



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

12.10.2023



ESTD : 1889

Learning Shines with Righteousness

BOOK 2 of 3

(Syllabi Pages : 691-1362)



THE MADURA COLLEGE (AUTONOMOUS)

(Affiliated to Madurai Kamaraj University, Reaccredited (4th Cycle) with "A" Grade by NAAC)

Ordinary Meeting of the Academic Council

Venue : Seminar Hall

Date : 12.10.2023

Time : 10.30 a.m.

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

R.Eswaran
Member Secretary

Dr. J. Suresh
Principal & Chairman



THE MADURA COLLEGE (AUTONOMOUS)

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ACADEMIC COUNCIL

Date:
21.09.2023

NOTICE

An ordinary meeting of the Academic Council will be held on **12th October 2023 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 27.09.2023. The deadline for withdrawal of resolutions will be 29.09.2023 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



THE MADURA COLLEGE (AUTONOMOUS)
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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)

Director – Madura College Board,

Madurai.

Sri.R.Sridharan,

(Member representing Profession)

Director – Madura College Board,

Madurai.

Sri.K.K.Raman,

(Member representing Industry)

President,

Sundaram Industries (TVS Rubber)

Madurai.

INTERNAL MEMBERS

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



THE MADURA COLLEGE (AUTONOMOUS) **(Reaccredited with “A” Grade by NAAC)**

ACADEMIC COUNCIL

AGENDA FOR THE MEETING ON 12.10.2023

1. Prayer
2. Welcome Address : The Chairman, Academic Council
3. Confirmation of the Minutes of the previous Academic Council Meeting held on 20.07.2022
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

CONTENTS

Sl. No.	Particulars	Page No.
I.	CONFIRMATION OF THE MINUTES OF THE PREVIOUS ACADEMIC COUNCIL MEETING HELD ON 17.06.2021	i-ix
II.	BUSINESS BROUGHT FORWARD BY THE CHAIRMAN	x
III.	RESOLUTIONS BROUGHT FORWARD BY THE HEADS OF THE DEPARTMENT	x - xxiii
	1. FROM THE BOARD OF STUDIES IN TAMIL 2. FROM THE BOARD OF STUDIES IN HINDI 3. FROM THE BOARD OF STUDIES IN SANSKRIT 4. FROM THE BOARD OF STUDIES IN ENGLISH 5. FROM THE BOARD OF STUDIES IN ECONOMICS 6. FROM THE BOARD OF STUDIES IN COMMERCE 7. FROM THE BOARD OF STUDIES IN MATHEMATICS 8. FROM THE BOARD OF STUDIES IN STATISTICS 9. FROM THE BOARD OF STUDIES IN PHYSICS 10. FROM THE BOARD OF STUDIES IN CHEMISTRY 11. FROM THE BOARD OF STUDIES IN BOTANY 12. FROM THE BOARD OF STUDIES IN ZOOLOGY 13. FROM THE BOARD OF STUDIES IN COMPUTER SCIENCE 14. FROM THE BOARD OF STUDIES IN INFORMATION TECHNOLOGY 15. FROM THE BOARD OF STUDIES IN MICROBIOLOGY 16. FROM THE BOARD OF STUDIES IN BIOTECHNOLOGY	
IV.	ANY OTHER SUBJECTS BROUGHT FORWARD BY THE CHAIRMAN	xxiii
	BOOK – I	
V.	COURSE STRUCTURE AND SYLLABUS FOR TAMIL	1-156
	COURSE STRUCTURE AND SYLLABUS FOR HINDI	157-167
	COURSE STRUCTURE AND SYLLABUS FOR SANSKRIT	168-180
	COURSE STRUCTURE AND SYLLABUS FOR ENGLISH	181-303
	COURSE STRUCTURE AND SYLLABUS FOR ECONOMICS	304-433
	COURSE STRUCTURE AND SYLLABUS FOR COMMERCE	434-690
	BOOK – II	
	COURSE STRUCTURE AND SYLLABUS FOR MATHEMATICS	691-840
	COURSE STRUCTURE AND SYLLABUS FOR STATISTICS	841-1066
	COURSE STRUCTURE AND SYLLABUS FOR PHYSICS	1067-1193
	COURSE STRUCTURE AND SYLLABUS FOR CHEMISTRY	1194-1362

	BOOK – III	
	COURSE STRUCTURE AND SYLLABUS FOR BOTANY	1363-1476
	COURSE STRUCTURE AND SYLLABUS FOR ZOOLOGY	1477-1505
	COURSE STRUCTURE AND SYLLABUS FOR COMPUTER SCIENCE	1506-1562
	COURSE STRUCTURE AND SYLLABUS FOR INFORMATION TECHNOLOGY	1563-1655
	COURSE STRUCTURE AND SYLLABUS FOR MICROBIOLOGY	1656-1838
	COURSE STRUCTURE AND SYLLABUS FOR BIOTECHNOLOGY	1839-1872
	<i>ASSESSMENT RUBRICS</i>	1873-1878

**I. CONFORMATION OF MINUTES OF THE PREVIOUS ACADEMIC COUNCIL
MEETING HELD ON 20.07.2022.**



THE MADURA COLLEGE

(Autonomous, Affiliated to Madurai Kamaraj University, Re-accredited (3rd Cycle) with 'A' Grade by NAAC)

MADURAI -625 011

MEETING OF THE ACADEMIC COUNCIL

Date : 20.07.2022 (Wednesday)

Venue: Seminar Hall

Time : 10.30a.m.

MINUTES OF THE ACADEMIC COUNCIL MEETING

A meeting of the Academic Council was held in the Seminar Hall on Wednesday, 20th July 2022 at 10.30 am.

Members Present

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

69) Dr. P. Gajendran
 70) Dr. M. Malarvizhi
 71) Dr. S.V. Karthikeyan
 72) Prof. S. Vidhyasankar
 73) Dr. R. Ramachandran
 74) Prof. S. Selvakumar
 75) Dr. P. Prasanna
 76) Dr. M. Boominathan
 77) Dr. M. HasmathFarzana
 78) Dr. J. Shanmugapriya
 79) Prof. S. ChellaPandian
 80) Dr. P. Kannan
 81) Dr. S. Karuppusamay
 82) Dr. S. GnaanaSaraswathi
 83) Prof. V. MeenakshiSundaram
 84) Dr. N. Janakiraman
 85) Dr. P. Jansi Rani
 86) Dr. M. Karpagajothi
 87) Dr. S. Saravanan

88) Dr. S. Dinakaran
 89) Dr. L.D. Devasree
 90) Dr. B. Latha
 91) Dr. C. Selvakumar
 92) Dr. P. Sivakumar
 93) Er. J. Rajendran
 94) Prof. R. Umasankari
 95) Dr. T. SreeRamkumar
 96) Dr. K. Kathirvelpandian
 97) Prof. C. Hema
 98) Dr. N. Paneerselvam
 99) Prof. K. Rajasaravanakumar
 100) Dr. R. Chitra
 101) Prof. G. Sreedevi
 102) Dr. P. Pandi
 103) Dr. R. Karthikeyan
 104) Prof. J. Premkumar
 105) Prof. S. Selvaulaganathan
 106) Mr. M. Venkataramam

SPECIAL INVITEE

Dr. N. SuriyaNarayanan

1. The meeting was called to order by the Principal and Chairman of the Academic Council (*Here after The Chairman*), Dr.J.Suresh, and the meeting started with the college prayer. The Chairman welcomed Sri.S.Sridharan, President, Madura College Board (MCB), Sri.S.Natanagopal, Secretary, MCB, Sri.N.Anand Srinivasan, Treasurer, MCB, University nominees: Dr.M.Thanagaraj and Dr.T.Dharmaraj, all Heads of the Departments (HoDs), Deans, Dr.N.Suriya Narayanan, Chief Coordinators (Self-Financing Stream), Controller of Examinations, Deputy Controller of Examinations, Co-ordinators (SF stream), special invitees and all other members of the Academic Council.

2. The Chairman, in his welcome address, overviewed the milestones of achievements of The Madura College after the conferment of Autonomy status. And with delight, he explained that our college was one among a few first set of colleges that received autonomy status from University Grants Commission in 1978. The uniqueness of our council is that all permanent teachers are the members of Academic council, which facilitate the involvement of every faculty in designing the curriculum related deliberations and understand the complexity of designing curriculum. He also emphasized that the role of Academic council is not only to design the curriculum but also involvement of framing academic policies of the college. He explained, with pride, that the 44 years of rich experience of the council resulted in the up-to-date curriculum design to meet the national and global standards.

3. The Minutes of the previous Academic Council meeting held on 17.06.2021 were confirmed and passed. The Chairman invited the Chairmen, Board of Studies (BoS) of all the Departments to present their resolutions.

4. Resolutions No. **1.1 to 1.9** were moved by **Dr.S.Dhanasamy**, Chairman & Head, Board of Studies (BoS), Tamil and seconded by **Dr.A.Atheeswari**. Dr.S.Dinakaran, queried the resolution 1.5., regarding the add-on course on Research Methodology. He explained that It was decided earlier to offer a course on Research Methodology as a compulsory course in all the Post-graduate programme in our college and the department proposing to offer the course as an add-on course. After a lengthy discussion it was decided **to withdraw the resolution 1.5**. After the queries raised by the members and a lengthy discussion, it was also suggested by the council to rewrite the resolutions 1.7. & 1.8

The members raised their queries on the modalities and standards of offering certificate courses and Diploma. Prof..S.Chellapandian questioned on the non-uniformity in the title of the courses as some department offer the course as certificate course and others as a diploma. The chairman explained that it is the departments' freedom to decide the nature of course as whether certificate or diploma. Dr.S. Muthukumar queried about the number of Units and hours for a diploma course. Prof.S.Sivaramakrishnan gave an overview about UGC regulations on offering diploma courses. Dr.S.Karuppasamy also clarified that Diploma is a program and certificate is a course. The chairman narrated the shortcoming of the resolution and directed the department to revise the number of courses/papers and lecture hours in a standard allocation and the council would accept after the revision.

Then, the motion was put to vote and CARRIED.

5. Resolution No. **2.1** was moved by **Prof.S.Murali**, Chairman & Head, Board of Studies in Hindi and seconded by **Dr.S.Dinakaran**. Prof.S.Sivaramakrishnan requested to include the word "students" in the resolution 2.1. Prof.S.Murali agreed to correct the resolution

Then the motion was put to vote and CARRIED.

6. Resolution No. **3.1**. was moved by **Prof. P. Manikandan**, Chairman & Head, Board of Studies in Sanskrit and seconded by **Prof.S.Murali**. Members unanimously agreed the resolution.

Then, the motion was put to vote and CARRIED.

7. Resolutions No. **4.1 to 4.12.** were moved by **Dr.R.Subramony**, Chairman & Head, Board of Studies in English and seconded by **Dr.Sheela P.Karthick**. The motion was then thrown open for discussion.

The members queried about the norms for the minimal number of departments to offer multidisciplinary course (MDC). The Chairman clarified that the MDC will be at PG programme and Inter-disciplinary course (IDC) at UG programme, and minimal number of departments are 3 and 2 respectively. Further, he clarified that the MDC offered by the Department of English was considered as a special case and the same was discussed and got approved in the HoD meeting. Dr.T.Dharmaraj, University nominee, suggested that the MDC can be offered with the departments/disciplines (specialized resources persons of Environment, Ecology etc.) and he further opined that Disciplines cannot be equated with departments. The Chairman clarified the need for following uniform guidelines for MDC and IDC for the whole college and he also further detailed about workload sharing and other problems in implementation.

Dr.T.Dharmaraj suggested to rephrase the term as Inter-departmental and multi-departmental course. The chairman clarified that we followed the standard usage of the term followed in other higher educational institutions. When, Dr.R.Subramony read the addendum 4.13. and 4.14. The members suggested to include the details about changing of title of course and asked to rewrite the resolutions. Dr.A.Xavier queried about resolution 4.8., about the contradiction on inclusion of more additional elective courses and workload allotment. He further argued that the elective courses offered during the I year PG were already approved in the previous academic council. Prof.S.Sivaramakrishnan explained that elective courses offered during II year PG alone is submitted before the council for approval and suggested to rewrite the resolution. Dr.R.Subramony agreed to rewrite the resolutions.

Then the motion was put to vote and CARRIED.

8. Resolutions No. **5.1 to 5.7.** were moved by **Dr.S.Theenathayalan**, Chairman & Head, Board of Studies in Economics, and seconded by **Dr.P.Kannan**. The motion was then thrown open for discussion.

While reading the resolution on MDC (Resolution. 5.4.), Dr.S.Theenathayalan appealed to the council to change the modality for conducting tests as the present system allows only two departments. The chairman reminded about the decision taken during the HoD meeting and also clarified that the third department can handle the other internal components such as quiz/assignment/seminar etc. as the same was approved in the HoD meeting. He added. The Chairman requested to follow the standard guidelines also by the Economics department.

Dr.S.Theenathayalan appealed to chairman for granting permission to keep two department for offering MDC as a special case for the Economics department. The chairman explained that the same

cannot be allowed at this stage since it was passed in BoS and the third department can't find a pair department to go further. He also gave a general announcement that the resolution passed in the BoS cannot be changed at the later stage at academic council and requested the departments to concretely finalize the resolution and get approved in BoS and submit the same to Academic council. He again advised the Economics department to follow the present guidelines of conducting two tests by the two departments (one each) and the other department can handle other internal components of about 8-10 types as suggested by the UGC and other Higher education institutions like NAAC otherwise the department can follow that standard format as suggested and decided in the Heads meeting.

Dr.S.Theenathayalan agreed to accept the change.

