearing –brooding management-grower and layers	3	Chalk and Talk, PPT Test
	Management of broilers – lighting, summer winter management – debunking.	3	
IV	Poultry Nutrition: Energy – protein and aminoacids – Vitamins – essential organic elements	3	Chalk and Talk, PPT Test
	Non – nutrition feed additives – feed stuffs for poultry – feed formation.	3	
V	Diseases: Viral, bacterial, fungal and parasitic disease.	3	Chalk and Talk, PPT Assignment
	Vaccines and vaccination programmes	3	Chalk and Talk, PPT Assignment

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe about the morphology and genetics of fowls breed	Up to K2
CLO-2	Illustrate the poultry housing and cage systems	Up to K3
CLO-3	Explain about the practical aspects of chick rearing	Up to K4
CLO-4	Illustrate about poultry nutrition and Non – nutrition feed additives	Up to K3
CLO-5	Explain about poultry disease control and management	Up to K4

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	3
CLO-2	3	2	2	3	3
CLO-3	3	2	2	3	3
CLO-4	3	2	2	3	3
CLO-5	3	2	2	3	3

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	2	2	3	3
CLO-2	3	2	2	3	3
CLO-3	3	2	2	3	3
CLO-4	3	2	2	3	3
CLO-5	3	2	2	3	3

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

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Poultry Science and Management

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 K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
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(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	
K2	5	6	10	10	31	25.83	42%
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 BIOTECHNOLOGY				CLASS: II B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	SEC	23U4LSED7	Aquaculture	2	2	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	✓

Course Objectives

- To gain knowledge on the characteristics of cultivable fishes
- To learn about methods of composite fish culture
- To get in-depth knowledge on applied aquaculture

Unit	Description	Hours	K-level	CLO
I	Aquaculture-Global scenario, Origins and growth of aquaculture, Present status in India and Tamil Nadu; Fish pond construction-site selection; types of ponds, water quality analyses, liming and fertilization, morphology and commercial characteristics of cultivable fishes, culture practice, predator fishes, weed fishes control, Sources of pollution, Environmental impacts.	6	2	1
II	Fin fish culture - Composite fish culture (Indian Major Carps and Murrels); Sewage fed fish culture and integrated fish culture, Marine water fish culture. Shellfish and seaweed culture - Culture of marine prawns, edible and pearl oysters, adaptive management; Seaweeds- types and their culture practices.	6	3	2
III	Live feed organisms – Artemia and rotifers culture; Fish feed - types, formulation and preparation, techniques, Consequences of artificial feeding; Natural, supplementary and artificial breeding; Breeding – Bundh breeding and induced breeding; rearing of hatchlings, fry and fingerlings.	6	4	3
IV	Fungus infections. Protozoan diseases. Worm diseases. Non parasitic diseases. Transport of fish seed and Brood fish. Causes of mortality in transport. Methods for packaging and transport. Use of chemicals in live fish transport. Anesthetic drugs. Antiseptics and Antibiotics.	6	3	4
V	Applied aquaculture: Identification of cultivable fish species; Morphometry of pond (Enclosed rectangular method/Shore length/ shore area and shore line development).Fishing technology (crafts and gears). Home aquarium and agency involved in aquaculture.	6	4	5

Books for Study

1. Biswas K P. 2000. Prevention and control of fish and prawn diseases. Narendra Publishing
2. Hute M and Kahn H. 2000. Textbook of fish culture, Blackwell Scientific Publication,
3. Ninawe AS and Khadkar GD. 2009. Nutrition in Aquaculture, First Edition, Narendra Publishing House, New Delhi.

Books for Reference

1. Jameson JD and Santhanam R. 1996, Manual of ornamental fishes and farming, Technologies.
2. Jhingran, VG. 1997. Fish and Fisheries of India. Hindustan Publishers, New Delhi.
3. Srinivasulu M, Reddy KRS, Rao S. 1999. Text book of Aquaculture, Discovery Publishing House, New Delhi.

Web resources

- [Course: Principle of Aquaculture \(1+1\) \(iasri.res.in\)](http://iasri.res.in)

Rationale for nature of the course

The Discipline specific elective course Aquaculture focuses on the students ability to be a job provider. The course includes the topics on aquaculture in global scenario, fish culture, fish feeds and disease management in aquaculture.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Visit to a fish farm
- Maintaining ornamental fish

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr P Vimal

Dr N Vidhyalakshmi

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Aquaculture-Global scenario, Origins and growth of aquaculture, Present status in India and Tamil Nadu; Fish pond construction- site selection; types of ponds, water quality analyses, liming and fertilization, morphology	3	Chalk and Talk, PPT, Quiz Test
	Commercial characteristics of cultivable fishes, culture practice, predator fishes, weed fishes control, Sources of pollution, Environmental impacts.	3	
II	Fin fish culture - Composite fish culture (Indian Major Carps and Murrels); Sewage fed fish culture and integrated fish culture, Marine water fish culture.	3	Chalk and Talk, PPT, Quiz Test
	Shellfish and seaweed culture - Culture of marine prawns, edible and pearl oysters, adaptive management; Seaweeds- types and their culture practices.	3	
III	Live feed organisms – Artemia and rotifers culture; Fish feed - types, formulation and preparation, techniques, Consequences of artificial feeding;	3	Chalk and Talk, PPT, Quiz Test
	Natural, supplementary and artificial breeding; Breeding – Bundh breeding and induced breeding; rearing of hatchlings, fry and fingerlings.	3	
IV	Fungus infections. Protozoan diseases. Worm diseases. Non parasitic diseases. Transport of fish seed and Brood fish. Causes of mortality in transport.	4	Chalk and Talk, PPT, Quiz Test
	Methods for packaging and transport. Use of chemicals in live fish transport. Anesthetic drugs. Antiseptics and Antibiotics.	2	
V	Applied aquaculture: Identification of cultivable fish species; Morphometry of pond (Enclosed rectangular method/Shore length/ shore area and shore line development).	4	Chalk and Talk, PPT, Quiz Assignment
	Fishing technology (crafts and gears). Home aquarium and agency involved in aquaculture.	2	

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe about the requirements for aquaculture	Up to K2
CLO-2	Illustrate the various composite culture	Up to K3
CLO-3	Explain about the live feeds for aquaculture	Up to K4
CLO-4	Illustrate about infectious diseases in fishes and ways to control it	Up to K3
CLO-5	Explain about fishing technology and home aquarium	Up to K4

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	3
CLO-2	3	2	2	3	3
CLO-3	3	2	2	3	3
CLO-4	3	2	2	3	3
CLO-5	3	2	2	3	3

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	2	2	3	3
CLO-2	3	2	2	3	3
CLO-3	3	2	2	3	3
CLO-4	3	2	2	3	3
CLO-5	3	2	2	3	3

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

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Aquaculture 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 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 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: II B.SC BIOTECHNOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major Practical	23U4LCCP4	Major Practical-IV	3	3	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	

Course Objectives

- To make the students to solve the problems related to gene inheritance.
- To identify the various stages of mitosis and meiosis.

	Experiments
1	Isolation of genomic DNA
2	Isolation of RNA
3	Isolation of plasmid DNA
4	Restriction Digestion of DNA
5	Production of competent cells for transformation
6	Bacterial transformation
7	PCR (Demonstration)
8	Restriction Fragment Length Polymorphism (DEMO)
Spotters Restriction enzyme, Ligase, pBR322, pUC18, Electroporation, Microinjection, Carps , Murrels,	

Books for study

- Vennison SJ. 2009. Laboratory Manual for Genetic Engineering, First Edition. PHI Publications
- S Rajan , R Selvi Christy, Experimental Procedures in Life Sciences, 2018,CBS Publishers

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	Demonstrate genomic DNA isolation	K2
CLO-2	Experiment with RNA	K3
CLO-3	Analyze the restriction digestion patterns	K4
CLO-4	Experiment with bacterial cell transformation	K3
CLO-5	Analyze and interpret the PCR products	K4

Rationale for nature of the course

The course focuses on basic techniques in rDNA technology, upon completion of the course the students would gain knowledge on the various strategies of gene cloning .

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	PO-6
CLO-1	3	2	2	3	3	3
CLO-2	3	2	2	3	3	3
CLO-3	3	2	2	3	3	3
CLO-4	3	2	2	3	3	3
CLO-5	3	2	2	3	3	3

Mapping of Course outcomes with Program specific Outcomes

CO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	3	3
CLO-2	3	2	2	3	3
CLO-3	3	2	2	3	3
CLO-4	3	2	2	3	3
CLO-5	3	2	2	3	3

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

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.SC. MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Generic Elective - 1 (EC1)	23U1LGET1	Basic and Clinical Biochemistry	4	4	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	

Course Objectives

- To attain thorough knowledge on carbohydrates and lipids, their characteristic properties
- To explain the biological activity of amino acids and proteins.
- To identify the metabolic errors in enzymes of carbohydrates and lipids.