Then the motion was put to vote and CARRIED.

9. Resolution Nos. **6.1. to 6.10.** were moved by **Dr.A.Mayil Murugan**, Chairman & Head, Board of Studies in Commerce, and seconded by **Dr.S.Selvakumar**. Dr.S.Muthukumar queried about resolution. 6.1. and asked whether the courses offered to all students of various programmes or for commerce and related programmes. Dr.A.Mayil Murugan replied that it is offered to all the students of The Madura college. Prof.S.Chellapandian suggested to include the word 'all students' and it may cover the M.Phil. scholars also. The attainment of the course could be an another livelihood option for the students and by considering the true spirit of the department this resolution can be considered as such, He appended. Dr.S.Muthukumar queried on the resolution 6.10 about whether the course title alone changed or the contents too. Dr.A.Mayil murugan replied that the title alone changed.

Then the motion was put to vote and CARRIED.

10. Resolutions No.**7.1 to 7.12.** were moved by **Dr.S.Muthukumar**, Chairman & Head, Board of Studies in Mathematics and seconded by **Dr.C.Thangapandi**. Prof. S. Chellapandian, reminded to include the word "and onwards" after the academic year in the resolution. Regarding resolution 7.5., Dr.S.Theenatahayalan enquired about slight change observed in the programme structure for M.Sc. Mathematics self-financed stream (SF stream). He also reiterated that the same pattern of programme structure, syllabi followed in all the courses offered in both Aided and SF stream by the college. The chairman clarified that the Core and allied courses should be uniform and the changes can be allowed in elective and Skill based elective courses. The Chairman requested Dean (Academics) to clarify further. Prof.S.Sivaramakrishnan clarified that the course on "Research Methodology" could be included in either in Project or as elective course. It could not be offered as Add on course. Dr.S.Muthukumar agreed for the change.

Then the motion was put to vote and CARRIED.

11. Resolutions No. **8.1 to 8.13.** were moved **Dr.P.Vetriselvi**, Chairman & Head, Board of Studies in Statistics and seconded by **Dr.P.Madhanagopal**. Dr.S.Theenathayalan suggested to have a course title as “Population statistics” instead “Quantitative population studies” for a certificate course. Dr.P.Vetriselvi agreed for the change of title. Members queried about the usage of the term “Statistical Practicals” Dr.S.Theenathayalan and Dr.S.Dinakaran suggested to have a title as “Statistics Practical”. But Dr.P.Vetriselvi explained that the term “Statistical Practical” is widely used by the statisticians and also the term is used in curriculum of many higher education institutions offering statistics programmes. The forum agreed the explanation.

Then the motion was put to vote and CARRIED.

12. Resolutions No. **9.1 to 9.6.** were moved **Dr.M.Prema Rani**, Chairman & Head, Board of Studies in Physics, and seconded by **Prof.V.Meenakshi Sundaram**. Sri.S.Natanagopal, Secretary, MCB questioned the usage of the term “some appliances” in the title of certificate course. The Chairman clarified that since we could not offer the course on designing and servicing of all appliances, we give the course on some appliances.

Then the motion was put to vote and CARRIED.

13. Resolutions No. **10.1 to 10.6** were moved by **Dr.A.Xavier**, Chairman & Head, Board of Studies in Chemistry and seconded by **Dr.P.S.Harikrishnan**. While presenting resolution 10.2, Dr.S.Muthukumar suggested to give the resolution as two separate parts. Dr.A.Xavier agreed for the change. The motion was then thrown open for discussion. While presenting resolution, 10.5., The chairman questions the need of passing this resolution. Dr.A.Xavier explained that it is needed since the ancillary course structure is to be uniform for ancillary students of B.Sc. Botany and physics students. Further the ancillary course structure is similar for ancillary students from B.Sc. Zoology and Mathematics. While presenting resolution 10.6., Dr.S.Dinakaran queried that regarding Forensic Analysis (21P1CME2) course, whether the concentration was on chemistry aspects or also the biological components of Forensic analysis. Dr.A.Xavier replied that only chemistry component alone would be taught. Dr.S.Muthukumar queried about the status of syllabi of additional elective courses annexed in the concerned elective, which now converted as Add on course. Prof.S.Sivaramakrishnan explained that the Elective along with options in III semester removed totally, he explained.

Then the motion was put to vote and CARRIED.

14. Resolutions Nos.**11.1 to 11.6.** were moved by **Prof.S.Chellapandian**, Chairman & Head, Board of Studies in Botany and seconded by **Dr.P.Kannan**. The motion was then thrown open for discussion. As suggested, it was decided to split the resolution “11.1. as 11.1a & 11.1.b. and the first resolution was on ratification and second one about the introduction of syllabi respectively. While reading resolution 11.5., Dr.S.Dinkaran questioned that need of PG Diploma in Plant Identification since courses on taxonomy is practised in UG and PG programmes. Dr.S.Theenathayalan also expressed the same opinion. Prof.S.Chellapandian replied that the depth at which the subjects were taught in higher classes vary from the level of teaching in schools. Hence, he asked the members to understand the depth of the course taught instead of the title. He argued his stand with examples from chemistry programmes, by citing organic chemistry, inorganic chemistry and physical chemistry in UG and PG programmes of Chemistry. Everyone agreed the concept and examples pointed by the HoD of Botany. Then the motion was put to vote and CARRIED.

15. Resolutions No.**12.1 to 12.2** were moved by **Dr.S.Dinakaran**, Chairman & Head, Board of Studies in Zoology and seconded by **Dr.L.D.Devasree**. He read the resolution with suggested revisions. The motion was then thrown open for discussion. Then the motion was put to vote and CARRIED.

16. Resolutions No.**13.1 to 13.7.** were moved by **Er.J.Rajendran**, Chairman & Head, Board of Studies in Computer Science and seconded by **Prof.R.Umasankari**. The motion was then thrown open for discussion. The members felt that the resolution 13.4 was repetitive. Hence, the **resolution 13.4 was withdrawn**. Dr.S.Muthukumar, queried of resolution 13.5., and the need of a different pattern by including project & viva-voce as a separate component. Er.J.Rajendran explained the need of Project and viva-voce as separate components for the UG students of computer science. Since members queried on the necessity of resolution 13.6, Er.J.Rajendran, with a concern of The chairman, **withdrawn resolution 13.6**. Then the motion was put to vote and CARRIED.

17. Resolutions No.**14.1 to 14.6.** were moved by **Prof.K.Rajasaravanakumar**, Chairman & Head, Board of Studies in Information Technology and seconded by **Dr.N.Paneerselvam**. Er.J.Rajendran questioned about the inclusion of Project in workload in sixth semester. The chairman also clarified that project component could not be included in the regular workload and suggested the department to revise

the syllabi and discuss in the Board of Studies and get ratified in the next academic council meeting. Prof.K.Rajasaravanakumar agreed for the revision. Then the motion was put to vote and CARRIED.

18. Resolutions No.**15.1 to 15.6.** were moved by **Dr.N.Paneerselvam**, Chairman & Head, Board of Studies in Microbiology and seconded by **Prof.K.Rajasaravanakumar**. While passing resolution 15.3., Dr.S.Mutkukumar requested the BoS Chairman to listout the changes to be done in the mentioned courses in the resolution. The Chairman also appended that the departments could not do major changes in the content of corepapers. He also requested the department to mention the list of changes in the resolution. Dr.N.Paneerselvam agreed for the revision. Then the motion was put to vote and CARRIED.

19. Resolutions No.**16.1 to 16.4.** were moved by **Dr.N.Paneerselvam**, Chairman & Head, Board of Studies in Biotechnology and seconded by **Prof.K.Rajasaravanakumar**. After a long deliberations, The Chairman requested the department to reframe the resolutions Dr.N.Paneerselvam agreed for the revision. Then the motion was put to vote and CARRIED.

20. Resolution No.**17.1.** was 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.

21. The Chairman requested the University nominees, Dr.M.Thangaraj and Dr.T.Dharmaraj to give their observations and remarks. Dr.M.Thangaraj expressed his views about the deliberations of the academic council as follows:

1. Thanked all for the active deliberations and felt very happy to be a part of it.
2. He also congratulated and appreciated the meticulous planning in designing the curriculum. The voluminous courses offered by the college shows its rich experience.
3. Expressed his appreciation in adopting the Outcome Based Education (OBE) that help to get good scores in NAAC evaluation.
4. He also opined for the uniformity in hours and credits and viewed that computation is not uniform.

5. Suggested to include the contents/topics available in the particular web reference that enable the students to refer specific reference
6. He also stressed the departments to concur with the vision and mission of the college (not the vision and mission of the department as separate entity).
7. Also suggested to mention only 2-3 text books for the syllabi that would help poor students to buy and read.
8. Noticed a few typographical errors that should have been avoided, He also opined to avoid superfluous discussion in the forum.

Dr.T.Dharmaraj expressed his views as follows:

1. Appreciated the college for the meticulous planning and execution.
 2. Expressed his expectation on the valuation methods for the attainments accomplished.
 3. He suggested to have discussions on the structure and quality of curriculum.
 4. He felt happy about implementation of OBE, However, he opined to keep in mind on status of Tamilnadu government on implementation of OBE since it could ease approval of the programmes from Tamilnadu government.
 5. He again stressed to look into pedagogical and structural changes that could be discussed more in the forum.
22. The Member secretary, Dr.R.Eswaran proposed vote of thanks .
23. The Chairman adjourned the Academic Council followed by the National Anthem.



Dr.R.Eswaran

Member Secretary



Dr.J.Suresh

Principal & Chairman

II. BUSINESS BROUGHT FORWARD BY THE CHAIRMAN

III. RESOLUTIONS BROUGHT FORWARD BY HEADS OF VARIOUS DEPARTMENTS

1) FROM THE BOARD OF STUDIES OF TAMIL DEPARTMENT

Dr.S.Dhanasamy, Chairman, Board of Studies in Tamil, shall move and **Dr.A.Atheeswari** shall second the following resolutions, passed in the Board of Studies meeting held on 19.05.2023.

- 1.1. Resolved to ratify the Revised Part –I Tamil language syllabus based on TANSCHÉ model curriculum for first year B.A/B.Sc./B.com_Programme for students who join in these programmes from the Academic year 2023-24 **(pp 1-16)**.
- 1.2. Resolved to ratify the Revised curriculum and syllabus based on TANSCHÉ (Tamilnadu State Council for Higher Education) model curriculum for first year B.A Tamil_Programme for students who join the programme from the Academic year 2023-24 **(pp 17-70)**.
- 1.4. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year M.A Tamil programme for Students who join the programme from the Academic Year 2023-24 **(pp 71-150)**.
- 1.5. Resolved to ratify the syllabus for the Discipline Specific Elective courses to be offered to B.A. and M.A. Tamil who join their respective programmes from the Academic year 2023-24
(pp 32-36, 57-60; 99-109, 140-150).
- 1.6. Resolved to ratify 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 **(pp 151-156)**.
- 1.7. Resolved to ratify the syllabus for Skill Enhancement Courses to be offered to the students of B.A. Tamil and M.A. Tamil Programmes who join these programmes from the Academic Year 2023-24 **(pp 42-46; 61-70, 110-115)**.
- 1.8. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programmes offered by the department from the year 2023-24 **(pp 1873-1878)**.

**Resolutions 1.3. – 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 19.05.2023.

- 2.1. Resolved to ratify the Revised curriculum and syllabus for Part 1 Language Hindi based on TANSCHÉ model curriculum for first year B.A./ B.Sc./ B.Com./ Programme(s) for students who join the programme from the Academic year 2023-24 (**pp 157-167**).
- 2.2. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the courses offered by the department from the year 2023-24 (**pp 1873-1878**).

3) FROM THE BOARD OF STUDIES OF SANSKRIT DEPARTMENT

Prof.P.Manikandan, Chairman, Board of Studies in Sanskrit, shall move and **Prof.S.Murali** shall second the following resolutions, passed in the Board of Studies meeting held on 19.05.2023.

- 3.1. Resolved to ratify the revised curriculum and syllabus for Part 1 Language Sanskrit based on TANSCHÉ model curriculum for first year B.A/ B.Sc./ B.Com./ Programme(s) for students who join the programme from the Academic year 2023-24 (**pp 168-180**).
- 3.2. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the courses offered by the department from the year 2023-24 (**pp 1873-1878**).

4) FROM THE BOARD OF STUDIES OF ENGLISH DEPARTMENT

Dr.Sheela P.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 19.5.2023

- 4.1. Resolved to ratify the Revised curriculum and syllabus for Part – II English based on TANSCHÉ model curriculum for the first year B.A/ B.Sc./ B.Com programmes for students who join the programme from the Academic year 2023-24 (**pp 181-198**).

- 4.2. Resolved to ratify the Revised curriculum and syllabus based on TANSCHÉ model curriculum for the first year B.A. English programme for students who join the programme from the Academic year 2023-24 **(pp 199-246)**.
- 4.3. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for the first year M.A. English programme for students who join the programme from the Academic Year 2023-24 **(pp 247-303)**.
- 4.4. Resolved to ratify the syllabus for the Generic elective courses to be offered to the students of BA English programme who join the programme from the Academic year 2023-24 **(pp 216-219, 236-239)**.
- 4.5. Resolved to ratify the syllabus for Skill Enhancement Courses to be offered to the students of B.A English programme who join the programme from the Academic Year 2023-24 **(pp 220-223, 240-246)**.
- 4.6. Resolved to ratify the syllabus for Skill Enhancement Courses to be offered to the students of M.A. English programme who join the programme from the Academic Year 2023-24 **(pp 275-278)**.
- 4.7. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programme offered by the department from the year 2023-24 **(pp 1873-1878)**.
- 4.8. Resolved to ratify the change of course type of “Life Skills” as Certificate Course instead of Add-on Course.

5) FROM THE BOARD OF STUDIES OF ECONOMICS DEPARTMENT

Dr.S.Theenathayalan, Chairman, Board of Studies in Economics, shall move and **Dr.P.Kannan** shall second the following resolutions, passed in the Board of Studies meeting held on 19.05.2023.

- 5.1. Resolved to ratify the revised curriculum and syllabi based on TANSCHÉ model curriculum for first year B.A. Economics Programme for students who join the programme from the Academic year 2023-24 **(pp 304-347)**.

- 5.2. Resolved to ratify the revised curriculum and syllabi based on TANSCHÉ model curriculum for first year M.A. Economics programme for Students who join the programme from the Academic Year 2023-24 **(pp 351-428)**.
- 5.3. Resolved to ratify the syllabi for the Generic Elective Courses (GEC) to be offered to the students of I – Year B.A. Economics and I – Year M.A. Economics programmes who join their respective programmes from the Academic year 2023-24 **(pp 316-319, 336-339, 369-388, 409-428)**.
- 5.4. Resolved to ratify 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 and onwards **(pp 348-350)**.
- 5.5. Resolved to ratify the syllabi for Skill Enhancement Courses (SEC) to be offered to the students of I-Year B.A. Economics programme who join from the Academic Year 2023-24 **(pp 320-323, 340-347, 389-393)**.
- 5.6. Resolved to ratify the syllabi 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 **(pp 429-433)**.
- 5.7. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programme offered by the department from the year 2023-24 **(pp 1873-1878)**.

6) FROM THE BOARD OF STUDIES OF COMMERCE DEPARTMENT

Dr.A.Mayil Murugan, Chairman, Board of Studies in Commerce, shall move and **Dr.S.Selvakumar** shall second the following resolutions, passed in the Board of studies meeting held on 19.05.2023.

- 6.1. Resolved to ratify the revised curriculum and syllabi based on TANSCHÉ model curriculum for first year B.Com (General) Programme for students who join the programme from the Academic year 2023-24 **(pp 434-437, 441-586)**.
- 6.2. Resolved to ratify the revised curriculum and syllabi based on TANSCHÉ model curriculum for first year B.Com (Professional Accounting) Programme for students who join the programme from the Academic year 2023-24 **(pp 434-436, 438, 441-586)**.

- 6.3. Resolved to ratify the revised curriculum and syllabi based on TANSCHÉ model curriculum for first year B.Com (Banking and Insurance) Programme for students who join the programme from the Academic year 2023-24 **(pp 434-436, 439, 441-586)**.
- 6.4. Resolved to change of nomenclature as B.Com (Financial Marketing Analytics) as per recent guideline of TANSCHÉ in the place of B.Com (Capital Markets) from the Academic Year 2023-24, subject to the approval of Madurai Kamaraj University **(P 440)**
- 6.5. Resolved to ratify the Revised curriculum and syllabi based on TANSCHÉ model curriculum for first year B.Com (Financial Marketing Analytics) Programme for students who join the programme from the Academic year 2023-24 **(pp 434-436, 440, 441-586)**.
- 6.6. Resolved to ratify the revised curriculum and syllabi based on TANSCHÉ model curriculum for first year M.Com. programme for Students who join the programme from the Academic Year 2023-24 **(pp 595-690)**.
- 6.7. Resolved to ratify Multi-Disciplinary Course (Commerce, Mathematics and Computer Science) on “Behavioural Applications and Technology” for B.Com students those who have joined in the Academic year 2020-21, 2021-22 and 2022-23 under 2020 Curriculum Regulations.
- 6.8. Resolved to ratify Multi-Disciplinary Course (Commerce, Statistics & Economics) on “Insurance, Actuarial Statistics and Economy” for M.Com students those who have joined in the Academic year, 2021-22 and 2022-23 under 2021 Curriculum Regulations.
- 6.9. Resolved to ratify the Revised curriculum and syllabi based on TANSCHÉ model curriculum for first year B.A. (Economics) Programmes Generic Elective Courses Viz., ‘Fundamentals of Management’ during I Semester and ‘Introduction to E- Commerce’ during II Semester for students who join the programme from the Academic year 2023-24 **(pp 587-594)**.
- 6.10. Resolved to pass the revised curriculum and syllabi based on TANSCHÉ model curriculum for first year Post Graduate Programme as Non Major Elective Courses Viz., ‘Managerial Skills’ during II Semester and ‘Advertising and Salesmanship’ during III Semester for students who join the programme from the Academic year 2023-24 **(pp 685-689)**
- 6.11. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programme offered by the department from the year 2023-24 **(pp 1873-1878)**.

7) FROM THE BOARD OF STUDIES OF MATHEMATICS DEPARTMENT

Dr.S.Muthukumar, Chairman, Board of Studies in Mathematics, shall move and **Dr.C.Thangapandi** shall second the following resolutions, passed in the Board of studies meeting held on 19.05.2023.

- 7.1. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year B.Sc. Mathematics Programme for students who join the programme from the Academic year 2023-24 **(pp 691-750)**.
- 7.2. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year M.Sc. Mathematics programme for Students who join the programme from the Academic Year 2023-24 **(pp 751-817)**.
- 7.3. Resolved to ratify 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 **(pp 730-750)**.
- 7.4. Resolved to ratify the syllabus for Skill Enhancement Courses offered to the students of B.Sc. Mathematics who join their respective programmes from the Academic year 2023-24 **(pp 703-707, 721-729, 814-817)**.
- 7.5. Resolved to ratify 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 **(pp 818-821)**.
- 7.6. Resolved to pass the syllabus for “Certificate Course entitled “Mathematical Transfiguration” to under graduate and post graduate students **(pp 822-823)**.
- 7.7. Resolved to pass the syllabus for “Certificate Course entitled “Reasoning Enhancement” to under graduate and post graduate students **(pp 824-825)**.
- 7.8. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programmes offered by the department from the year 2023-2024 **(pp 1873-1878)**.
- 7.9. Resolved to Ratify the inclusion of one chapter and correction of sections in Chapters in the recommended book for the paper “Numerical Methods”, subject code 20U6MME2(A) B.Sc., Mathematics students who joined the program in the Academic year 2020-21 **(pp 826-833)**.

- 7.10. Resolved to Ratify the corrections in the K-Levels mentioned in the tables of Formative and Summative Examination pattern in the paper “Linear Algebra”, subject code 21P2MMC7 M.Sc., Mathematics Students who joined the program in the Academic year 2021-22 **(pp 834-840)**.

8) FROM THE BOARD OF STUDIES OF STATISTICS DEPARTMENT

Dr.P.Vetriselvi, Chairman, Board of Studies in Statistics, shall move and **Dr.P.Madhanagopal** shall second the following resolutions, passed in the Board of studies meeting held on 19.05.2023.

- 8.1. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year B.Sc. Statistics Programme for students who join the programme from the Academic year 2023-24 and onwards **(pp 841-857, 866-879, 885-893)**.
- 8.2. Resolved to ratify the revised curriculum and syllabus for third year B.Sc. Statistics for Students who joined the programme from the Academic Year 2021-22 **(pp 894-978)**.
- 8.3. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year M.Sc. Statistics Programme for Students who join the programme from the Academic Year 2023-24 and onwards **(pp 979-1052)**.
- 8.4. Resolved to ratify 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 and onwards **(pp 858-862, 880-884)**.
- 8.5. Resolved to ratify 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 and onwards **(pp 1053-1055)**.
- 8.6. Resolved to ratify the syllabus for Skill Enhancement Courses to be offered to the students of B.Sc. Statistics and M.Sc. Statistics Programmes who join these programmes from the Academic Year 2023-24 and onwards **(pp 863-865, 885-890, 1018-1020)**.
- 8.7. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programmes offered by the department from the year 2023-24 and onwards **(pp 1873-1878)**.

- 8.8. Resolved to introduce the certificate courses to Post Graduate students from the Academic Year 2023-2024 (**pp 1056-1057**).
- Statistics for Competitive Examination
 - Documentation and Computation in MS office
- 8.9. Resolved to ratify the content of all units in the paper titled **Sampling Techniques** (20U3SMC6) offered to second year B.Sc. statistics students in the III semester who joined the programme from the Academic Year 2021-22 (**pp 1058-1062**).
- 8.10. Resolved to ratify the Formative and Summative Assessment Pattern of Non - Major Elective II **Matrix Algebra** (20U4SNM2) offered to second year B.Sc. statistics students in the IV semester who joined the programme from the Academic Year 2021-22 (**pp 1063-1066**).

9) FROM THE BOARD OF STUDIES OF PHYSICS DEPARTMENT

Dr.M.Prema Rani, Chairman, Board of Studies in Physics, shall move and **Mr.V.Meenakshi Sundaram** shall second the following resolutions, passed in the Board of studies meeting held on 19.05.2023.

- 9.1. Resolved to ratify the revised curriculum and syllabi based on TANSCHÉ model curriculum for first year B.Sc Physics Programme for students who join the programme from the Academic year 2023-24 (**pp 1067-1083, 1092-1107, 1115-1122**).
- 9.2. Resolved to ratify the revised curriculum and syllabi based on TANSCHÉ model curriculum for first year M.Sc Physics programme for Students who join the programme from the Academic Year 2023-24 (**pp 1123-1189**).
- 9.3. Resolved to ratify the syllabi 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 (**pp 1084-1091, 1108-1114**).
- 9.4. Resolved to ratify the syllabi 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 (**pp 1190-1193**).
- 9.5. Resolved to ratify the syllabi for Skill Enhancement Courses to be offered to the students of B.Sc and M.Sc Physics Programme(s) who join these programmes from the Academic Year 2023-24 (**pp 1092-1095, 1115-1122, 1157-1160**).

- 9.6. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programmes offered by the department from the year 2023-24 **(pp 1873-1878)**.

10) FROM THE BOARD OF STUDIES OF CHEMISTRY DEPARTMENT

Dr.A.Xavier, Chairman, Board of Studies in Chemistry, shall move and **Dr.P.S.Harikrishnan** shall second the following resolutions, passed in the Board of studies meeting held on 19.05.2023.

- 10.1. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year B.Sc., Chemistry Programme for students who join the programme from the Academic year 2023-24 **(pp 1194-1226, 1248-1261)**.
- 10.2. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year M.Sc., Chemistry programme for Students who join the programme from the Academic Year 2023-24 **(pp 1278-1358)**.
- 10.3. Resolved to ratify the syllabus for the Generic elective courses to be offered to the students of programmes B.Sc., (Mathematics and Physics) other than their programme of study and who join their respective programmes from the Academic year 2023-24 **(pp 1227-1230, 1235-1240, 1245-1247)**.
- 10.4. Resolved to ratify the syllabus for the Generic elective courses to be offered to the students of programmes B.Sc., (Botany and Zoology) who join their respective programmes from the Academic year 2023-24 **(pp 1231-1234, 1235-1236, 1241-1247)**.
- 10.5. Resolved to ratify the syllabus for the Generic elective courses to be offered to the students of programmes (SF stream) B.Sc., (Biotechnology) who join their respective programmes from the Academic year 2023-24 **(pp 1262-1277)**.
- 10.6. Resolved to ratify the syllabus for foundation course (FC) to be offered in first semester of 1st B.Sc., Chemistry who joined the programme from the Academic year 2023-2024 **(pp 1213-1216)**.
- 10.7. Resolved to ratify the syllabus for Skill Enhancement Courses (SEC) to be offered to students of B.Sc., Chemistry Programme who join these programme from the Academic Year 2023-24 **(pp 1248-1261)**.

- 10.8. Resolved to ratify the syllabus for Skill Enhancement Courses (SEC) to be offered in M.Sc., Chemistry Programme(s) who join the programme from the Academic Year 2023-24 **(pp 1324-1327)**.
- 10.9. Resolved to ratify 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 **(pp 1359-1362)**.
- 10.10. Resolved to ratify the teaching and evaluation pattern and Rubrics for UG and PG students who joined these programmes from the Academic Year 2023-24 **(pp 1873-1878)**.

11) FROM THE BOARD OF STUDIES OF BOTANY DEPARTMENT

Prof.S.Chellapandian, Chairman, Board of Studies in Botany, shall move and **Dr.P.Kannan** shall second the following resolutions, passed in the Board of studies meeting held on 19.05.2023.

- 11.1. Resolved to introduce the revised syllabi and question paper pattern based on TANSCHÉ model curriculum for those students who join B.Sc. Botany Programme from the Academic year 2023-24 and onwards **(pp 1363-1398)**.
- 11.2. Resolved to introduce the revised syllabi and question paper pattern based on TANSCHÉ model curriculum for those students who join M.Sc. Botany Programme from the Academic year 2023-24 and onwards **(pp 1415-1472)**.
- 11.3. Resolved to introduce the revised syllabi and question paper pattern for Ancillary Botany, which is hereafter called Generic Elective Courses, for those students who join B.Sc. Zoology Programme from the academic year 2023-24 and onwards **(pp 1399-1414)**.
- 11.4. Resolved to introduce the syllabi for Skill Enhancement Courses, hitherto called NME to be offered to the students of programmes other than their Major subject for those students who join from the Academic Year 2023-24 and onwards **(pp 1473-1476)**.
- 11.5. Resolved to introduce the syllabi for Skill Enhancement Courses to be offered to the students who join B.Sc. and M.Sc. Botany Programme(s) from the Academic Year 2023-24 and onwards **(pp 1374-1378, 1391-1398, 1444-1448)**.
- 11.6. Resolved to introduce the components of assessment and the associated rubrics of assessment for students who join the programmes offered by the department from the year 2023-24 and onwards **(pp 1873-1878)**.