Unit	Description	Hours	K-level	CLO
I	Biomolecules -Carbohydrate – General properties, function, structure, classification– monosaccharides (Glucose, Fructose, Galactose), Oligoaccharides (Sucrose, Maltose, Lactose) and polysaccharides (Starch, Glycogen,) and biological significance. Lipids – General properties, functions, structure, classification (Simple, Derived and Complex), Cholesterol, LDL, HDL – biological significance.	12	2	1
II	Biomolecules - Amino acids – General properties, functions, structure, classification and biological significance. Proteins– General structure, Properties, functions, classification and biological significance.	12	3	2
III	Disorders of Metabolism: Disorders of carbohydrate metabolism: diabetes mellitus, ketoacidosis, hypoglycemia, glycogen storage diseases, galactosemia and lactose intolerance. Disorders of lipid metabolism: hyperlipidemia, hyperlipoproteinemia, hypercholesterolemia, hypertriglyceridemia, sphingolipidosis.	12	4	3
IV	Disorders of Metabolism: Disorders of amino acid metabolism: alkaptonuria, phenylketonuria, phenylalaninemia, homocystineuria, tyrosinemia, aminoacidurias.	12	3	4

V	Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase.	12	4	5

Books for Study

1. Satyanarayana U. and Chakrapani U. 2014. Biochemistry, 4th Edition, Made Simple Publisher.
2. Jain JL, Sunjay Jain and Nitin Jain. 2016. Fundamentals of Biochemistry, 7th Edition, S. Chand Company.
3. Vasudevan DM, Sreekumari S and Vaidyanathan K. 2019. Textbook of Biochemistry for Medical Students. Jaypee Brothers Medical Publishers

Books for Reference

1. Amit Kessel & Nir Ben-Tal. 2018. Introduction to Proteins: structure, function and motion. 2nd Edition, Chapman and Hall.
2. Nelson DL and Cox MM. 2017. Lehninger Principles of Biochemistry, 7th Edition W.H. Freeman and Co., NY.
3. Voet D, Voet J, Pratt C. 2016. Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, Wiley.

Web resources

<https://www.abebooks.com › plp>
<https://kau.in/document/laboratory-manual-biochemistry>
<https://metacyc.org>

Rationale for nature of the course

The course focuses on the topics related to basic and clinical biochemistry. Upon completion of the course the students will be able to explain and interpret the results of biochemical analysis.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Case study about disorders of metabolism,
- Poster making about lipid profile,
- Group discussion about various organ function test.

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr P Vimal
 Dr N Vidhyalakshmi

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Biomolecules -Carbohydrate – General properties, function, structure, classification– monosaccharides (Glucose, Fructose, Galactose), Oligoaccharides (Sucrose, Maltose, Lactose) and polysaccharides (Starch, Glycogen,) and biological significance.	6	Chalk and Talk, Quiz, PPT Test
	Lipids – General properties, functions, structure, classification (Simple, Derived and Complex), Cholesterol, LDL, HDL – biological significance.	6	
II	Biomolecules - Amino acids – General properties, functions, structure, classification and biological significance.	8	Chalk and Talk, Quiz, PPT Test
	Proteins– General structure, Properties, functions, classification and biological significance.	4	
III	Disorders of Metabolism: Disorders of carbohydrate metabolism: diabetes mellitus, ketoacidosis, hypoglycemia, glycogen storage diseases, galactosemia and lactose intolerance.	6	Chalk and Talk, Quiz, PPT Test
	Disorders of lipid metabolism: hyperlipidemia, hyperlipoproteinemia, hypercholesterolemia, hypertriglyceridemia, sphingolipidosis.	6	
IV	Disorders of Metabolism: Disorders of amino acid metabolism: alkaptonuria, phenylketonuria, phenylalaninemia	6	Chalk and Talk, Quiz,PPT Test
	Disorders of Metabolism: Disorders of amino acid metabolism: homocystineuria, tyrosinemia, aminoacidurias.	6	
V	Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions.	6	Chalk and Talk, PPT Assignment
	Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase.	6	Chalk and Talk, PPT Assignment

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe about the biochemistry of carbohydrates and lipids	Up to K2
CLO-2	Illustrate the structure and functions of amino acid and proteins	Up to K3
CLO-3	Explain about the disorders of carbohydrate and lipid metabolism	Up to K4
CLO-4	Illustrate about the disorders of amino acid metabolism	Up to K3
CLO-5	Explain about biochemical tests of organ function tests	Up to K4

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	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

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	PO-6
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

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

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Basic and Clinical Biochemistry
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 K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.SC. MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Generic Elective - 1 (EC1-P)	23U1LGEP1	Allied Practical-I	2	2	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	

Course Objectives

- To gain knowledge on biochemical tests.
- To analyse and interpret the results of biochemical tests.

	Experiments
1	Preparation of plasma and serum
2	Qualitative estimation of carbohydrates.
3	Qualitative estimation of Proteins.
4	Qualitative estimation of lipids.
5	Quantitative estimation of Glucose.
6	Quantitative estimation of Protein.
7	Estimation of Blood Glucose.
8	Estimation of cholesterol
9	Assay of SGOT/SGPT.
Spotters Glucose, Glycosidic bond, Amino acid Peptide bond, Triglyceride, Molisch reagent, Ninhydrin, starch, glycogen	

Books for study

- Jayaraman J. 2011. Laboratory Manual in Biochemistry. New Age International Pvt. Ltd.
- Sadasivam S and Manickam A. Biochemical methods. 2009. New Age International Publishers
- S Rajan , R Selvi Christy, Experimental Procedures in Life Sciences, 2018,CBS Publishers

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	Associate the experimental results with identification of carbohydrates	K2
CLO-2	Analyse protein and lipid samples and interpret the results.	K3
CLO-3	Experiment with biochemical methods.	K4
CLO-4	Demonstrate biochemical analysis	K3
CLO-5	Apply basic principles of chemistry to biological systems.	K4

Rationale for nature of the course

The course focuses on the experiments with biomolecules. Upon completion of the course the students will be able to interpret the biochemical test of clinical samples.

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	PO-6
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

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	3
CLO-2	3	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

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

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.SC. MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
II	Generic Elective - 2 (EC2)	23U2LGET2	Clinical Laboratory Technology	4	4	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	

Course Objectives

- To understand the basic clinical laboratory practices
- To gain knowledge on biological specimen collection
- To gain knowledge on Quality Standards in Health Laboratories

Unit	Description	Hours	K-level	CLO
I	Introduction to Clinical Laboratory Science: Basic laboratory principles - Code of conduct for medical laboratory personnel - Organization of clinical laboratory and role of medical laboratory technician - Safety measures. Assessment of a patient and brief history of collection. Maintenance of Hygiene & Infection Control Practices.	6	2	1
II	Specimen collection and processing - Blood, urine, stool, sputum CSF, amniotic fluid and bile. Separation of serum and plasma, Handling of specimens for testing, preservation of specimens, transport of specimens and factors affecting the clinical results.	6	3	2
III	Introduction to histopathology -Methods of examination of tissues and cells, Fixation of tissues: Classification and properties of fixatives. Tissue processing - Collection of specimens, Labeling and fixation, Dehydration, Clearing, Impregnation, Embedding - Paraffin block making, Section Cutting, Microtomes – types and mounting of sections.	6	4	3
IV	Introduction to Haematology - Laboratory methods used in the investigation of coagulation disorders - coagulation tests, Routine coagulation tests, (prothrombin time, plasma recalcification time, partial thromboplastin time, activated partial thromboplastin time, thrombin time), Laboratory diagnosis of bleeding disorders. Estimation of fibrinogen, Assay of coagulation factors.	6	3	4

V	Quality Standards in Health Laboratories – Development and implementation of standards, Accreditation Boards –NABL, ISO, CAP, COLA, Performing quality assessment - pre-analytical, analytical, and post-analytical phases of testing.	6	4	5

Books for Study

1. Mukharji KL. 2000. Medical Laboratory Techniques, Vol - I, II & III, 5th Edition. Tata McGraw Hill.
2. Ochei A, Kolhatkar. A. 2000. Medical Laboratory Science: Theory and Practice, McGraw Hill Education.
3. Ramnik Sood. 2015. Concise Book of Medical Laboratory Technology: Methods and Interpretation, 2nd Edition, Jaypee Brothers Medical Publishers.