- 11.7. Resolved to change the title of the paper in the VI semester (Major Elective IV) as Ethnobotany and Pharmacognosy instead of Ethnobotany and Herbal Botany.
- 11.8. Resolved to replace the blueprint for question paper setting for the course code 20U6BSM (Renewable Energy) with the blue-print of core papers as in the Academic Council page number 1778 of Vol.II.

12) FROM THE BOARD OF STUDIES OF ZOOLOGY DEPARTMENT

Dr.S.Dinakaran, Chairman, Board of Studies in Zoology, shall move and **Dr.L.D.Devasree** shall second the following resolutions, passed in the Board of studies meeting held on 19.05.2023.

- 12.1. Resolved to ratify the revised curriculum and I-semester syllabus based on TANSCHÉ model curriculum for first year B.Sc. Zoology Programme for students who join the programme from the Academic year 2023-24 (**pp 1477-1498**)
- 12.2. Resolved to ratify the syllabus for the Generic elective courses to be offered to the students of programme other than their programme of study and who join their respective programme from the Academic year 2023-24 (**pp 1499-1505**).
- 12.3. Resolved to ratify the syllabus for Skill Enhancement Courses to be offered to the students who join the programme from the Academic year 2023-24 (**pp 1495-1498**).
- 12.4. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programme offered by the Department of Zoology from the year 2023-24 (**pp 1873-1878**).

13) FROM THE BOARD OF STUDIES OF COMPUTER SCIENCE DEPARTMENT

Er.J.Rajendran, Chairman, Board of Studies in Computer Science, shall move and **Prof.R.Umasankari** shall second the following resolutions, passed in the Board of studies meeting held on 19.05.2023.

- 13.1. Resolved to pass the Revised curriculum and syllabus based on the TANSCHÉ model curriculum for first-year Semester I and Semester II of B.Sc. Computer Science Programme for students who join the programme from the Academic year 2023-24 (**pp 1506-1562**).

- 13.3. Resolved to pass the syllabus for Skill Enhancement Courses to be offered to the students of I year B.Sc. Computer science programme those who join from the Academic year 2023-24 **(pp 1527-1532, 1552-1562)**.
- 13.4. Resolved to pass the Assessment rubrics to the students of B.Sc. Computer Science Programme who join from the Academic Year 2023-24 **(pp 1873-1878)**.

**Resolutions 13.2. - withdrawn*

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 19.05.2023.

- 14.1. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year B.Sc. Information Technology Programme for students who join the programme from the Academic year 2023-24 **(pp 1563-1572, 1578-1588, 1594-1600)**.
- 14.2. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year M.Sc. Computer Science programme for Students who join the programme from the Academic Year 2023-24 **(pp 1601-1652)**.
- 14.3. Resolved to ratify the syllabi 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 **(pp 1573-1577, 1589-1593)**.
- 14.4. Resolved to ratify the syllabi 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 **(pp 1653-1655)**.
- 14.5. Resolved to ratify the syllabi for Skill Enhancement Courses to be offered to the students of B.Sc. Information Technology and M.Sc. Computer Science Programmes who join these programmes from the Academic Year 2023-24 **(pp 1581-1583, 1594-1600, 1626-1628)**.
- 14.6. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programmes offered by the department from the Academic Year 2023-24 **(pp 1873-1878)**.

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 19.05.2023.

- 15.1. Resolved to pass the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year B.Sc. Microbiology Programme for students who join the programme from the Academic year 2023-24 (**pp 1656-1669, 1679-1699, 1709-1720**).
- 15.2. Resolved to pass the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year M.Sc. Microbiology programme for students who join the programme from the Academic Year 2023-24 (**pp 1721-1833**).
- 15.3. 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 (**pp 1670-1678, 1700-1708**).
- 15.4. Resolved to ratify the syllabus for Skill Enhancement Courses to be offered to the students of B.Sc and M.Sc. Microbiology Programme(s) who join these programmes from the Academic Year 2023-24 (**pp 1679-1684, 1709-1720, 1775-1779**).
- 15.5. Resolved to ratify 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 (**pp 1834-1838**).
- 15.6. Resolved to pass the components of assessment and the associated rubrics of assessment for students who join the programmes offered by the department from the year 2023-24 (**pp 1873-1878**).

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 of Biotechnology held on 19.05.2023.

- 16.1. Resolved to ratify the revised curriculum and syllabus based on TANSCHÉ model curriculum for first year B.Sc. Biotechnology Programme for students who join the programme from the Academic year 2023-24 (**pp 1839-1863**).

- 16.2. Resolved to ratify the syllabus for the Generic elective courses to be offered to the students of programme other than their programme of study and who join their respective programme from the Academic year 2023-24 (**pp 1864-1872**)
- 16.3. Resolved to ratify the syllabus for Skill Enhancement Courses to be offered to the students of B.Sc. Biotechnology Programme who join the programme from the Academic Year 2023-24 (**pp 1852-1857**)
- 16.4. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programme offered by the Department of Biotechnology from the year 2023-24 (**pp 1873-1878**).

17) FROM DEAN (ACDEMICS)

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

- 17.1. Resolved to ratify the components of assessment and the associated rubrics of assessment for students who join the programmes offered by the Institutions from the academic year 2023-24 and onwards (**pp 1873-1878**).
- 17.2. Resolved to implement evaluation of attainment of outcomes through evaluation of direct and indirect attainments in both formative assessment and summative examinations for students who join all programmes from the academic year 2023-24 and onwards.

IV. Any Other Subject



Dr. R. Eswaran
Member Secretary



Dr. J. Suresh
Principal & Chairman



DEPARTMENT OF MATHEMATICS

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 semesters (B.Sc. Mathematics)

Allied Courses

I and II semesters (M.Sc. Mathematics)

THE MADURA COLLEGE
Department of Mathematics

VISION

To train the students so that they are strong in logic, which enables them to approach, analyze and solve any problem, both scientific and sociological, in an unbiased manner and to enhance the quantitative and analytical skill.

MISSION

- To provide an environment where students can learn and become an efficient and accurate problem solver of Mathematics and Mathematical applications.
- To make the students as Mathematical thinkers and enable them to become a long time learners of Mathematics.
- To make the students to have core knowledge and able to correlate this core mathematical knowledge with other disciplines

PROGRAMME OUTCOMES FOR B.Sc. GRADUATES:

At the end of the program the graduates will be able to

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:

PSO1: Acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.

PSO2: Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.

PSO3: To prepare the students who will demonstrate respectful engagement with other’s ideas, behaviors, beliefs and apply diverse frames of references to decisions and actions. To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organization

The Madura College (Autonomous), Madurai – 625 011

Department of Mathematics

UG Programme Structure

SEMESTER - I

Part	Course Description	Course Code	Hours per week	Credit
I	Language - I Tamil / Hindi / Sanskrit	23U1TLAN1/23U1HLAN1/23U1SLAN1	6	3
II	Language - II English	23U1NENG1	6	3
III	Core Course - 1 (CC1)-Algebra & Trigonometry	23U1MCCT1	4	4
	Core Course - 2 (CC2)-Differential Calculus	23U1MCCT2	4	4
	Generic Elective - 1 (EC1)-Allied Mathematics -1(PHYSICS)	23U1MGET1 (P)	6	5
	Generic Elective - 1 (EC1)- Numerical Methods(Computer Science)	23U1MGET1 (D)		
IV	Skill Enhancement Course (SEC1)- Fourier Series	23U1MSED1	2	2
	Foundation course (FC)- Bridge Mathematics	23U1MFCT1	2	2
	Total		30	23

SEMESTER - II

Part	Course Description	Course Code	Hours per week	Credit
I	Language - I Tamil / Hindi / Sanskrit	23U2TLAN2/23U2HLAN2/23U2SLAN2	6	3
II	Language - II English	23U2NENG2	6	3
III	Core Course - 3 (CC3)-Analytical Geometry	23U2MCCT3	4	4
	Core Course - 4(CC4)- Integral Calculus	23U2MCCT4	4	4
	Generic Elective - 2 (EC2)Allied Mathematics -2(PHYSICS)	23U2MGET2 (P)	6	5
	Generic Elective - 2 (EC2)Graph Theory And Its Applications (Computer Science)	23U2MGET2 (D)		
IV	Skill Enhancement Course (SEC2)- Transform Techniques	23U2MSED2	2	2
	SEC - Major (SEC-3)Computational Mathematics	23U2MSED3	2	2
	Total		30	23

Title of the Course		ALGEBRA & TRIGONOMETRY					
Paper Number		CORE M1					
Category	Core	Year	I	Credits	4	Course Code	23U1MCCT1
		Semester	I				
Instructional Hours per week	Lecture		Tutorial		Lab Practice		Total
	3		1		--		4
Pre-requisite		12 th Standard Mathematics					
Objectives of the Course		- Basic ideas on the Theory of Equations, Matrices and Number Theory. - Knowledge to find expansions of trigonometry functions, solve theoretical and applied problems.					
Course Outline		Unit I: Reciprocal Equations-Standard form-Increasing or decreasing the roots of a given equation- Removal of terms, Approximate solutions of roots of polynomials by Horner’s method – related problems.					
		Unit II: Summation of Series: Binomial– Exponential –Logarithmic series (Theorems without proof) – Approximations - related problems.					
		Unit III: Characteristic equation – Eigen values and Eigen Vectors-Similar matrices - Cayley – Hamilton Theorem (Statement only) - Finding powers of square matrix, Inverse of a square matrix up to order 3 - Diagonalization of square matrices - related problems.					
		Unit IV: Expansions of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$ - Expansion of $\tan n\theta$ in terms of $\tan \theta$, Expansions of $\cos^n\theta$, $\sin^n\theta$, $\cos^m\theta\sin^n\theta$ –Expansions of $\tan(\theta_1+\theta_2+\dots+\theta_n)$ -Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in terms of θ - related problems.					
		Unit V: Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex quantities, Summation of trigonometric series - related problems.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill.					

Text Books	1. Theory of Equations and Trigonometry by Arumugam & Issac, New Gamma Publications, 2007. Unit 1: Chapter 1: 1.3, 1.4, 1.5, 2.3 (Horner's Method) 2. Summation of Series and Trigonometry by Arumugam & Issac, New Gamma Publications, 2003. Unit 2: (PART-A) Chapter 1: 1.1 to 1.3 3. Modern Algebra by S. Arumugam & A. T. Issac, Scitech Publications, PVT Ltd, 2014. Unit 3: Chapter 7: 7.7 & 7.8 only 4. Trigonometry by Arumugam & Issac, New Gamma Publications, 2012. Unit 4: Chapter 1: 1.1 to 1.3 Unit 5: Chapters: 2, 3, 4 (4.1, 4.2 only) 5. W.S. Burnstine and A.W. Panton, Theory of equations 6. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007 7. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005 8. C. V. Durell and A. Robson, Advanced Trigonometry, Courier Corporation, 2003
Reference Books	1. J. Stewart, L. Redlin, and S. Watson, Algebra and Trigonometry, Cengage Learning, 2012. 2. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Classify and Solve reciprocal equations

CLO 2: Find the sum of binomial, exponential and logarithmic series

CLO 3: Find Eigen values, eigen vectors, verify Cayley – Hamilton theorem and diagonalize a given matrix

CLO 4: Expand the powers and multiples of trigonometric functions in terms of sine and cosine

CLO 5: Determine relationship between circular and hyperbolic functions and the summation of trigonometric series

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

BLUE PRINT – External Exam
Mapping with Course Learning Outcomes (CLOs)

S. No.	CLOs	K-level	Section A		Section B		Section C	Section D
			MCQs		Short Answers		(Either/or Choice)	(Open Choice)
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K3	2	K1 & K2	1	K1	2(K2 & K2)	1(K3)
2	CLO 2	Up to K3	2	K1 & K2	1	K2	2(K3 & K3)	1(K3)
3	CLO 3	Up to K3	2	K1 & K2	1	K1	2(K1 & K1)	1(K2)
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 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	100%

Lesson Plan

S. No.	Unit	Description	Taking Hours	Total	Pedagogy
1.	I	Reciprocal Equations-Standard form	3	12	Lecture, Quiz,
		Increasing or decreasing the roots of a given equation	4		Lecture, Problem Solving
		Removal of terms, Approximate solutions of roots of polynomials by Horner's method – related problems.	5		Chalk and Talk, Group Discussion
2.	II	Binomial– Exponential –Logarithmic series (Theorems without proof)	8	12	Lecture, Group Discussion
		Approximations - related problems	4		Lecture, Problem Solving
3.	III	Characteristic equation – Eigen values and Eigen Vectors	4	12	Lecture, Seminar
		Cayley – Hamilton Theorem (Statement only) - Finding powers of square matrix, Inverse of a square matrix up to order 3	5		Lecture, Quiz
		Diagonalization of square matrices - related problems	3		Lecture
4.	IV	Expansions of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$	3	12	Lecture, Quiz
		Expansion of $\tan n\theta$ in terms of $\tan \theta$, Expansions of $\cos^n\theta$, $\sin^n\theta$, $\cos^m\theta\sin^n\theta$	5		Lecture, Problem Solving
		Expansions of $\tan(\theta_1+\theta_2+\dots+\theta_n)$ - Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in terms of θ - related problems	4		Lecture, Tutorial
5.	V	Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions	5	12	Lecture, Quiz
		Logarithm of complex quantities	3		Lecture
		Summation of trigonometric series - related problems.	4		Lecture, Seminar
		Total		60	

Course Designer:

1. Dr. V. Sangeethasubha, Assistant Professor, Department of Mathematics.
2. Dr.S.Vallirani, Assistant Professor, Department of Mathematics.

Title of the Course		DIFFERENTIAL CALCULUS						
Paper Number		CORE M2						
Category	Core	Year	I	Credits	4	Course Code	23U1MCCT2	
		Semester	I					
Instructional Hours per week		Lecture		Tutorial		Lab Practice		Total
		4		--		--		4
Pre-requisite		12 th Standard Mathematics						
Objectives of the Course		• The basic skills of differentiation, successive differentiation, and their applications. • Basic knowledge on the notions of curvature, evolutes, involutes and polar co-ordinates and in solving related problems.						
Course Outline		UNIT-I: Successive Differentiation: Introduction (Review of basic concepts) – The n^{th} derivative – Standard results – Fractional expressions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the n^{th} derivative of a product – Feynman’s method of differentiation.						
		UNIT-II: Partial Differentiation: Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit Functions.						
		UNIT-III: Partial Differentiation (Continued): Homogeneous functions – Partial derivatives of a function of two functions– Maxima and Minima of functions of two variables - Lagrange’s method of undetermined multipliers.						
		UNIT-IV: Envelope: Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter.						
		UNIT-V: Curvature: Definition of Curvature – Circle, Radius and Centre of Curvature – Evolutes and Involute – Radius of Curvature in Polar Co-ordinates.						
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC // TNPSC / others to be solved (To be discussed during the Tutorial hour)						
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill						

Recommended Text	1. Calculus, 2014th edition by S.Arumugam & Issac, New Gamma Publishing House. 2. Calculus Volume I, 2015th edition by S.Narayanan & T.K. Manicavachagam Pillay. Unit I – T1: Chapter 2(2.11,2.12,2.13) Unit II – T1: Chapter 2(2.14) T2: Chapter VIII(1.3,1.4,1.5) Unit III – T1: Chapter 2(2.15)&Chapter3(3.7) T2: Chapter VIII(1.7) Unit IV - T1: Chapter 3(3.6) Unit V – T1:Chapter 3(3.4,3.5) 3. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002. 4. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010. 5. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
Reference Books	1. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer- Verlag, New York, Inc., 1989. 2. T. Apostol, Calculus, Volumes I and II. 3. S. Goldberg, Calculus and mathematical analysis.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with PLOs and PSOs)

Students will be able to

CLO 1: Find the nth derivative, form equations involving derivatives and apply Leibnitz formula

CLO 2: Find the partial derivative and total derivative coefficient

CLO 3: Determine maxima and minima of functions of two variables and to use the Lagrange's method of undetermined multipliers

CLO 4: Find the envelope of a given family of curves

CLO 5: Find the evolutes and involutes and to find the radius of curvature using polar co-ordinates

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

BLUE PRINT – External Exam
Mapping with Course Learning Outcomes (CLOs)

S. No.	CLOs	K-level	Section A		Section B		Section C	Section D
			MCQs		Short Answers		(Either/or Choice)	(Open Choice)
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K3	2	K1 & K2	1	K1	2(K2 & K2)	1(K3)
2	CLO 2	Up to K3	2	K1 & K2	1	K2	2(K3 & K3)	1(K3)
3	CLO 3	Up to K3	2	K1 & K2	1	K1	2(K1 & K1)	1(K2)
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 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	100%

Lesson Plan

S. No.	Unit	Description	Taking Hours	Total	Pedagogy
1.	I	The n^{th} derivative-Standard results - Fractional expressions	4	12	Lecture, Quiz,
		Trigonometrical transformation – Formation of equations involving derivatives	4		Lecture, Problem Solving
		Leibnitz formula for the n^{th} derivative of a product – Feynman’s method of differentiation	4		Chalk and Talk, Group Discussion
2.	II	Partial derivatives – Successive partial derivatives	4	12	Lecture, Group Discussion
		Function of a function rule – Total differential coefficient	4		Lecture, Problem Solving
		A special case – Implicit Functions	4		Lecture, Quiz
3.	III	Homogeneous functions – Partial derivatives of a function of two variables	4	12	Lecture, Seminar
		Maxima and Minima of functions of two variables	4		Lecture, Quiz
		Lagrange’s method of undetermined multipliers.	4		Lecture
4.	IV	Method of finding the envelope	4	12	Lecture, Quiz
		Another definition of envelope	4		Lecture, Problem Solving
		Envelope of family of curves which are quadratic in the parameter.	4		Lecture, Tutorial
5.	V	Definition of Curvature – Circle, Radius and Centre of Curvature	4	12	Lecture, Quiz
		Evolutes and Involutives	4		Lecture
		Radius of Curvature in Polar Co-ordinates.	4		Lecture, Seminar
		Total		60	

Course Designer:

1. Dr. S. Usha, Assistant Professor, Department of Mathematics.
2. Prof.S.Meenakshi Selvaraj, Assistant Professor, Department of Mathematics.

Title of the Course		FOURIER SERIES					
TANSCHÉ Course type		SEC1					
Course Category		SKILLED					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23U1MSED1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2	---		---		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		12 th Standard Mathematics					
Objectives of the Course		• Demonstrate Fourier series to study the behaviour of periodic functions. • Determine the Fourier series of a function and to find the half range sine and cosine Fourier series. • Determine the Fourier series of a function and to find the Harmonic analysis methods					
Course Outline		Unit I: Fourier series: Definition – Trigonometric Series – Dirichlet’s conditions for existence of Fourier series – Finding Fourier Coefficients of periodic function with period 2π – Fourier Series – Related Problems.					
		Unit II: Odd and even functions: Definition of odd and even functions – Properties of Odd and Even functions – odd function of Fourier series – even function of Fourier series – Related Problems.					
		Unit III: Half Range Fourier series: Half range cosine series – Half range sine series – Related Problems.					
		Unit IV: Change of Interval – Combination of Series – Related Problems.					
		Unit V: Harmonic Analysis: First Harmonic – Second Harmonic coefficients – Related Problems.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Justification for nature of course	The Concept of Fourier series play a vital role in various areas of science and engineering. It finds very wide applications in various areas of science, electrical engineering, optics, control engineering, mathematics and signal processing.
Text Book(s)	1. Calculus – Volume III, S. Narayanan & T.K. Manicavachagom Pillay, S. Viswanathan (Printers & Publishers), Pvt., Ltd. 2011. Unit – I – Chapter 6 : Sections 1 and 2 Unit – II – Chapter 6 : Sections 3 (3.1 , 3.2) Unit – III – Chapter 6 : Sections 4 and 5 Unit – IV – Chapter 6 : Sections 6 and 7 Unit – V – Chapter 6 : Sections 8 (8.1 , 8.2)
Reference Book(s)	1. Manicavachagom Pillai T.K. and S. Narayanan, Trigonometry – Viswanathan Publishers and Printers Pvt., Ltd. 2. Robert T. Seeley, Fourier Series and Integrals, Dover Publications, New York, 2006. 3. S. Arumugam , A. Thangapandi Issac and A. Somasundaram, Higher Engineering Mathematics Volume-II, Edition 2010, Scitech Publications.
Websites and e-Learning resources	https://math24.net/fourier-series-definition-typical-examples.html https://www.intmath.com/fourier-series/4-fourier-half-range-functions.php https://www.brainkart.com/article/Harmonic-Analysis_6497/

COURSE OUTCOMES:

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

CO	Course Learning Outcome	K-level
CO1	Write given function in terms of sine and cosine terms in Fourier series.	Up to K2
CO2	Determine the Fourier series for odd and even functions.	Up to K3
CO3	Obtain Fourier sine series and the Fourier cosine series in the half range.	Up to K3
CO4	Find the change of intervals in Fourier series.	Up to K4
CO5	Determine the first three harmonics of the Fourier series for the values.	Up to K3

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
CLO1	2	1	2	3	2	3	3	2	1
CLO2	2	1	2	3	2	3	3	2	1
CLO3	2	1	2	3	2	3	3	2	1
CLO4	2	1	2	3	2	3	3	2	1
CLO5	2	1	2	3	2	3	3	2	1

The Components of Assessment

CLO	Component	Weight / Mark	K-Level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1,CLO2,CLO3, CLO4,CLO5	Quiz	5	K1,K2

Blueprint for Semester Examination

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

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

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	41.66%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	41.67%
K4	-	-	10	10	20	16.67	16.67%
Total marks	10	10	50	50	120	100	100%

LESSON PLAN

Unit	Description	Hours		Mode
I	Definition – Trigonometric Series – Dirichlet’s conditions for existence of Fourier series	3	6	Lecture, Chalk and Talk
	Finding Fourier Coefficients of periodic function with period 2π – Fourier Series – Related Problems.	3		Problem Solving, Quiz
II	Odd and even functions: Definition of odd and even functions	2	6	Lecture, Quiz
	Properties of Odd and Even functions – odd function of Fourier series	2		Lecture, Chalk and Talk
	Even function of Fourier series – Related Problems.	2		Lecture, Problem Solving
III	Half range Fourier series.	2	6	PPT, Lecture
	Half range cosine series	2		PPT, Tutorial
	Half range sine series	2		Problem Solving , Quiz
IV	Change of Interval	3	6	Lecture, Tutorial
	Combination of Series- Related Problems.	3		Lecture, Tutorial
V	Harmonic Analysis: First Harmonic	3	6	PPT, Lecture
	Second Harmonic coefficients – Related Problems.	3		Lecture, Problem Solving, Assignment
Total Hours		30		

COURSE DESIGNER:

1. Prof. S.MEENAKSHI, Assistant Professor, Department of Mathematics.
2. Dr. S.USHA , Assistant Professor, Department of Mathematics.

Title of the Course		Foundation course- Bridge Mathematics					
TANSCHHE Course type		FC					
Course Category		FC					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23U1MFCT1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2	-		-		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		12 th Standard Mathematics					
Objectives of the Course		- To bridge the gap and facilitate transition from higher secondary to tertiary education; - To instil confidence among stakeholders and inculcate interest for Mathematics;					
Course Outline		UNIT-I : Algebra: Binomial theorem, General term, middle term, problems based on these concepts					
		Unit-II : Sequences and series (Progressions). Fundamental principle of counting. Factorial n.					
		Unit-III : Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups.					
		Unit-IV : Trigonometry: Introduction to trigonometric ratios, proof of sin(A+B), cos(A+B), tan(A+B) formulae, multiple and sub multiple angles, sin(2A), cos(2A), tan(2A) etc., transformations sum into product and product into sum formulae, inverse trigonometric functions, sine rule and cosine rule.					
		Unit-V: Calculus: Limits, standard formulae and problems, differentiation, first principle, uv rule, u/v rule, methods of differentiation, application of derivatives, integration - product rule and substitution method.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved(To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Justification for nature of course	A bridge course is a type of educational program that helps students transition from one educational level to another. For example, a bridge course might help a student transition from school to college. Bridge courses typically provide students with skills and knowledge they need to be successful in their new educational setting.
Text Book(s)	1. NCERT class XI and XII text books. 2. Any State Board Mathematics text books of class XI and XII
Reference Book(s)	
Websites and e-Learning resources	https://nptel.ac.in

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

CO	Course learning outcome	K-level
CO1	Prove the binomial theorem and apply it to find the expansions of any $(x + y)^n$ and also, solve the related problems	Upto K2
CO2	Find the various sequences and series and solve the problems related to them. Explain the principle of counting.	Upto K2
CO3	Find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations	Upto K2
CO4	Explain various trigonometric ratios and find them for different angles, including sum of the angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations.	Upto K2
CO5	Find the limit and derivative of a function at a point, the definite and indefinite integral of a function. Find the points of min/max of a function.	Upto K2

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).

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

The Components of Assessment Shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K2
2	CLO5	Seminar	5	K1
3	CLO1,CLO2,CLO3, CLO4,CLO5	Quiz	5	K1

SUMMATIVE EXAMINATION–BLUEPRINT

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 K4	2	K1 & K2	1	K2	2(K4 & K4)	1(K4)
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(K1& K1)	1(K3)
4	CLO 4	Up to K3	2	K1 & K2	1	K1	2(K3 & K3)	1(K3)
5	CLO 5	Up to K2	2	K1 & K2	1	K2	2(K2& K2)	1(K2)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

Distribution of Section-wise Marks with K Levels

K 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%

LESSON PLAN

	Topics	Hours	Mode
I	Binomial theorem.	2	PPT, Chalk and Talk.
	General term, middle term	2	
	problems based on these concepts.	2	
II	Sequences and series (Progressions).	2	PPT, Chalk and Talk, Assignments and GD
	Fundamental principle of counting.	2	
	Factorial n.	2	
III	Derivation of formulae and their connections.	1	PPT, Chalk and Talk, Assignments
	simple applications, combinations with repetitions	2	
	arrangements within groups.	2	
	formation of groups.	1	
IV	Introduction to trigonometric ratios	1	PPT, Chalk and Talk, Assignments
	proof of $\sin(A+B)$, $\cos(A+B)$, $\tan(A+B)$ formulae, multiple and sub multiple angles, $\sin(2A)$, $\cos(2A)$, $\tan(2A)$ etc.,	3	
	transformations sum into product and product into sum formulae, inverse trigonometric functions, sine rule and cosine rule	2	
V	Limits, standard formulae and problems, differentiation.	1	Assignments , Seminar and GD
	first principle, uv rule, u/v rule, methods of differentiation, application of derivatives.	3	
	Integration - product rule and substitution method.	2	

Course Designers:

1. Dr. S.VALLIRANI, Assistant Professor, Department of Mathematics, The Madura College.
2. Dr.V.SANGEETHASUBHA, Assistant Professor, Department of Mathematics, The Madura College.