Books for Reference

1. Rutherford BH, Gradwohl AC, Jarett SL. Gradwohls. 2000. Clinical Laboratory Methods and Diagnosis, Vol-I, 8th Edition, Mosby.
2. Baker FJ, Silvertown RE, and Pallister J. 1998. An Introduction to Medical Laboratory Technology, 7th Edition, CBS Publishers and Distributors Pvt. Ltd.
3. Godkar. 2021. Textbook of Medical Laboratory Technology, 3rd Edition, Bhalani Publishing

Web resources

- <https://www.pdfdrive.com › wintrobess-clinical-hematology>
- <https://vlab.amrita.edu/index.php?sub=3&brch=272>
- <https://nptel.ac.in/courses/102105087>

Rationale for nature of the course

The course focuses on clinical laboratory practices and methods of biological sample analysis. Upon completion of the course the students would have gained knowledge to get placed in a clinical laboratory.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- A presentation about clinical test associated with a disease
- Analysis and interpretation of biochemical test with relevance to disease

Pedagogy

The teaching methods may include Chalk and Talk, PPT, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course content designers

Dr P Vimal

Dr N Kamala Dhasan

COURSE SCHEDULE

Unit	Description	Hours	Mode
I	Basic laboratory principles - Code of conduct for medical laboratory personnel -Organization of clinical laboratory and role of medical laboratory technician .	6	Chalk and Talk, Quiz, PPT Test
	Safety measures. Assessment of a patient and brief history of collection. Maintenance of Hygiene & Infection Control Practices.	6	
II	Blood, urine, stool, sputum CSF, amniotic fluid and bile. Separation of serum and plasma,	6	Chalk and Talk, Quiz, PPT Test
	Handling of specimens for testing, preservation of specimens, transport of specimens and factors affecting the clinical results.	6	
III	Methods of examination of tissues and cells, Fixation of tissues: Classification and properties of fixatives.	6	Chalk and Talk, Quiz, PPT Test
	Tissue processing - Collection of specimens, Labeling and fixation, Dehydration, Clearing, Impregnation, Embedding - Paraffin block making, Section Cutting, Microtomes – types and mounting of sections.	6	
IV	Laboratory methods used in the investigation of coagulation disorders - coagulation tests , Routine coagulation tests, (prothrombin time , plasma recalcification time, partial thromboplastin time , activated partial thromboplastin time, thrombin time),	8	Chalk and Talk, Quiz, PPT Test
	Laboratory diagnosis of bleeding disorders. Estimation of fibrinogen, Assay of coagulation factors.	4	
V	Development and implementation of standards, Accreditation Boards –NABL, ISO, CAP, COLA,	6	Chalk and Talk, PPT Quiz, Assignments
	Performing quality assessment - pre-analytical, analytical, and post-analytical phases of testing.	6	

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Describe about the practices in clinical laboratories	Up to K2
CLO-2	Illustrate the biological samples collection and processing	Up to K3
CLO-3	Explain about the methods of examination of tissues and cells	Up to K4
CLO-4	Illustrate about techniques in haematology	Up to K3
CLO-5	Explain about the Quality Standards in Health Laboratories	Up to K4

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	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

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	PO-6
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

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

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Clinical Laboratory 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 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 (K3&K3)	1(K4)
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(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%

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.SC. MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Generic Elective - 1 (EC2-P)	23U2LGEP2	Allied Practical-II	2	2	25	75	100

Nature of Course					
Skill oriented	✓	Employability oriented	✓	Entrepreneurship oriented	

Course Objectives

- To make the students to solve the problems related to gene inheritance.
- To identify the various stages of mitosis and meiosis.

	Experiments
1	Collection of blood sample, separation of serum and plasma
2	Total and Differential count
3	Erythrocyte Sedimentation Rate (ESR)
4	Estimation of serum cholesterol
5	Isolation of microbes from throat (using swab)
6	Enumeration of bacteria using colony counter
7	Physical and chemical analysis of urine
8	WIDAL test
Spotters: Hemoglobinometer, RBC, WBC, NABL, ISO, Microtome, Pro thrombin time.	

Books for study

- Sood, R, 1999, Medical Laboratory Technology – methods and interpretations, Fifth edition, Jaypee, New Delhi.
- Mukherjee, L.K. 1988, Medical Laboratory Technology, Hill Publishing Ltd., New Delhi.
- Connie R. Mahon. Diane G. Tice. 2006. Clinical Laboratory Immunology. 8th edition. Pearson Prentice Hall.

Course content designers

Dr P Vimal

Dr N Kamaladhasan

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K –Level
CLO-1	Associate the sample collection with analysis	Up to K2
CLO-2	Analyse the cellular components in blood	Up to K3
CLO-3	Experiment with biochemical methods.	Up to K4
CLO-4	Demonstrate microbiological analysis	Up to K3
CLO-5	Apply basic principles of biochemistry to biological systems.	Up to K4

Rationale for nature of the course

The course focuses on experiments with biomolecules and its interpretation with relevant to biological samples.

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	PO-6
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	

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	3
CLO-2	3	3	3	3	3
CLO-3	3	3	3	3	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	3	3

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

DEPARTMENT OF BIOTECHNOLOGY					CLASS: II B.Sc. Biotechnology			
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
III	Add on	23U3LAD01	Forensic Biotechnology	2	2	50	50	100

Course Objectives

- To gain insight into Forensic Biotechnology
- To gain knowledge on various investigation protocols
- To gain knowledge on the use of molecular approaches to forensic investigations

Unit	Description	Hours	K-level	CLO
I	Definition and scope of Forensic Biotechnology, History and development, Forensic genetics, Forensic agriculture.	6	2	1
II	Crime scene investigation; collection, preservation, packing and forwarding of physical and trace evidence. Questioned documents – identification of handwriting, signature and detection of forgery.	6	3	2
III	Serology - Fresh blood grouping and typing, stains of bloods. Identification of blood stains, collection and storage of allied body fluids (semen, saliva and blood). Case studies.	6	4	3
IV	PCR, RFLP, AFLP, Microscopy (Electron, Fluorescent) and Chromatography (Paper, TLC & HPLC) in forensic investigation.	6	3	4
V	DNA Profiling, Isolation of DNA from blood samples, DNA testing in cases of disputed paternity and maternity.	6	4	5

Books for Study

1. Nageshkumar GR. 2013. Textbook of Forensic Medicine & Toxicology, Jaypee.
2. Narayan Reddy KS and Murty OP. 2017. The Essentials of Forensic Medicine & Toxicology, 35th Edition, Jaypee.
3. Jim Fraser.2010. Forensic Science: A very short introduction, Oxford University Press.

DEPARTMENT OF BIOTECHNOLOGY					CLASS: II B.Sc. Biotechnology			
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Add on	23U4LAD02	Herbal Medicine	2	2	50	50	100

Course Objectives

- To gain knowledge about the identification of medicinal plants
- To identify and understand the effects of plant chemical constituents on humans
- To understand clearly about the reliable information about medicinal plants and herbal supplements
- To demonstrate understanding of the importance of medicinal plants

Unit	Description	Hours
I	Ethnomedicine – definition, history and its scope – Inter disciplinary approaches in ethnobotany – Collection of ethnic information.	6
II	Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins).	6
III	Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – <i>Aegle marmelos</i> , <i>Ficus benghalensis</i> , <i>Curcuma domestica</i> , <i>Cynodon dactylon</i> and <i>Sesamum indicum</i> .	6
IV	Traditional knowledge and utility of some medicinal plants in Tamil Nadu – <i>Solanum trilobatum</i> , <i>Cardiospermum halicacabum</i> , <i>Vitex negundo</i> , <i>Adathoda vasica</i> , <i>Azadirachta indica</i> , <i>Gloriosa superba</i> , <i>Eclipta alba</i> , <i>Aristolochia indica</i> and <i>Phyllanthus fraternus</i> .	6
V	Plants in day today life - <i>Ocimum sanctum</i> , <i>Centella asiatica</i> , <i>Cassia auriculata</i> , <i>Aloe vera</i> . Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and Vegetables - Greens (<i>Moringa</i> , <i>Solanum nigrum</i> , Cabbage).	6

Books for Study

1. Sinha RK & Shweta Sinha. 2001. Ethnobiology. Surabhe Publications.
2. Pal DC & S.K. Jain Naya Prakash SK. 1998. Tribal medicine, Bidhan Sarani, Calcutta.
3. Jain SK. 2001. Contribution to Indian Ethnobotany – S.K. Jain, 3rd edition, Scientific James Green. 2000. The Herbal Medicine-Maker's Handbook: A Home Manual

DEPARTMENT OF BIOTECHNOLOGY					CLASS: II B.Sc. Biotechnology			
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
IV	Self study	23U4LSS1	Good Laboratory Practices	2	-	50	50	100

Course Objectives

- To Understand the GLP Principles
- To Prepare GLP Implementation Plan

Unit	Description	Hours
I	Biotechnology lab organization - Types of labs associated with Biotechnology (General lab, microbial culture lab, plant tissue culture lab, Fermentation lab, computational stimulation lab), Types of Chemical (Analytical grade, molecular grade) and its various arrangement (Arrangement of basic chemicals, solvent, acid and base, fine chemicals like dyes, protein and enzyme storage units), Physical chemical characteristics: hygroscopic, corrosive, volatile properties; Fire and explosion hazard data, Health hazards (how to use UV-illuminator), Fumigation technique.	6
II	Lab ethics - Regulatory affairs: Methods and types of documentation (pre-lab writes, result recording and post lab report: interpretation of result), Dilution factor calculation, Molarity, %, dilution of concentrated solution, metric units (kg to gms and vice -versa).	6
III	Instrument calibration and importance - Principles, use and maintenance of laboratory instruments like Autoclave, hot air oven, Incubators, Water bath, Refrigerator, Centrifuge, Calorimeter, pH meter, Haemocytometer, Microtome, Electronic balances, Bio safety cabinets. SOP preparation for instrumentation	6
IV	GLP & Biotechnology Industry standards - Good Laboratory guidelines, Elements of GLP, Standard Operating Procedures and its importance, Quality Assurance & Quality control, Internal audit basics, ISO, BIS and HACCP standards.	6
V	Types of wastes and safe disposal methods - Definition of waste, types of waste: Biological and chemical waste, methods of Safe Disposal of biological and chemical waste: treatment methods of Ethidium Bromide solutions, Electrophoresis Gels, Contaminated Gloves, debris, Wastes containing sodium azide, Silver staining solutions, Perchloric acid, Nanoparticle wastes, Spill management, Awareness and training for personnel.	6

Books for Study

- WHO training manual on Good Laboratory Practices, 2nd Edition.
- Milton A. Anderson GLP Essentials: A Concise Guide to Good Laboratory Practice, Second Edition 2nd Edition, Published by CRC press.