Title of the Course		ANALYTICAL GEOMETRY (Two & Three Dimensions)						
TANSCHÉ Course type		CC3						
Course Category		CORE III						
Nature of Course		Employability / 0Skill Development						
Category	Core	Year	I	Credits	4	Course Code	23U2MCCT3	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		3		1		---		4
Marks		CIA			Semester		Total	
		25			75		100	
Pre-requisite(s)		12 th Standard Mathematics						
Objectives of the Course		- Necessary skills to analyze characteristics and properties of two- and three-dimensional geometric shapes. - To present mathematical arguments about geometric relationships. - To solve real world problems on geometry and its applications.						
Course Outline		UNIT-I: Pole, Polar - conjugate points and conjugate lines – diameters – conjugate diameters of an ellipse - semi diameters- conjugate diameters of hyperbola.						
		UNIT-II: Polar coordinates: General polar equation of straight line – Polar equation of a circle given a diameter, Equation of a straight line, circle, conic – Equation of chord, tangent, normal.						
		UNIT-III: System of Planes - Angle between two planes - Length of the perpendicular – angle bisectors of two planes						
		UNIT-IV: Representation of line–angle between a line and a plane – co – planar lines – shortest distance between two skew lines –length of the perpendicular–intersection of three planes.						
		UNIT-V: Equation of a sphere-general equation-section of a sphere by a plane-equation of the circle - tangent plane- angle of intersection of two spheres- condition for the orthogonally						
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)						

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Justification for nature of course	The concept of Analytical Geometry are the simplest geometric elements such as points, straight line, plane, curves and surfaces. Its principal aim is to study the method of coordinates and the method of elementary algebra. It also has uses in multidimensional space for performing some complex calculations and studies.
Text Book(s)	1. Analytical Geometry, S. Arumugam, A. Thangapandi Issac and A. Somasundaram, Yes Dee Publishing Pvt. Ltd, Chennai, Tamilnadu, 2020. Unit 1: chapter 5: 5.4, chapter 6: 6.1 Unit 2: chapter 7: 7.1 – 7.4, 7.5 (Theorems only) Unit 3: chapter 10: 10.1 – 10.3 Unit 4: chapter 11: 11.1 – 11.2, 11.4 Unit 5: chapter 12: 12.1 – 12.4 2. S. L. Loney, Co-ordinate Geometry. 3. Robert J. T. Bell, Co-ordinate Geometry of Three Dimensions. 4. William F. Osgood and William C. Graustein, Plane and Solid Analytic Geometry, Macmillan Company, New York, 1916.
Reference Book(s)	1. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010. 2. Robert C. Yates, Analytic Geometry with Calculus, Prentice Hall, Inc., New York, 1961. 3. Earl W. Swokowski and Jeffery A. Cole, Algebra and Trigonometry with Analytic Geometry, Twelfth Edition, Brooks/Cole, Cengage Learning, CA, USA, 2010. 4. William H. McCrea, Analytical Geometry of Three Dimensions, Dover Publications, Inc, New York, 2006. 5. John F. Randelph, Calculus and Analytic Geometry, Wadsworth Publishing Company, CA, USA, 1969. 6. Ralph Palmer Agnew, Analytic Geometry and Calculus with Vectors, McGraw-Hill Book Company, Inc. New York, 1962.
Websites and e-Learning resources	https://nptel.ac.in

COURSE OUTCOMES:

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

CO	Course Outcome	K-level
CLO1	Find pole, polar for conics, diameters, conjugate diameters for ellipse and hyperbola.	Upto K2
CLO2	Find the polar equations of straight line and circle, equations of chord, tangent and normal	Upto K3
CLO3	Explain in detail the system of Planes.	Upto K3
CLO4	Explain in detail the system of Straight lines	Upto K4
CLO5	Explain in detail the system of Spheres	Upto K4

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

MAPPING 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
CLO1	2	2	2	1	-	-	3	2	1
CLO2	2	2	2	1	-	-	3	2	1
CLO3	3	2	2	1	-	-	3	2	1
CLO4	3	2	3	1	-	-	3	2	1
CLO5	3	2	3	1	-	-	3	2	1

Components of Assessment

CLO	Component	Weight / Mark	K-Level
CLO5	Assignment	5	K5
CLO5	Seminar	5	K2
CLO1,CLO2,CLO3, CLO4,CLO5	Quiz	5	K1,K2.K3

Blueprint for Semester Examination

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

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

Distribution of section wise marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	5	4	10	-	19	15.83	50%
K2	5	6	20	10	41	34.17	
K3	-	-	10	20	30	25.00	25%
K4	-	-	10	20	30	25.00	25%
Total marks	10	10	50	50	120	100	100%

LESSON PLAN

Unit	Description	Hours		Mode
I	Pole, Polar - conjugate points and conjugate lines – diameters	6	12	Lecture, Chalk and Talk
	conjugate diameters of an ellipse - semi diameters-conjugate diameters of hyperbola	6		Problem Solving, Quiz
II	General polar equation of straight line – Polar equation of a circle given a diameter	4	12	Lecture, Quiz
	Equation of a straight line, circle, conic	4		Lecture, Chalk and Talk
	Equation of chord, tangent, normal	4		Lecture, Problem Solving
III	System of Planes – Angle between two planes	6	12	PPT, Lecture, Quiz
	Length of the perpendicular - angle bisectors of two planes	6		PPT, Tutorial Problem Solving ,
IV	Representation of line–angle between a line and a plane–	4	12	Lecture, Tutorial
	co – planar lines–shortest distance between two skew lines	4		Lecture, Problem Solving,
	length of the perpendicular–intersection of three planes	4		Lecture, PPT
V	Equation of a sphere-general equation-section of a sphere by a plane	4	12	Lecture, Chalk and Talk
	equation of the circle- tangent plane	4		Lecture, PPT
	angle of intersection of two spheres- condition for the orthogonally	4		Lecture, Problem Solving, Assignment
Total Hours		30		

COURSE DESIGNER:

1. Dr. I. Padmavathi, Assistant Professor, PG and Research Department of Mathematics.
2. Prof.S.Meenakshi, Assistant Professor, Department of Mathematics.

Title of the Course		INTEGRAL CALCULUS					
TANSCHÉ Course type		CC4					
Course Category		Core course IV					
Nature of Course		Knowledge and skill					
Category	Core	Year	I	Credits	4	Course Code	23U2MCCT4
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		3	1		-		4
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		12 th Standard Mathematics					
Objectives of the Course		• Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals. • Knowledge about Beta and Gamma functions and their applications. • Skills to Determine Fourier series expansions.					
Course Outline		UNIT-I: Reduction formulae -Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions - Bernoulli’s formula, Feynman’s technique of integration.					
		UNIT-II: Multiple Integrals - definition of double integrals - evaluation of double integrals – double integrals in polar coordinates - Change of order of integration.					
		UNIT-III: Triple integrals –applications of multiple integrals - volumes of solids of revolution - areas of curved surfaces–change of variables - Jacobian.					
		UNIT-IV: Beta and Gamma functions – infinite integral - definitions– recurrence formula of Gamma functions – properties of Beta and Gamma functions- relation between Beta and Gamma functions - Applications.					
		UNIT-V: Geometric and Physical Applications of Integral calculus.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Justification for nature of course	The course provides knowledge on integration and its applications. Moreover, it imparts skills such as Problem Solving, Analytical ability and Professional Competency.
Text Book(s)	1. Calculus, 2014th edition by S.Arumugam & Issac, New Gamma Publishing House. 2. Calculus and Fourier Series, volume-2 by Dr.M.K.Venkataraman & Dr.Manorama Sridhar Unit I – T1: Chapter 2(2.7,2.8) Unit II – T1: Chapter 3(3.1,3.2) Unit III – T1: Chapter 3(3.3,3.4) Unit IV – T1: Chapter 4(4.1) Unit V – T2: Chapter 5(5.1,5.2), Chapter 6(6.1-6.4). 3. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002. 4. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
Reference Book(s)	1. D. Chatterjee, Integral Calculus and Differential Equations, Tata-McGraw Hill Publishing Company Ltd. 2. P. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer Undergraduate Mathematics Series, 2001 (second edition).
Websites and e-Learning resources	https://nptel.ac.in

COURSE OUTCOMES:

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

CO1	Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae	K3
CO2	Evaluate double and triple integrals and problems using change of order of integration	K3
CO3	Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution	K3
CO4	Explain beta and gamma functions and to use them in solving problems of integration	K3
CO5	Explain Geometric and Physical applications of integral calculus	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
CLO1	3	1	3	-	-	-	3	1	1
CLO2	3	1	3	-	-	-	3	1	1
CLO3	3	1	3	-	-	-	3	-	1
CLO4	3	1	3	-	-	-	3	-	1
CLO5	3	1	3	-	2	1	3	-	-

ASSESSMENT SCHEME**Components of CIA**

Component	Weight / Mark
Test	10
Quiz	5
Assignment	5
Library/N-list usage	5

Distribution of Section-wise Marks with K levels for semester Exams

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	-	-	-	05	4	50%
K2	5	10	20	20	55	46	
K3	-	-	20	20	40	33.33	33.33%
K4	-	-	10	10	20	16.67	16%
Total marks	10	10	50	50	120	100	100%

Blue Print for Semester Examinations

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	K3	2	K1 & K2	1	K2	2 (K2)	1(K2)
2	CLO 2	K3	2	K1 & K2	1	K2	2 (K3)	1(K3)
3	CLO 3	K4	2	K1 & K2	1	K2	2 (K2)	1(K4)
4	CLO 4	K3	2	K1 & K2	1	K2	2 (K3)	1(K2)
5	CLO 5	K4	2	K1 & K2	1	K2	2 (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

Course Designers:

1. Dr.I.SAHUL HAMID, Assistant Professor, PG and Research Department of Mathematics.
2. Prof.MEENAKSHI SELVARAJ, Assistant Professor, Department of Mathematics.

Title of the Course		TRANSFORM TECHNIQUES						
TANSCHÉ Course type		SEC2						
Course Category		SKILLED						
Nature of Course		Skill Development						
Category	Core	Year	I	Credits	2	Course Code	23U2MSED2	
		Semester	II					
Instructional Hours per week	Lecture	Tutorial		Practical		Total		
	2	---		---		2		
Marks	CIA		Semester			Total		
	25		75			100		
Pre-requisite(s)		Fourier Series						
Objectives of the Course		• Determine Laplace transform of a function and understand the fundamental properties. • Use Laplace transform and inverse Laplace transform in solving differential and integral equations. • Demonstrate their understanding of Fourier transforms, Fourier Cosine and sine transforms by applying them to appropriate examples.						
Course Outline		Unit I: The Laplace transforms – Sufficient conditions for the existence of the Laplace transforms – Laplace transform of periodic functions – Some general theorems –Using Laplace transform evaluate certain integrals – Related problems.						
		Unit II: The inverse Laplace transforms – Some properties – Related problems.						
		Unit III: Application of Laplace transforms to solve ordinary differential equations with constant coefficients –The Laplace transforms to solve system of differential equations – The Laplace transform to solve differential equations with variable coefficients– The Laplace transform to solve integral equations– Related problems.						
		Unit IV: Fourier transforms: Complex form of Fourier integral formula – Fourier integral theorem – Properties of Fourier transform – Related problems.						
		Unit V: Fourier cosine and Fourier sine transforms: Fourier cosine transform – Fourier sine transform – Properties of Fourier cosine and Fourier sine transforms – Related problems.						