The Madura College (Autonomous), Madurai – 625 011

Department of BIOTECHNOLOGY

UG Programme % of Syllabus Revision

SEM	Course Code	Title of the Course	Hours	Credits	Nature of Course(Employability/ Entrepreneurship/ Skill Development)			Scope of Focus (Local / National / Global developmental needs)			% of Syllabus Revision/New
					Empl	Ent	Skill	Local	National	Global	
I	23U1LCCT1	Cell and Molecular Developmental Biology	5	5			✓		✓	✓	New
	23U1LCCP1	Major Practicals-I	3	3			✓	✓	✓		New
	23U1LSED1	Food Chemistry	2	2	✓	✓	✓	✓	✓	✓	New
	23U1LFCT1	Basics of Biotechnology	2	2			✓	✓	✓	✓	--
II	23U2LCCT2	Genetics	5	5	✓		✓		✓	✓	45
	23U2LCCP2	Major Practicals-II	3	3	✓		✓	✓	✓	✓	New
	23U2LSED2	Mushroom Cultivation	2	2	✓	✓	✓	✓	✓		New
	23U2LSED3	Clinical Nutrition & Dietary Management	2	2	✓	✓	✓	✓	✓		New
III	23U3LCCT3	Immunology and Immunotechnology	4	4	✓		✓	✓	✓	✓	29
	23U3LCCP3	Major Practicals-III	3	3	✓		✓	✓	✓	✓	New
	23U3LSED4	Food and Bioprocess Technology	2	2	✓	✓	✓	✓	✓	✓	New
	23U3LSED5	Vermitechnology	2	2	✓	✓	✓	✓	✓		New

IV	23U4LCCT2	Genetic Engineering and rDNA Technology	4	4			✓	✓	✓	✓	40
	23U4LCCP2	Major Practicals-II	3	3			✓	✓	✓	✓	New
	23U4LSED6	Poultry Science and Management	2	2	✓	✓	✓	✓	✓		New
	23U4LSED7	Aquaculture	2	2	✓	✓	✓	✓	✓		New

Emp- Employability; Ent- Entrepreneurship; Skill- Skill Development



PART – V Activities

(NCC, NSS, YRC, PHYSICAL EDUCATION)

Revised Curriculum
TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION (TANSCHE)
(Choice Based Credit system with Outcome Based Education)

Academic Year 2023-2024 onwards

I and II year UG Programmes



THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
REVISED PART – V N.C.C. SYLLABUS 2023-24 ONWARDS
FIRST YEAR

NCC				CLASS: UG Students				
Sem	Course type	Course code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
II	Part V	23U2NCC1	Introduction to NCC	1	-	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives: *The objective of this course is to make the student*

- (i) *To know about NCC & its organization in India.*
- (ii) *To know about national integration*
- (iii) *To develop their personality*
- (iv) *To get aware of disasters*
- (v) *To involve in social service activities.*

UNIT I. N.C.C. General

Aims and Objectives of NCC – Motto and Cardinals of NCC – Organization and structure of NCC – Training in NCC: Training activities – Types of camps – Youth Exchange Programme – NCC song.

UNIT II. National Integration

Religions and culture of India: Main religions of India – Importance and Necessity of National Integration – National Interests and National Objectives – Threats and opportunities for NI – Major Problems/Challenges of NI – Measures to achieve NI – Importance and Fundamentals of National unity – Relevance of NCC in unifying India – Slogans of NI.

UNIT III. Personality Development and Leadership

Personality Development: Ten core life skills – Factors influencing personality – Self-awareness – Empathy – Critical and creative thinking – Decision making and problem solving.

Communication skills: Understanding basics – Different ways of communication – Components of effective communication – Common barriers to effective communication.

Leadership: Important leadership traits – Indicators of leadership and evaluation: Morale, team spirit, discipline and competence – Motivation – Moral values – Character traits – honour code.

UNIT IV. Disaster Management

National Disaster Management Authority – Organization of NDMA – Classification of disasters – Types of natural disasters – Causes and prevention of fire – Firefighting parties and equipment – Responsibilities of traffic police in disaster management – Employment of NCC cadets under traffic police during natural disasters – Role of NCC cadets in maintaining essential services – Assistance by NCC during natural or other calamities.

UNIT V. Social Service and Community Development

Social Service: Basics – Types – Contribution of NCC cadets. Rural Development: Objectives – Important rural development programs: MGNREGA, PMGSY, NSAP, SAGY, PMAY, JJB, PMKSY. Social security schemes of government: APY, PMJJBY, PMSBY Swachh Barath Abhiyan: Aims and Objectives – Implementation – Outcome and benefits – Contribution of NCC in Swachh Barath Abhiyan

Community Development Activities: Social evils – Female foeticide – Dowry – Corruption – Drug abuse and trafficking – HIV/AIDS – Beti Bachao, Beti Padhao – Mission Indradhanush – Digital India – Waste Management – Women Health and Sanitization – Tree plantation – Traffic Awareness

Books for study:

1. NCC Guide – Army Wing, Priya Publications, Major R. Ramasamy, Karur, 2010.
2. Cadets hand book-Common subjects for SD/SW, OTA training materials, Kamptee, 2019.

Books for reference:

1. Precis, Published by Officer Training School, Kamptee, 2009.
2. Cadet's diary, Published by cadets' center, Chennai, 2000.
3. NCC: Handbook of NCC cadets, R. Gupta, Ramesh Publishing House, 2015.
4. A hand book of NCC-Army wing, Lt. S. N. Saravanamoorthy, Jayalakshmi publications, Madurai, 2015.

Web resources:

1. <https://indiancc.nic.in/>
2. https://play.google.com/store/apps/details?id=com.chl.ncc&hl=en_IN&gl=US
3. <https://joinindianarmy.nic.in/default.aspx>
4. <https://www.joinindiannavy.gov.in/>
5. <https://indianairforce.nic.in/>

Rationale for nature of the course

This course will enable the students to enrich the understanding of NCC and its organization. Through the course, students are motivated to involve in social service activities.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

Cadets will be involved in social service activities like tree plantation, awareness rallies, street

shows, field works related to NCC and able to act upon various emergency situations. Through battalion, students can participate in trekking, mountaineering and other adventure training national level.

After successful completion of this course, the students will be able to

	CLO Statement	Knowledge level
CLO-1	Understand the structure, organization of NCC and armed forces.	Up to K2
CLO-2	Explain the need of national integration	Up to K2
CLO-3	Develop qualities like character, comradeship and discipline through regular training and field work.	Up to K2
CLO-4	Elaborate the ways to act in emergency situations	Up to K2
CLO-5	Involve in social service activities and act in the emergency situation.	Up to K2

PO and CLO mapping:

#	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	3	2	1	1	1	2
CLO-2	2	2	3	1	2	3
CLO-3	2	3	3	2	2	2
CLO-4	2	2	2	2	2	2
CLO-5	2	2	2	2	2	2

EVALUATION PATTERN:

INTERNAL ASSESMENT	:	25 marks
EXTERNAL EXAMINATION	:	75 marks
TOTAL	:	100 marks

• **INTERNAL ASSESMENT**

TOTAL	:	25 MARKS

Following components are fixed for internal assessment:

Field work/Camp/Rallies/Special camp, etc.	:	15 marks
Attendance	:	05 marks
Assignment	:	05 marks

• **EXTERNAL ASSESMENT**

Duration: 3 Hrs

Max Marks: 75

Part – A.	Answer ANY FIVE questions from eight questions (Open Choice)	5 x 2 = 10
Part – B.	Answer ANY FIVE questions from eight questions. (Open Choice)	5 x 7 = 35
Part – C.	Answer ANY THREE questions from five questions. (Open Choice)	3 x 10= 30

Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section-A (Short Answer)		Section-B Paragraph		Section-C Essay	
			(Open choice)		(Open 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	1	K2
2	CLO-2	Up to K2	1	K1	1	K2	1	K2
3	CLO-3	Up to K2	2	K1	2	K2	1	K2
4	CLO-4	Up to K2	2	K1	2	K2	1	K2
5	CLO-5	Up to K2	2	K1	2	K2	1	K2
No. of Questions to be asked			8		8		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 Answer)	Section B (Paragraph)	Section C (Essay)	Total Marks	% of Marks without choice
K1	16	-	-	16	15
K2	-	42	50	92	85
Total marks				108	

Name of the course Designer

- Lt Dr. S. V. Karthikeyan



THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
REVISED PART – V N.C.C. SYLLABUS 2023-24 ONWARDS
SECOND YEAR

NCC				CLASS: UG Students				
Sem	Course type	Course code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Part V	23U4NCC2	Field training in NCC	1	-	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives: *The objective of this course is to make the student*

- (i) To know about armed forces and police organizations.*
- (ii) To know about the modes of entry into army and police*
- (iii) To all types of drill with arms and without arms*
- (iv) To understand the types of weapons*
- (v) To identify type of ground and concepts of map reading.*

UNIT I. Armed Forces

Organization and Administration – Command and Headquarters of Army, Navy and Air force – Types of Central armed police force and other Police Organizations – Badges of ranks: Army, Navy, Air force, Police and CAPF. Honours and Awards: Gallantry awards in war time and peace time – Non Gallantry awards.