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Justification for nature of course	The Concept of Laplace transforms and Fourier transforms play a vital role in various areas of science and engineering. It finds very wide applications in various areas of science, electrical engineering, optics, control engineering, mathematics and signal processing. To apply Fourier transforms, this plays an important role in the study of continuous time signals.
Text Book(s)	1. Calculus – Volume III, S. Narayanan & T.K. Manicavachagom Pillay, S. Viswanathan (Printers & Publishers), Pvt., Ltd. 2011. Unit – I – Chapter 5 : Sections 1, 2, 3, 4, 5 Unit – II – Chapter 5: Sections 6, 7 Unit – III – Chapter 5 : Sections 8, 9, 10 and 11 Unit – IV – Chapter 6 : Sections 9 and 10 Unit – V – Chapter 6 : Sections 11 and 12
Reference Book(s)	1. S. Arumugam , A. Thangapadi Issac and A. Somasundaram, Higher Engineering Mathematics Volume-II, Edition 2010, Scitech Publications. 2. Kandaswamy . P and K. Thilagavathi, Mathematics for B.Sc., Vol III, S.Chand and Co., New Delhi, 2004.
Websites and e-Learning resources	1. https://faculty.atu.edu/mfinan/4243/Laplace.pdf 2. https://www.ndsu.edu/pubweb/~novozhil/Teaching/266%20Data/lecture_16.pdf 3. https://mathworld.wolfram.com/FourierTransform.html

COURSE OUTCOMES:

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

CO	Course Learning Outcome	K-level
CO1	Find the Laplace transform of a function from the definition of Laplace transform.	Up to K2
CO2	Determine the inverse Laplace transform and its Properties.	Up to K3
CO3	Apply Laplace transform and its inverse to solve initial value differential equations.	Up to K4
CO4	Write given function in terms of Complex form of Fourier integral theorem.	Up to K3
CO5	Obtain Fourier cosine transforms and the Fourier sine transforms in the functions.	Up to K3

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
CLO1	2	1	2	3	2	3	3	2	1
CLO2	2	1	2	3	2	3	3	2	1
CLO3	2	1	2	3	2	3	3	2	1
CLO4	2	1	2	3	2	3	3	2	1
CLO5	2	1	2	3	2	3	3	2	1

The Components of Assessment

CLO	Component	Weight / Mark	K-Level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1,CLO2,CLO3, CLO4,CLO5	Quiz	5	K1,K2

Blueprint for Semester Examination

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(K4 & K4)	1(K4)
4	CLO 4	Up to K3	2	K1 & K2	1	K1	2(K3 & K3)	1(K3)
5	CLO 5	Up to K3	2	K1 & K2	1	K2	2(K3 & K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

K4 - Examining, analyzing, presentation and make inferences with 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	41.66%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	41.67%
K4	-	-	10	10	20	16.67	16.67%
Total marks	10	10	50	50	120	100	100%

LESSON PLAN

Unit	Description	Hours		Mode
I	The Laplace transforms – Sufficient conditions for the existence of the Laplace transforms – Laplace transform of periodic functions.	3	6	Lecture, Chalk and Talk
	Some general theorems – Using Laplace transform evaluate certain integrals – Related problems.	3		Problem Solving, Quiz
II	The inverse Laplace transforms – Inverse transforms of functions.	3	6	Lecture, Quiz
	Some Properties – Related problems.	3		Lecture, Problem Solving
III	Application of Laplace transforms to solve ordinary differential equations with constant coefficients.	2	6	PPT, Lecture
	The Laplace transforms to solve system of differential equations.	2		PPT, Tutorial
	The Laplace transform to solve differential equations with variable coefficients– The Laplace transform to solve integral equations– Related problems.	2		Problem Solving , Quiz
IV	Fourier transforms: Complex form of Fourier integral formula.	2	6	Lecture, Tutorial
	Fourier integral theorem.	2		Lecture, Tutorial
	Properties of Fourier transform – Related problems.	2		Problem Solving , Quiz
V	Fourier cosine and Fourier sine transforms: Fourier Cosine transform – Fourier sine transform.	3	6	PPT, Lecture
	Properties of Fourier cosine and Fourier sine transforms – Related problems.	3		Lecture, Problem Solving, Assignment
Total Hours		30		

COURSE DESIGNER:

1. Prof. S.MEENAKSHI, Assistant Professor, Department of Mathematics.
2. Dr. V.SANGEETHASUBHA, Assistant Professor, Department of Mathematics.

Title of the Course		Computational Mathematics					
TANSICHE Course type		SEC – 3					
Course Category		SEC – 3(Discipline Specific/Generic)					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23U2MSED3
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2	-		-		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic arithmetic					
Objectives of the Course		- To be able to design and apply algorithms to solve problems numerically and graphically. - To acquire the skills and confidence to learn new mathematical knowledge as becomes necessary in the course of a lifetime.					
Course Outline		UNIT-I : High Speed Computation: Introduction, Computer Arithmetic, Errors, Machine Computation, Computer Software.					
		Unit-II : Transcendental and Polynomial Equations: Introduction, Bisection Method, Iteration methods Based on First and Second Degree Equation, General Iteration Methods.					
		Unit-III : Transcendental and Polynomial Equations: System of Nonlinear Equations, Methods for Complex roots, Polynomial Equations.					
		Unit-IV : System of Linear Algebraic Equations: Introduction, Direct Methods, Iteration methods.					
		Unit-V: Introduction, Lagrange and Newton Interpolations, Finite Difference Operators Unit – I – Chapter 1 : Sections 1.1 - 1.5 Unit – II – Chapter 2: Sections 2.1 - 2.4, 2.6 Unit – III – Chapter 2 : Sections 2.7 - 2.9 Unit – IV – Chapter 3 : Sections 3.1, 3.2, 3.4 Unit – V – Chapter 4 : Sections 4.1 - 4.3					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved(To be discussed during the Tutorial hour)					

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Computational mathematics is an area of mathematics devoted to the interaction between mathematics and computer computation. A large part of computational mathematics consists roughly of using mathematics allowing and improving computer computation in areas of science and engineering where mathematics are useful. This involves in particular algorithm design, computational complexity, numerical methods and computer algebra.
Text Book(s)	1. M.K.Jain, S.R.K.Iyengar, R.K.Jain (2003): Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, fourth edition.
Reference Book(s)	1. S. Arumugam, S.Thangapandi Isaac and A.Soma Sundaram, Numerical Analysis, New Gamma Publishing House 2007. 2. S.S.Sastry, Introductory methods of Numerical Analysis, Prentice Hall of India.
Websites and e-Learning resources	1. https://protonstalk.com/polynomials/bisection-method/ 2. https://www.cs.usask.ca/~spiteri/M211/notes/chapter4.pdf 3. https://math.stackexchange.com/questions/1509340/newton-form-vs-lagrange-form-for-interpolating-polynomials

COURSE OUTCOMES:

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

CO	Course learning outcome	K-level
CO1	Apply mathematical and computing knowledge.	Upto K2
CO2	Problem solve through modeling of real world phenomena using mathematics and computing.	Upto K2
CO3	Communicate mathematical and computing knowledge.	Upto K2
CO4	Assess current technology and future trends in computer science.	Upto K2
CO5	Approach mathematics and computer science research questions from a perspective consistent with the norms of the field.	Upto K2

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).

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

The Components of Assessment Shall be

S. No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K2
2	CLO5	Seminar	5	K1
3	CLO1,CLO2,CLO3, CLO4,CLO5	Quiz	5	K1

SUMMATIVE EXAMINATION-BLUEPRINT

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 K4	2	K1 & K2	1	K2	2(K4 & K4)	1(K4)
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(K1& K1)	1(K3)
4	CLO 4	Up to K3	2	K1 & K2	1	K1	2(K3 & K3)	1(K3)
5	CLO 5	Up to K2	2	K1 & K2	1	K2	2(K2& K2)	1(K2)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	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%

Lecture schedule

Unit	Topics	Hours	Mode
I	High Speed Computation: Introduction.	2	PPT, Chalk and Talk.
	Computer Arithmetic, Errors.	2	
	Machine Computation, Computer Software.	2	
II	Transcendental and Polynomial Equations: Introduction.	2	PPT, Chalk and Talk, Assignments and GD
	Bisection Method, Iteration methods Based on First and Second Degree Equation.	2	
	General Iteration Methods.	2	
III	Transcendental and Polynomial Equations: System of Nonlinear Equations.	2	PPT, Chalk and Talk, Assignments
	Methods for Complex roots.	2	
	Polynomial Equations.	2	
IV	System of Linear Algebraic Equations: Introduction.	2	PPT, Chalk and Talk, Assignments
	Direct Methods.	2	
	Iteration methods.	2	
V	Introduction.	1	Assignments, Seminar and GD
	Lagrange and Newton Interpolations.	3	
	Finite Difference Operators.	2	

Course Designer:

1. Dr. S.VALLIRANI, Assistant Professor, Department of Mathematics, The Madura College.
2. Dr.V.SANGEETHASUBHA, Assistant Professor, PG & Research Department of Mathematics, The Madura College.

Title of the Course		ALLIED MATHEMATICS-I					
TANSCHÉ Course type		EC1					
Course Category							
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23U1MGET1 (P)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		---		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		12 th Standard Mathematics					
Objectives of the Course		• Be able to understand higher order differentiation and to know application of differential calculus. • Know the properties of definite integrals and methods of integration of higher powers of trigonometric functions. • Know the physical applications of derivatives of vectors especially the divergence and curl. • Have thorough knowledge of solving definite integrals and obtain a numerical solution.					
Course Outline		UNIT-I: Application of DeMoivre’s Theorem : Expression for $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$ – Expression for $\sin^n \theta$, $\cos^n \theta$ and $\sin^m\theta\cos^n\theta$ – Problems.					
		UNIT-II: Differentiability – Chain rule – Differentiation of Inverse trigonometric functions – Differentiation by transformation – Differentiation of logarithmic functions – Differentiation of implicit functions – Higher derivatives – n^{th} derivatives of some standard functions – Leibnitz’s rule – Problems.					
		UNIT-III: Integration by parts – Reduction formulafor $\int \sin^n x \, dx$, $\int \cos^n x \, dx$ and $\int \sin^m x \cos^n x \, dx$ (Problems only) – Evaluation of double and triple integrals (Simple Problems only).					
		UNIT-IV: Vector differentiation – Vector differential operator – Gradient, Divergence and Curl and their simple properties – Directional Derivative and its maximum value — Solenoidal and Irrotational vectors (simple problems only) – Vector integration (Line Integrals only).					
		UNIT-V: Numerical Integration – Trapezoidal rule – Simpson’s1/3 and 3/8 rules – Romberg’s Method –Weddle’s rule – Problems.					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Justification for nature of course	The concept of Analytical Geometry are the simplest geometric elements such as points, straight line, plane, curves and surfaces. Its principal aim is to study the method of coordinates and the method of elementary algebra. It also has uses in multidimensional space for performing some complex calculations and studies.
Text books	1. Allied Mathematics, Dr. S. Arumugam & Isaac. Vol I, New Gamma Publishing House, Palayamkottai. (2014) (For Unit I, III) (Part – III Chapter: 1(1.1,1.2); Part – II Chapter 3(3.4-3.6)) 2. Calculus, Dr. S. Arumugam & Isaac, New Gamma Publishing House, Palayamkottai. (2008) (For Unit II) (Chapter: 2(2.4 – 2.7, 2.10 – 2.12)) 3. Allied Mathematics, Dr. S. Arumugam & Isaac. Vol II, New Gamma Publishing House, Palayamkottai. (2011) (For Unit IV) (Chapter: 1,2) 4. Numerical Methods, P. Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand Publishers, 2008. (For Unit V) (Chapter: 9(9.7 – 9.15))
Reference Book(s)	1. Ancillary Mathematics, T.K. Manikavasagampillai & Others Viswanathan printers and publishers Pvt. Ltd., Chennai. 2. Allied Mathematics, Volume II, P. Kandasamy, K. Thilagavathy, S. Chand & Company Pvt. Ltd.
Websites and e-Learning resources	1. https://brilliant.org/wiki/expansions-of-certain-trigonometric-functions/#expanding-sintheta-costheta-tantheta-in-terms-of-theta-for-small-theta 2. https://www.math24.net/leibniz-formula/ 3. https://www.whitman.edu/mathematics/calculus_online/section08.02.html 4. http://tutorial.math.lamar.edu/Classes/CalcIII/LineIntegralsVectorFields.aspx 5. http://mathforcollege.com/nm/mws/gen/07int/mws_gen_int_txt_gaussquadrature.pdf

COURSE OUTCOMES:

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

Number	Course Learning Outcome	Knowledge level
CLO 1	Apply DeMoivre's theorem to solve problems on powers of trigonometric functions.	Upto K2
CLO 2	Use the concept of differentiation to find derivatives of inverse trigonometric functions, implicit function and logarithmic functions.	Upto K3
CLO 3	Evaluate integrals using integration by parts and apply integration with nth power.	Upto K4
CLO 4	Use vector differentiation to evaluate gradient, divergence and curl of a vector point function and related identities.	Upto K3
CLO 5	Use the concept of integration to solve numerical problems.	Upto K3

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

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/ PO-PSO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO 1	3	2	2	1	2	1	3	2	2
CLO 2	3	2	2	1	2	1	3	2	2
CLO 3	3	2	2	1	2	1	3	2	2
CLO 4	3	2	2	1	2	1	3	2	2
CLO 5	3	2	2	1	2	1	3	2	2

Pedagogy

Lecture, Seminar, Quiz, Problem Solving, Tutorial, Group Discussion and Power point presentation.