Modes of entry to Army, CAPF and Police: Army – Permanent Commission and Short service Commission – Entry Schemes (Men and Women) into: NDA, 10 + 2 TES, IMA direct, OTA, JAG, NCC (Special) Entry, UES, TGC, SSC, AEC, ACC,

UNIT II. Drill

Foot Drill: Word of command, Savdhan, Vishram, Aram se aur murdha, teen line banana, khuli line aur nikat line, visarjan, line tod, tej chal, dhire chal, dhahine, baen, aage aur piche kadam lena.

Drill with arms: Rifle ke sath Savdhan, Vishram, Aram se, visarjan, line tod, Sashtara: Bhumi, Uthao, Bagal aur Baju, Squad drill.

Ceremonial Drill with arms: Guard mounting, Guard of Honor.

UNIT III. Weapon Training

.22 Rifle: Introduction – Characteristics – Ammunition – Handling – Stripping, Assembling and cleaning - Lying position – Holing and aiming.

7.62 mm SLR: Characteristics – ammunition – Handling – Stripping, Assembling and cleaning.

Characteristics of 7.62 mm sniper rifle, 7.62 mm MMG, 30 mm automatic grenade launcher, 84 mm rocket launcher, Anti-tank guided missile, 5.56 mm INSAS rifle

Range procedure – Theory of group – Short range firing.

UNIT IV. Map reading

Definition of map – Conventional Signs – Scales and Grid systems: Definition – Methods of expressing – Topographical forms and technical terms – Definition for Relief, contour and Gradient – Cordinal points and Types of North

Conduct of Map reading: Types of bearing – Conversion between magnetic, grid and back bearing – Service protractor and its uses – Prismatic compass and its use – GPS – Map setting by various methods – Map to ground – Ground to map – Google maps and applications.

UNIT V. Field craft & Battle craft

Introduction – Judging Distance methods – Definition for landmark, target and reference point – Types of ground – Indication of land marks.

Observation, Camouflage and Concealment: Why things are seen – Personal Camouflage – Camouflage of equipment – Types of cover.

Fire and Move: Field signals – Signal with hands, weapons and whistle – Different types of section formation – Importance of fire discipline and fire control orders – Sequence and types of fire control orders.

Books for study:

1. NCC Guide – Army Wing, Priya Publications, Major R. Ramasamy, Karur, 2010.
2. Cadets hand book-Common subjects for SD/SW, OTA training materials, Kamptee.
3. Cadets hand book-Special subjects for SD/SW, OTA training materials, Kamptee

Reference Books:

1. Precis, Published by Officer Training School, Kamptee, 2019.
2. Cadet's diary, Published by cadets' center, Chennai, 2000.
3. NCC: Handbook of NCC cadets, R. Gupta, Ramesh Publishing House, 2015.
4. A hand book of NCC-Army wing, Lt. S. N. Saravanamoorthy, Jayalakshmi publications, Madurai, 2015.

Web resources:

1. <https://indiancc.nic.in/>
2. https://play.google.com/store/apps/details?id=com.chl.ncc&hl=en_IN&gl=US
3. <https://joinindianarmy.nic.in/default.aspx>
4. <https://www.joinindiannavy.gov.in/>
5. <https://indianairforce.nic.in/>

Rationale for nature of the course

This course will enable the students to enrich the understanding of geography and current affairs of world. Through the course, students are motivated to join in armed forces.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

Cadets will be able to handle weapons, read map and develop qualities like character, comradeship, discipline, leadership, secular outlook, spirit of adventure, ethics and ideals of selfless services. Through battalion, students can participate in rock climbing, para sailing, cycling, trekking, mountaineering and other adventures training at both state level and national level.

After successful completion of this course, the students will be able to

	CLO Statement	Knowledge level
CLO-1	Understand the organization and administration of armed forces and police organizations.	Up to K2
CLO-2	Do various types of drill	Up to K2
CLO-3	Recall the specifications of various rifles	Up to K2
CLO-4	Read maps and related sign systems, Identify types of ground and relate compass and maps	Up to K2
CLO-5	Comprehend the methods for Camouflage and Concealment	Up to K2

PO and CLO mapping:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	2	2	2	1	1	2
CLO-2	2	2	1	1	1	2
CLO-3	2	1	2	1	1	2
CLO-4	2	2	2	1	1	2
CLO-5	2	2	2	1	1	2

EVALUATION PATTERN:

INTERNAL ASSESMENT	:	25 marks
EXTERNAL EXAMINATION	:	75 marks
TOTAL	:	100 marks

• INTERNAL ASSESMENT

TOTAL	:	25 MARKS

Following components are fixed for internal assessment:

Field work/Camp/Rallies/Special camp, etc.	:	15 marks
Attendance	:	05 marks
Assignment	:	05 marks

- **EXTERNAL ASSESMENT**

Duration: 3 Hrs

Max Marks: 75

Part – A.	Answer ANY FIVE questions from eight questions (Open Choice)	5 x 2 = 10
Part – B.	Answer ANY FIVE questions from eight questions. (Open Choice)	5 x 7 = 35
Part – C.	Answer ANY THREE questions from five questions. (Open Choice)	3 x 10= 30

Summative Examination – Blue Print

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

S. No.	CLOs	K-Level	Section-A (Short Answer)		Section-B Paragraph		Section-C Essay	
			(Open choice)		(Open 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	1	K2
2	CLO-2	Up to K2	1	K1	1	K2	1	K2
3	CLO-3	Up to K2	2	K1	2	K2	1	K2
4	CLO-4	Up to K2	2	K1	2	K2	1	K2
5	CLO-5	Up to K2	2	K1	2	K2	1	K2
No. of Questions to be asked			8		8		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 Answer)	Section B (Paragraph)	Section C (Essay)	Total Marks	% of Marks without choice
K1	16	-	-	16	15
K2	-	42	50	92	85
Total marks				108	

Name of the course Designer

- Lt Dr. S. V. Karthikeyan



THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
REVISED PART – V - NSS SYLLABUS 2023-24 ONWARDS
FIRST YEAR

NSS				CLASS: UG Students				
Sem	Course type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Part V	23U2NPN	Introduction to National Social Scheme	0	-	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives: *The objective of this course is to make the student*

- (i) To understand the community in which they work and their relation.*
- (ii) To identify the needs and problems of the community and involve them in problem solving*
- (iii) To develop capacity to meet emergencies and natural disasters*
- (iv) To develop competences required for group living and sharing responsibilities.*
- (v) To acquire leadership qualities and democratic attitude.*

Unit – I –BASICS OF NATIONAL SERVICE SCHEME

NSS-Motto-Aim – Role of Programme officer- Role of NSS Group leader and volunteers in the implementation.

Unit –II – ADMINISTRATIVE STRUCTURE OF NSS

Structure of NSS at world level, Regional level, University level, College level – body –functions - Planning and execution

Unit – III – PROGRAMMES AND ACTIVITIES

Activities of NSS – Traffic regulation- Working with Police commissioner’s Office- with Corporation of Madurai – Working with Health Department –Blind assistance- collection during disaster – Non-formal education – Environmental Education, and Training (EEAT)’ Blood donation

Unit – IV- COMMUNITY DEVELOPMENT

Camp-fund allocation –procedure for special camp activities to be carried out in adopted – general awareness programs during camp

Unit – V DEVELOPMENT AND PARTICIPATION WITH SOCIAL ISSUES

Economic survey- first aid – disaster management (flood) –communicable and non-diseases –HIV, DENGUE- people participation.

Books for study:

1. NATIONAL SERVICE SCHEME MANUAL (REVISED) by Government of India Ministry of Youth Affairs & Sports New Delhi
2. Hand book of National Service Scheme Empanelled Training Institution, Avinashilingam University for Women, Coimbatore

Reference Books:

1. National Service Scheme Manual (Revised) Ministry of Human Resource Development of India.
2. A. Kumar (2006), “Health and Nutritional Status of Indian Women”, Anmol Publications Pvt, Ltd., New Delhi

Web resources:

1. <https://nss.gov.in/nss-detail-page>
2. www.icmr.nic.in
3. <https://www.avit.ac.in/nss/index.php>
4. <https://nss.gov.in/>

Rationale for nature of the course

This course will enable the students to enrich the understanding of NSS and its organization. Through the course, students are motivated to involve in social service activities.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

Cadets will be involved in social service activities like

1. National Integration Camp
2. Shramdaan
3. Blood donation
4. Immunization
5. Plantation
6. Disaster Management
7. Adventure programs.

After successful completion of this course, the students will be able to

	CLO Statement	Knowledge level
CLO-1	To identify the needs and problems of the community and involve them in problem solving process	Up to K2
CLO-2	To develop among themselves a sense of social and civic responsibility	Up to K2
CLO-3	To Acquire leadership qualities and democratic attitudes	Up to K2
CLO-4	Develop qualities like character, comradeship and discipline through regular training and field work.	Up to K2
CLO-5	Improve kind heartedness, spirit of humanity and ideals of selfless red cross service.	Up to K2

PO and CLO mapping:

#	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	2	2	2	1	1	2
CLO-2	2	2	1	1	1	2
CLO-3	2	1	2	1	1	2
CLO-4	2	2	2	1	1	2
CLO-5	2	2	2	1	1	2

EVALUATION PATTERN:

INTERNAL ASSESMENT	:	25 marks
EXTERNAL EXAMINATION	:	75 marks
TOTAL	:	100 marks

• **INTERNAL ASSESMENT**

TOTAL	:	25 MARKS

Following components are fixed for internal assessment:

Field work/Camp/Rallies/Special camp, etc.	:	15 marks
Attendance	:	05 marks
Assignment	:	05 marks

• **EXTERNAL ASSESMENT**

Duration: 3 Hrs		Max Marks: 75
Part – A.	Answer ANY FIVE questions from eight questions (Open Choice)	5 x 2 = 10
Part – B.	Answer ANY FIVE questions from eight questions. (Open Choice)	5 x 7 = 35
Part – C.	Answer ANY THREE questions from five questions. (Open Choice)	3 x 10= 30

Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section-A (Short Answer)		Section-B Paragraph		Section-C Essay	
			(Open choice)		(Open 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	1	K2
2	CLO-2	Up to K2	1	K1	1	K2	1	K2
3	CLO-3	Up to K2	2	K1	2	K2	1	K2
4	CLO-4	Up to K2	2	K1	2	K2	1	K2
5	CLO-5	Up to K2	2	K1	2	K2	1	K2
No. of Questions to be asked			8		8		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 Answer)	Section B (Paragraph)	Section C (Essay)	Total Marks	% of Marks without choice
K1	16	-	-	16	15
K2	-	42	50	92	85
Total marks				108	

Name of the course Designer

- Dr. Y. Natarajan, Assistant Professor, Department of commerce.



THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
REVISED PART – V - NSS SYLLABUS 2023-24 ONWARDS
SECOND YEAR

NSS				CLASS: UG Students				
Sem	Course type	Course code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Part V	23U4NPN	Community Services	1	-	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives:

The objective of this course is to make the student

- (i) *To understand the community in which they work and their relation.*
- (ii) *To identify the needs and problems of the community and involve them in problem solving*
- (iii) *To develop capacity to meet emergencies and natural disasters*
- (iv) *To develop competences required for group living and sharing responsibilities.*
- (v) *To acquire leadership qualities and democratic attitude.*

Unit – I –SOCIAL AWARENESS

Philosophy, ideology- Relationship of Social Work with Social Service, Social welfare, Social Security & Social Reforms – Drugs abuse.

Unit –II – ENVIRONMENTAL AWARENESS

Conservation, enrichment and Sustainability –Climate change, Global Efforts for conservation- Waste management – Natural resource management Rain water Energy Conservation, Waste land development, Soil conservation and Afforestation

Unit – III – GENDER EQUALITY

Concept of family and society – Growing up in the family-dynamics- in values – Concept & Importance – Concept of Gender Justice & its need

Unit – IV- HEALTH AWARENESS

Sanitation- Definition, needs and scope of health education – Food and Nutrition, Balance Diet- Safe drinking water, water borne disease- National Health Programme and Nursing and First Aid

Unit – V POLITICAL AWARENESS

Features of Constitutions of India – Fundamental Rights and duties – Human Rights- awareness and the legal rights of the consumer –Rights to Information Act. 2005- Education Act- Right to Employment Act.

Books for study:

1. Eugene (2010), “Environment Economics”, Vrinda Publishers, New Delhi.
2. A. Kumar (2006), “Health and Nutritional Status of Indian Women” Anmol Publications Pvt., Ltd., New Delhi.

Reference Books:

1. C. N Shankar Rao (2012), Principles of Sociology”, S. Chand & Co., Pvt., Ltd., Ram Nagar, NewDelhi.
2. Dr. P. Saravanan & P. Andichamy (2011), Value Education, Merit India Publications, Madurai

Web resources:

1. <https://indiaNSS.nic.in/>
2. www.rtionline.gov.in
3. www.nhrc.nic.in

Rationale for nature of the course

This course will enable the students to enrich the chance to improve skills important for a workplace, such as communication and organizational skills, teamwork, planning, problem-solving and task management.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

Cadets will be able to handle weapons, read map and develop qualities like Character, Volunteer at your local library, chaperone a field trip, Volunteer with a local nonprofit, Volunteer at an animal shelter, Volunteer at a community center, Volunteer as a lifeguard, Volunteer to be a crossing guard, Volunteer to do social media for a local org

After successful completion of this course, the students will be able to

	CLO Statement	Knowledge level
CLO-1	To Engaging in community service provides students with the opportunity to become active members of their community	Up to K2
CLO-2	To enables students to acquire life skills and knowledge, as well as provide a service to those who need it most.	Up to K2
CLO-3	To abolish the differences among individuals, develop spirit of common interest and sacrifice and also participate collectively in community programs.	Up to K2
CLO-4	Develop qualities like compassion, kindness and caring sense through regular training and field work.	Up to K2
CLO-5	Improve kind heartedness, spirit of humanity and ideals of selfless red cross service	Up to K2

PO and CLO mapping:

#	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	2	2	2	1	1	2
CLO-2	2	2	1	1	1	2
CLO-3	2	1	2	1	1	2
CLO-4	2	2	2	1	1	2
CLO-5	2	2	2	1	1	2

EVALUATION PATTERN:

INTERNAL ASSESMENT	:	25 marks
EXTERNAL EXAMINATION	:	75 marks
TOTAL	:	100 marks

• **INTERNAL ASSESMENT**

TOTAL	:	25 MARKS

Following components are fixed for internal assessment:

Field work/Camp/Rallies/Special camp, etc.	:	15 marks
Attendance	:	05 marks
Assignment	:	05 marks

• **EXTERNAL ASSESMENT**

Duration: 3 Hrs

Max Marks: 75

Part – A.	Answer ANY FIVE questions from eight questions (Open Choice)	5 x 2 = 10
Part – B.	Answer ANY FIVE questions from eight questions. (Open Choice)	5 x 7 = 35
Part – C.	Answer ANY THREE questions from five questions. (Open Choice)	3 x 10= 30

Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section-A (Short Answer)		Section-B Paragraph		Section-C Essay	
			(Open choice)		(Open 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	1	K2
2	CLO-2	Up to K2	1	K1	1	K2	1	K2
3	CLO-3	Up to K2	2	K1	2	K2	1	K2
4	CLO-4	Up to K2	2	K1	2	K2	1	K2
5	CLO-5	Up to K2	2	K1	2	K2	1	K2
No. of Questions to be asked			8		8		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 Answer)	Section B (Paragraph)	Section C (Essay)	Total Marks	% of Marks without choice
K1	16	-	-	16	15
K2	-	42	50	92	85
Total marks				108	

Name of the course Designer

- Dr. Y. Natarajan, Assistant Professor, Department of commerce.



THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
REVISED PART – V YRC SYLLABUS 2023-24 ONWARDS
FIRST YEAR

YRC				CLASS: UG Students				
Sem	Course type	Course code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
II	Part V	23U2YRC1	Introduction to Youth Red Cross	1	-	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives:

- (i) To furnish the youth representation part in the Red Cross for their humanitarian commitment.
- (ii) To equip the Young volunteers for providing significant contribution to the most vulnerable people through the Red Cross youth Programme
- (iii) To learn and understand the community in which they work
- (iv) To identify the problems of the community and develop problem solving skills

UNIT I. BASICS OF YRC

Introduction- History of Red Cross and Red Crescent Movement- Origin of Indian Red Cross Society- Principles of YRC- Academic Activities.

UNIT II. INDIAN RED CROSS SOCIETY

Mission: Indian Red Cross Society – Fundamental Principles of the International Red Cross and Red Crescent Movement- Junior/Youth Red Cross – History- Valuing the role of young people.

UNIT III. ORGANISATIONAL STRUCTURE IRCS

Organizational structure of IRCS Junior / Youth- Member and Volunteer of IRCS- Formation procedure at Indian Red Cross Society, National Headquarters- Formation procedure at State Branches- Formation procedure at District Branches- Junior/Youth Red Cross groups.

UNIT IV. COUNSELLORS AND PROGRAM OFFICERS

Organize junior and youth Red Cross- Recognition of services of counsellors and Programme officers- Recognition to Junior/Youth Red Cross members & volunteers- Correspondence between State Headquarters & District Branches.

UNIT V. COMMUNITY DEVELOPMENT

Camps/Zonal meetings- Finances- Membership, fees, etc.- Special fund: Junior/Youth Red Cross funds- Transportation Suggested activities for junior and youth groups.

Books for study:

1. Guidelines for Junior and Youth Red Cross, Indian Red Cross Society

.Books for reference:

1. Indian First Aid Manual 2016 (7th Edition) Authorized Manual – English Version
2. Junior Red Cross Activities: Teachers Manual. October, 1918 Paperback – Import, 2 September 2011
3. Basics about red cross - Published by : Indian Red Cross Society, National Headquarters

Web resources:

1. <https://www.indianredcross.org/youth/>
2. <https://henrybakercollege.edu.in/StudentsSupport/G/Youth%20Red%20Cross>
3. <https://indianredcross.org/publications/basics-of-red-cross.pdf>
4. <https://www.icrc.org/en/doc/assets/files/publications/icrc-002-0962.pdf>
5. <https://redcrossernakulam.org/upload/forms/Youth%20Red%20Cross.pdf>

Rationale for nature of the course

This course will enable the students to understand the YRC and its organization, through this course students are motivated to involve in social service activities.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

Students will be involved in social service activities like

- Orientation Programme to newly admitted students about YRC AIDS Awareness Programme- Celebrating Life
- Eye Camp
- HIV/AIDS Awareness Programme
- Blood Donation Camp
- First Aid & Fire Safety Training
- Drive Safety Awareness Campaign
- Blood Donation Awareness Rally
- Road Safety Rally and other activities

After successful completion of this course, the students will be able to

	CLO Statement	Knowledge level
CLO-1	Equip to conduct social and health awareness programmes.	Up to K2
CLO-2	Making awareness regarding red cross service and social activities	Up to K2
CLO-3	Encourage and to youth members and other students to contribute in red cross activities.	Up to K2
CLO-4	Develop qualities like compassion, kindness and caring sense through regular training and field work.	Up to K2
CLO-5	Improve kind heartedness, spirit of humanity and ideals of selfless red cross service	Up to K2

PO and CLO mapping:

#	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	3	2	1	1	1	2
CLO-2	2	2	3	1	2	3
CLO-3	2	3	3	2	2	2
CLO-4	2	2	2	2	2	2
CLO-5	2	2	2	2	2	2

EVALUATION PATTERN:

INTERNAL ASSESMENT	:	25 marks
EXTERNAL EXAMINATION	:	75 marks
TOTAL	:	100 marks

• **INTERNAL ASSESMENT**

TOTAL	:	25 MARKS

Following components are fixed for internal assessment:

Field work/Camp/Rallies/Special camp, etc.	:	15 marks
Attendance	:	05 marks
Assignment	:	05 marks

EXTERNAL ASSESSMENT

Duration: 3 Hrs

Max Marks: 75

Part – A.	Answer ANY FIVE questions from eight questions (Open Choice)	5 x 2 = 10
Part – B.	Answer ANY FIVE questions from eight questions. (Open Choice)	5 x 7 = 35
Part – C.	Answer ANY THREE questions from five questions. (Open Choice)	3 x 10= 30

Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section-A (Short Answer)		Section-B Paragraph		Section-C Essay	
			(Open choice)		(Open choice)		(Open choice)	
			No. of questions	K-Level	No. of questions	K-Level	No. of questions	K-Level
1	CLO-1	Up to K2	2	K1	2	K2	1	K2
2	CLO-2	Up to K2	2	K1	2	K2	1	K2
3	CLO-3	Up to K2	2	K1	2	K2	1	K2
4	CLO-4	Up to K2	1	K1	1	K2	1	K2
5	CLO-5	Up to K2	1	K1	1	K2	1	K2
No. of Questions to be asked			8		8		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 Answer)	Section B (Paragraph)	Section C (Essay)	Total Marks	% of Marks without choice
K1	16	-	-	16	15
K2	-	42	50	92	85
Total marks				108	

Name of the course Designer

- Dr.S. Selvakumat, Associate Professor, Department of commerce
- Dr.S.Krithika, Assistant Professor, Department of commerce



THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
REVISED PART – V YRC SYLLABUS 2023-24 ONWARDS
SECOND YEAR

YRC				CLASS: UG Students				
Sem	Course type	Course code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Part V		Field Work In YRC	1	-	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives:

- (i) To furnish the youth representation part in the Red Cross for their humanitarian commitment.
- (ii) To equip the Young volunteers for providing significant contribution to the most vulnerable people through the Red Cross youth Programme
- (iii) To learn and understand the community in which they work
- (iv) To identify the problems of the community and develop problem solving skills

UNIT I. HISTORY OF RED CROSS

Introduction- History of Red Cross And RedCrescent Movement-Origin of Indian Red Cross Society
- international conventions (Geneva Conventions)- International Committee of the Red Cross -
International Federation of the Red Cross and Red Crescent Societies.

Unit-II BLOOD DONATION

Blood donation - The Science of Blood -The Blood Donation Criteria– blood donation camps -The Blood Donation Process-Success Factors for Blood Mobile.

Unit-III COMMUNITY SERVICES

Community services - First Aid - Red Cross Service Learning - Fund Raising / Food Aid - Disaster Management - Types of conflicts& National Disasters – Role of Red Cross Society in relief activities- how to handle the emergency situations - Psycho-Social Support Training.

Unit-IV LEADERSHIP DEVELOPMENT

Leadership Development: First war of Indian Independence – Gandhiji and Non Violence – Nethaji and INA Leadership–types and traits–Man management Duty and discipline, factors affecting duty and discipline Indian Citizenship – duties and responsibilities.

Unit-V CIVIL DEFENCE AND SELF DEFENCE

Civil Defence and Self Defence: Civil defence – organization – aim and services – aid to civil authorities in emergency Fire fighting – types of fire, spreading of fire, fire extinguishing and equipments Self defence – unarmed combat – attacking and throws – vital parts of human body. authorities in emergency Fire fighting – types of fire, spreading of fire, fire extinguishing and equipments Self defence – unarmed combat – attacking and throws – vital parts of human body

Booksforstudy:

1. Guidelines for Junior and Youth Red Cross, Indian Red Cross Society
2. Nagendran,N.A.AguidetoYouthRedCrossSociety.ThiagarajarCollege,Madurai

ReferenceBooks:

1. IndianFirstAidManual2016(7thEdition)AuthorizedManual–EnglishVersion
2. JuniorRedCrossActivities:TeachersManual.October,1918Paperback–Import,2September2011
3. Basicsaboutredcross-Publishedby:IndianRedCrossSociety,NationalHeadquarter

Web resources:

1. <https://www.indianredcross.org/youth/>
2. <https://henrybakercollege.edu.in/StudentsSupport/G/Youth%20Red%20Cross>
3. <https://indianredcross.org/publications/basics-of-red-cross.pdf>
4. <https://www.icrc.org/en/doc/assets/files/publications/icrc-002-0962.pdf>
5. <https://redcrossernakulam.org/upload/forms/Youth%20Red%20Cross.pdf>

Rationale for nature of the course

This course will enable the students to enrich the understanding of YRC national as well as international level and its organization. Through thecourse, students are motivated to involve in red cross services.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

Students will be involved in social service activities like

- OrientationProgrammetonewlyadmittedstudentsaboutYRCAIDSAwareness Programme-Celebrating Life
- Eye Camp
- HIV/AIDS Awareness Programme
- Blood Donation Camp
- First Aid & Fire Safety Training
- Drive Safety Awareness Campaign
- Blood Donation Awareness Rally
- Road Safety Rally and other activities

After successful completion of this course, the students will be able to

	CLO Statement	Knowledge level
CLO-1	To know the importance of YRC in national and international level	Up to K2
CLO-2	To make awareness of needs and importance of blood donation And its mobility	Up to K2
CLO-3	Create the knowledge to act in the emergency situations at the time of natural disaster	Up to K2
CLO-4	Develop qualities like compassion, kindness through regular training and field work.	Up to K2
CLO-5	Improve kindheartedness, spirit of humanity and ideals of selfless red cross service	Up to K2

PO and CLO mapping:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	2	2	2	1	1	2
CLO-2	2	2	1	1	1	2
CLO-3	2	1	2	1	1	2
CLO-4	2	2	2	1	1	2
CLO-5	2	2	2	1	1	2

EVALUATION PATTERN:

INTERNAL ASSESMENT	:	25 marks
EXTERNAL EXAMINATION	:	75 marks
TOTAL	:	100 marks

● **INTERNAL ASSESMENT**

TOTAL	:	25 MARKS

Following components are fixed for internal assessment:

Field work/Camp/Rallies/Special camp, etc.	:	15 marks
Attendance	:	05 marks
Assignment	:	05 marks

● **EXTERNAL ASSESSMENT**

Duration: 3 Hrs

Max Marks: 75

Part – A.	Answer ANY FIVE questions from eight questions (Open Choice)	5 x 2 = 10
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Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

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			(Open choice)		(Open choice)		(Open choice)	
			No. of questions	K-Level	No. of questions	K-Level	No. of questions	K-Level
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2	CLO-2	Up to K2	2	K1	2	K2	1	K2
3	CLO-3	Up to K2	2	K1	2	K2	1	K2
4	CLO-4	Up to K2	1	K1	1	K2	1	K2
5	CLO-5	Up to K2	1	K1	1	K2	1	K2
No. of Questions to be asked			8		8		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 Answer)	Section B (Paragraph)	Section C (Essay)	Total Marks	% of Marks without choice
K1	16	-	-	16	15
K2	-	42	50	92	85
Total marks				108	

Name of the course Designer

- Dr.S. Selvakumat, Associate Professor, Department of commerce
- Dr.S.Krithika, Assistant Professor, Department of commerce



THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
REVISED PART – V PHYSICAL EDUCATION SYLLABUS 2023-24
ONWARDS
FIRST YEAR

PHYSICAL EDUCATION				CLASS: UG Students				
Sem	Course type	Course code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
II	Part V	23U2PED1	History of Physical Education	0	-	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives: *The objective of this course is to make the student*

- (i) *To know about physical education national and international level.*
- (ii) *To know about ancient Olympics and modern Olympics.*
- (iii) *To understand Games rules and ground measurements (volleyball, football, ball badminton).*

UNIT I. PHYSICAL EDUCATION

Meaning – national level – international level – importance – benefits – need of physical education.

UNIT II. ANCIENT OLYMPICS & MODERN OLYMPIC

About Olympics – history of Olympics– importance of Olympics – ancient Olympics – modern Olympics – history of ancient Olympics – history of modern Olympics.

UNIT III. GAMES RULES AND GROUND measurements

- a. Volley ball rules and ground measurements
- b. Football rules and ground measurements
- c. Ball badminton rules and ground measurements.

UNIT IV. FIRST AID

Basic things in First Aid – Importance of first aid – Benefits of first aid.

UNIT V. YOGA

History of yoga – Importance of yoga – Benefits of yoga – Needs of yoga.

Books for Study:

1. Essentials of physical education, A. Singh, J. Bains, Kalyani publications, 2016.
2. The complete book of the Olympics, D. Wallechinsky, Aurum press, 2004.
3. The complete book of yoga, Swami Vivekananda, Finger print publishing, 2019.

Books for Reference:

1. Rules of games and sports, K. Sharma, Khel Sathiya Kendra publications, 2018.
2. Sports and games: Rules and Regulations, P. V. Pathak, Khel Sathiya Kendra publications, 2019.
3. Olympics, C. Oxlade, D. Baliheimer, Dorling Kindersley publications, 2000.
4. Light on yoga, B. K. S. Iyengar, Thorsons publications, 2006.
5. Manual of First aid, L. C. Gupta, A. Gupta, JPB publications, 2012.

Web resources:

1. <https://study.com/academy/lesson/what-is-physical-education-definition-overview.html>
2. <https://olympics.com/en/>
3. <https://olympics.com/ioc/ancient-olympic-games>
4. <https://www.verywellhealth.com/basic-first-aid-procedures-1298578>
5. <https://www.yogajournal.com/lifestyle/health/womens-health/count-yoga-38-ways-yoga-keeps-fit/>

Rationale for nature of the course

This course will enable the students to enrich the understanding of Physical education. Through the course, students are motivated to participate in various games in all levels.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

Students will be involved in sports competition under district level, state level and national level and daily sports activities.

After successful completion of this course, the students will be able to

	CLO Statement	Knowledge level
CLO-1	Know physical education in national and international level.	Up to K2
CLO-2	Understand ancient Olympics, modern Olympics, first aid and yoga	Up to K2
CLO-3	Comprehend games rules and ground measurements	Up to K2
CLO-4	Develop their physique in good shape through regular work outs and exercises.	Up to K2
CLO-5	Realize the need of physical education.	Up to K2

PO and CLO mapping:

#	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	3	2	1	1	1	2
CLO-2	2	2	3	1	2	3
CLO-3	2	3	3	2	2	2
CLO-4	2	2	2	2	2	2
CLO-5	2	2	2	2	2	2

EVALUATION PATTERN:

INTERNAL ASSESMET	:	25 marks
EXTERNAL EXAMINATION	:	75 marks
TOTAL	:	100 marks

- **INTERNAL ASSESMENT**

TOTAL	:	25 MARKS

Following components are fixed for internal assessment:

Field work, playing games and participating competition, etc.:	15 marks
Attendance	: 05 marks
Assignment	: 05 marks

- **EXTERNAL ASSESMENT**

Duration: 3 Hrs

Max Marks: 75

Part – A.	Answer ANY FIVE questions from eight questions (Open Choice)	5 x 2 = 10
Part – B.	Answer ANY FIVE questions from eight questions. (Open Choice)	5 x 7 = 35
Part – C.	Answer ANY THREE questions from five questions. (Open Choice)	3 x 10 = 30

Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section-A (Short Answer)		Section-B Paragraph		Section-C Essay	
			(Open choice)		(Open 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	1	K2
2	CLO-2	Up to K2	1	K1	1	K2	1	K2
3	CLO-3	Up to K2	2	K1	2	K2	1	K2
4	CLO-4	Up to K2	2	K1	2	K2	1	K2
5	CLO-5	Up to K2	2	K1	2	K2	1	K2
No. of Questions to be asked			8		8		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 Answer)	Section B (Paragraph)	Section C (Essay)	Total Marks	% of Marks without choice
K1	16	-	-	16	15
K2	-	42	50	92	85
Total marks				108	

Name of the course Designer

- Dr. K. Kathirvel Pandian



THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
REVISED PART – V PHYSICAL EDUCATION SYLLABUS 2023-24
ONWARDS
SECOND YEAR

PHYSICAL EDUCATION				CLASS: UG Students				
Sem	Course type	Course code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Part V	23U4PED2	Physical Education and Games	1	-	25	75	100

Nature of course	Skill oriented	✓	Employability oriented	✓	Entrepreneurship Oriented	

Objectives: *The objective of this course is to make the student*

- (i) To know about yoga and meditation.*
- (ii) To realize the importance of exercise in daily life.*
- (iii) To understand the components and benefits of wellness.*
- (iv) To Know about games*

UNIT I. MEDITATION

History of meditation – meaning of meditation – benefits of meditation – importance of meditation – needs of meditation.

UNIT II. EXERCISE IN PHYSICAL EDUCATION

Importance of exercise – time & duration – human life style.

UNIT III. WELLNESS IN PHYSICAL EDUCATION

Meaning of wellness – components – benefits of wellness – needs for wellness.

UNIT IV. GAMES

(Basketball, Cricket, Hockey)

- a. Rules and regulations of basketball and Ground Measurements.
- b. Rules and regulations of Cricket and Ground Measurements.
- c. Rules and regulations of Hockey and Ground Measurements.

UNIT V. NEW GAMES

(Boxing, Fencing, Judo)

- a. Rules and regulations of Boxing and Ground Measurements.
- b. Rules and regulations of Fencing and Ground Measurements.
- c. Rules and regulations of JUDO and Ground Measurements.

Books for study:

1. Meditation and its methods, Swami Vivekananda, Grapevine India publications, 2018.
2. The principles of exercise therapy, M. D. Gardiner, CBS Publications, 4th edition, 2005.
3. Sports and games: Rules and Regulations, P. V. Pathak, Khel Sathiya Kendra publications, 2019.

Books for Reference:

1. Most popular sports and games, J. K. Thakur, V. Singh, Sports Publications, 2019.
2. Rules of games and sports, K. Sharma, Khel Sathiya Kendra publications, 2018.
3. A Health and wellness handbook, A. Singh, Notion press, 2021.
4. Meditation, Osho, Griffin publications, 2004.

Web resources:

1. <https://www.healthline.com/nutrition/12-benefits-of-meditation>
2. https://www.physio-pedia.com/Physiology_In_Sport
3. <http://www.sportzvision.com/sports-rules.html>
4. <https://www.dimensions.com/collection/sports-rules-regulations>

Rationale for nature of the course

This course will enable the students to enrich the understanding of Physical education. Through the course, students are motivated to participate in various games in all levels.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

Cadets will be involved in sports competition like state level, district levels and national levels. And daily sports activities.

After successful completion of this course, the students will be able to

CLOs	CLO Statement	Knowledge level
CLO-1	Understand the meaning, benefits and essentials of yoga and meditation.	Up to K2
CLO-2	Maintain good physical and mental health by doing exercises, yoga and by taking nutritive foods.	Up to K2
CLO-3	Know the rules and regulations of games like boxing, fencing, judo, basketball, cricket, hockey.	Up to K2
CLO-4	Develop their physique in good shape through regular work outs and exercises.	Up to K2
CLO-5	Realize the need of physical education.	Up to K2

PO and CLO mapping:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CLO-1	2	2	2	1	1	2
CLO-2	2	2	1	1	1	2
CLO-3	2	1	2	1	1	2
CLO-4	2	2	2	1	1	2
CLO-5	2	2	2	1	1	2

EVALUATION PATTERN:

INTERNAL ASSESMENT	:	25 marks
EXTERNAL EXAMINATION	:	75 marks
TOTAL	:	100 marks

- **INTERNAL ASSESMENT**

TOTAL	:	25 MARKS

Following components are fixed for internal assessment:

Field work/Camp/Rallies/Special camp, etc.	:	15 marks
Attendance	:	05 marks
Assignment	:	05 marks

- **EXTERNAL ASSESMENT**

Duration: 3 Hrs

Max Marks: 75

Part – A.	Answer ANY FIVE questions from eight questions (Open Choice)	5 x 2 = 10
Part – B.	Answer ANY FIVE questions from eight questions. (Open Choice)	5 x 7 = 35
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Name of the course Designer

- Dr. K. Kathirvel Pandian