BLUE PRINT – External Exam

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

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

K4 - Examining, analyzing, presentation and make inferences with 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	-	-	9	7.5	42%
K2	5	6	20	10	41	34.17	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total marks	10	10	50	50	120	100	100%

Lesson Plan

Unit	Description	Hours		Mode
I	Application of DeMoivre’s Theorem: Expression for $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$	7	14	Lecture, Quiz
	Expression for $\sin^n \theta$, $\cos^n \theta$ and $\sin^m \theta \cos^n \theta$	7		Problem Solving
II	Differentiability – Chain rule	2	22	Lecture, Quiz
	Differentiation of Inverse trigonometric functions	3		Quiz
	Differentiation by transformation	3		Lecture, Problem Solving
	Differentiation of logarithmic functions – Differentiation of implicit functions	4		Lecture, Group Discussion
	Higher derivatives – nth derivatives of some standard functions – Leibnitz’s rule	10		Problem Solving
III	Integration by parts	4	18	PPT, Lecture
	Reduction formula for $\int \sin^n x \, dx$, $\int \cos^n x \, dx$ and $\int \sin^m x \cos^n x \, dx$ (Problems only)	6		PPT, Tutorial
	Evaluation of double integrals	4		Problem Solving
	Evaluation of triple integrals	4		Problem Solving
IV	Vector differentiation – Vector differential operator	3	18	Lecture, Tutorial
	Gradient, Divergence and Curl and their simple properties	4		Lecture, Tutorial
	Directional Derivative and its maximum value	4		Tutorial
	Solenoidal and Irrotational vectors (simple problems only)	3		Problem Solving
	Vector integration (Line Integrals only).	4		Problem Solving
V	Numerical Integration	2	18	PPT, Lecture
	Trapezoidal rule	3		Lecture
	Simpson’s 1/3 and 3/8 rules	5		Lecture
	Romberg’s Method	4		Tutorial, Seminar
	Weddle’s rule	4		Tutorial, Seminar
Total Hours		90		

Course Designer:

1. Dr. U.Karthik Raja, Assistant Professor, PG & Research Department of Mathematics, The Madura College (Autonomous), Madurai-11
2. Prof.N.Sriviveka Saratha, Assistant Professor, Department of Mathematics, The Madura College (Autonomous-SF), Madurai-11

Title of the Course		ALLIED MATHEMATICS-II					
TANSCHE Course type		EC2					
Course Category							
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23U2MGET2 (P)
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		---		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		12 th Standard Mathematics					
Objectives of the Course		• Know methods of solving differential equations of first order and higher order. • To understand the fundamental ideas of Partial differential equations. • Know application of Laplace transforms and method of solving ordinary differential equations using Laplace transforms.					
Course Outline		UNIT-I: Differential equation of first order and first degree – Variable-Separable – Homogeneous and Non-homogeneous differential equations – Exact Differential equations – Integrating factors-Problems.					
		UNIT-II: Introduction – Linear equation with constant coefficients – Methods of finding complementary functions – Methods of finding particular integrals – Problems.					
		UNIT-III: Formation of partial differential equations – Classification of solution of PDE – Solutions of standard types of first order partial differential equations (Types 1-4) – Lagrange’s linear equation -Problems.					
		UNIT-IV: Laplace transforms – Inverse Laplace transforms – solution of differential equations using Laplace transforms - Problems.					
		UNIT-V: Finite differences – Newton’s forward and backward formula – Lagrange’s formula – Problems.					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Justification for nature of course	The concept of Analytical Geometry are the simplest geometric elements such as points, straight line, plane, curves and surfaces. Its principal aim is to study the method of coordinates and the method of elementary algebra. It also has uses in multidimensional space for performing some complex calculations and studies.
Text Books:	1. Allied Mathematics by Dr.S.Arumugam & Issac. Vol III, New Gamma Publishing House, Palayamkottai. (2012) (For UNIT – I – IV) (Chapter1(1.1-1.4),2,3,4(4.1-4.4)). 2. Allied Mathematics by Dr.S.Arumugam & Issac. Vol II, New Gamma Publishing House, Palayamkottai. (2011) (For UNIT-V) (Chapter 7).
Reference Book(s)	1. Ancillary Mathematics, Volume I, T.K Manikavasagampillai & Others, Viswanathan Printers and Publishers Pvt Ltd.Chennai. 2. Allied Mathematics, Volume II, P.Kandasamy, K.Thilagavathy, S.Chand & Company Pvt. Ltd.
Websites and e-Learning resources	1. https://www.math24.net/exact-differential-equations/ 2. https://www.math24.net/higher-order-linear-homogeneous-differential-equations-constant-coefficients/ 3. https://www.brainkart.com/article/Lagrange---s-Linear-Equation_6488/ 4. https://lpsa.swarthmore.edu/LaplaceXform/FwdLaplace/LaplaceProps.html 5. https://www.geeksforgeeks.org/newton-forward-backward-interpolation/

COURSE OUTCOMES:

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

Number	Course Learning Outcome	Knowledge level
CLO1	Solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous and non-homogeneous differential equation.	Up to K3
CLO2	Solve 2nd and higher order differential equations with constant coefficients	Up to K3
CLO3	Construct partial differential equations and to solve first order partial differential equations	Up to K4
CLO4	Solve Laplace transform and inverse transform of simple functions and application to differential equations with constant coefficients.	Up to K3
CLO5	Apply various interpolation methods and finite difference concepts.	Up to K3

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

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/ PO-PSO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO 1	3	2	2	1	2	1	3	2	2
CLO 2	3	2	2	1	2	1	3	2	2
CLO 3	3	2	2	1	2	1	3	2	2
CLO 4	3	2	2	1	2	1	3	2	2
CLO 5	3	2	2	1	2	1	3	2	2

BLUE PRINT - External Exam

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

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	-	-	9	7.5	42 %
K2	5	6	30	-	41	34.17	
K3	-	-	10	40	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total marks	10	10	50	50	120	100	100%

Lesson Plan

Unit	Description	Hours		Mode
I	Differential equation of first order and first degree: Variable – Separable	3	16	Lecture
	Homogeneous and Non-homogeneous differential equations	5		Problem Solving
	Exact Differential equations – Integrating factors.	8		Problem Solving
II	Introduction – Linear equation with constant coefficients : Methods of finding complementary functions	6	16	PPT, Tutorial
	Methods of finding particular integrals	10		PPT, Tutorial
III	Formation of partial differential equations	2	20	Lecture
	Classification of solution of PDE	2		PPT, Group Discussion
	Solutions of standard types of first order partial differential equations Type I	3		Problem Solving
	Solutions of standard types of first order partial differential equations Type II	3		Problem Solving
	Solutions of standard types of first order partial differential equations Type III	3		Lecture, Tutorial
	Solutions of standard types of first order partial differential equations Type IV	3		Lecture, Tutorial
	Lagrange’s linear equation	4		Problem Solving
IV	Laplace transforms	4	18	PPT, Quiz, Lecture
	Inverse Laplace transforms	6		PPT, Quiz, Lecture
	Solution of differential equations using Laplace transforms	8		Problem Solving
V	Finite differences	6	20	Lecture
	Newton’s forward and backward formula	8		Tutorial, Seminar
	Lagrange’s formula	6		Tutorial, Seminar
Total Hours		90		

Course Designer:

1. Dr. U. Karthik Raja, Assistant Professor, PG & Research Department of Mathematics, The Madura College (Autonomous), Madurai-11.
2. Prof.N.Srivivekasaratha, Assistant Professor, Department of Mathematics, The Madura College (Autonomous-SF), Madurai-11.

Title of the Course		NUMERICAL METHODS (COMPUTER SCIENCE)					
TANSCHHE Course type		EC1					
Course Category		Elective Course 1					
Nature of Course		Skill Development					
Category	Elective	Year	I	Credits	5	Course Code	23U1MGET1 (D)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		6	-		--		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic Knowledge of Programming concept					
Objectives of the Course		The main objectives of this course are: 1. To introduce the various topics in Numerical methods. 2. To make understand the fundamentals of algebraic equations. 3. To apply interpolation and approximation on examples. 4. To solve problems using numerical differentiation and integration. 5. To solve linear systems, numerical solution of ordinary differential equations.					
Course Outline		Unit-I FUNDAMENTALS OF ALGEBRAIC EQUATION: Solution of algebraic and transcendental equations-Bisection method – Fixed point iteration method – Newton Raphson method –linear system of equations – Gauss elimination method – Gauss Jordan method .					
		Unit-II ITERATIVE, INTERPOLATION AND APPROXIMATION: Iterative methods - Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi’s method for symmetric matrices. Interpolation with unequal intervals – Lagrange’s interpolation – Newton’s divided difference interpolation.					
		Unit-III INTERPOLATION WITH EQUAL INTERVAL: Difference operators and relations. -Interpolation with equal intervals – Newton’s forward and backward difference formulae.					
		Unit-IV NUMERICAL DIFFERENTIATION AND INTEGRATION: Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson’s 1/3 rule					

	Unit-V INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS: Single step methods – Taylor’s series method – Euler’s method – Modified Euler’s method - Runge Kutta method for solving(first, second , Third and 4th) order equations – Multi step methods
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved(To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	In this course, mathematical modelling methods for engineering systems are studied. It entails the creation of mathematical models and the use of computers to address engineering issues using the following computational methods: Taylor Series approximation, numerical differentiation, root-finding with bracketing and open methods, fitting linear and polynomial curves, resolving matrices, numerical integration, and solving differential equations. Numerical analysis is used during laboratory sessions.
Text Book(s)	1. P. Kandasamy , K. Thilagavathy and K. Gunavathy – “Numerical Methods”, S.Chand& Company Ltd., Reprint 2019. Unit 1: Chapter - 3 : 3.1, 3.2, 3.4 Chapter - 4 : 4.1 – 4.2 Unit 2: Chapter - 4 : 4.7– 4.9 Chapter - 13 : 13.1 – 13.2 Chapter - 8 Unit 3 : Chapter - 9 : 9.1 – 9.3 Unit 4: Chapter - 9: 9.9 & 9.13 Unit 5: Chapter - 11 : 11.1 – 11.7,11.9, 11.11 – 11.12, 11.16 – 11.17

Reference Book(s)	1. S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, - "Numerical Methods"- 2022(Reprint) scitech publications(India) Pvt.Ltd. 2. Balasubramaniam, Pand Venkatraman, M.K. (1972) Numerical Mathematics, Part I and II, Rochoose and Sons, New Delhi. 3. Saxena, H.C. (1972) Finite differences, S. Chand & Co, New Delhi. 4. Rajaraman, V.(1993) Computer Oriented Numerical Methods, PHI learning, New Delhi. 5. Sastry, S. S. (1993) Introductory Methods of Numerical Analysis, PHI learning, New Delhi. 6. Hutchison, I. H. (2015) A student guide to Numerical Methods, Cambridge University Press, Cambridge.
Websites and e-Learning resources	e-books, tutorials on MOOC/SWAYAM courses on the subject 1. https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Note:

1. Chapters mentioned in the course outline.
2. The text and reference books were changed because the originals were inaccurate.

COURSE OUTCOMES:

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

CO	Description	K-level
CO1	Know how to solve various problems on numerical methods	Up toK2
CO2	Use approximation to solve problems	Up toK3
CO3	Differentiation and integration concept are applied	Up toK3
CO4	Apply , direct methods for solving linear systems	Up toK4
CO5	Numerical solution of ordinary differential equations	Up toK3

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	2	3	3	1	-	-	1	3	1	-	1
CLO2	2	3	3	1	-	-	1	3	1	-	1
CLO3	2	3	3	1	-	-	1	3	1	-	1
CLO4	2	3	3	1	-	-	1	3	1	-	1
CLO5	2	3	3	1	-	-	1	3	1	-	1

3- Advance Application

2 – Intermediate Level

1 – Basic Level

Assessment Scheme**Components of CIA**

CLO	Component	Weight / Mark	K- Level
CLO 1 – CLO 4	CIA	10	K1- K4
CLO 5	Assignment	5	K3
CLO 5	Seminar	5	K3
CLO 1, CLO 2, CLO 3, CLO 4, CLO 5	Quiz	5	K1,K2

Blueprint for Semester Examination
BLUE PRINT - External Exam

Units	CLOs	K. Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of questions	K. Level	No. of questions	K. level			
1	CLO 1	Up to K2	2	K1&K2	1	K1	2 (K1& K1)	1(K2)	
2	CLO 2	Up to K3	2	K1&K2	1	K2	2 (K2 & K2)	1(K3)	
3	CLO 3	Up to K3	2	K1&K2	1	K2	2 (K3& K3)	1(K3)	
4	CLO 4	Up to K4	2	K1&K2	1	K1	2 (K4& K4)	1(K4)	
5	CLO 5	Up to K3	2	K1&K2	1	K2	2 (K3 & K3)	1(K3)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

Distribution of section wise marks with K levels.

K 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	41.66%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	41.67%
K4	-	-	10	10	20	16.67	16.67%
Total	10	10	50	50	120	100	100%

LESSON PLAN

UNIT	Description	Hours		Mode
I	Solution of algebraic and transcendental equations-Bisection method.	6	18	Problem solving
	Fixed point iteration method – Newton Raphson method –linear system of equations.	6		Lecture
	linear system of equations – Gauss elimination method – Gauss Jordan method .	6		Problem solving
II	Iterative methods - Gauss Jacobi and Gauss Seidel	6	18	Lecture
	Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices.	6		PPT
	Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation.	6		Lecture
III	Difference operators and relations.	6	18	Problem solving
	Interpolation with equal intervals	6		Lecture
	Newton's forward and backward difference formulae.	6		Problem solving
IV	Approximation of derivatives using interpolation polynomials.	6	18	Lecture
	Numerical integration using Trapezoidal	6		Problem solving
	Numerical integration using Simpson's 1/3 rule	6		Lecture
V	Single step methods – Taylor's series method	6	18	Tutorial
	Euler's method – Modified Euler's method	6		Problem solving
	Runge Kutta method for solving(first, second , Third and 4th) order equations – Multi step methods	6		Problem solving
	Total	90		

Course Designer:

1. Prof. N. Sriviveka Saratha, Assistant Professor, Department of Mathematics.
2. .Dr.V.Sangeethasubha, Assistant Professor, PG& Research Department of Mathematics.

Title of the Course		Graph Theory and its applications(COMPUTER SCIENCE)					
TANSCHHE Course type		EC2					
Course Category		ALLIED					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23U2MGET2 (D)
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		6			-		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic knowledge in data and representations					
Objectives of the Course		1. To understand and apply the fundamental concepts in graph theory. 2. To apply graph theory based tools in solving practical problems. 3. Analysing the Various Concepts of Representation of Graphs,					
Course Outline		UNIT-I : INTRODUCTION: Graph-mathematical definition- Introduction – sub graphs –Walks, paths, Circuits connectedness- Components- Euler Graphs- Hamiltonian paths and circuits-Trees- properties of Trees- Distance and centers in Tree- Rooted and Binary Trees.					
		Unit-II : CONNECTIVITY AND PLANARITY: Introduction to circuits - cut set- properties of cut set- All cut sets –connectivity and separability – Network Flows - 1-Isomorphism - 2-Isomorphism- Combinatorial and Geometric graphs- Planar Graphs – Different representation of planar graph.					
		Unit-III : COLORING AND DIRECTED GRAPH: Basics of Colouring &Chromatic number – Chromatic partitioning – Graph Colouring – four colour Problem Chromatic polynomial - Matching – Covering - Directed graphs - Types of Directed Graphs – Diagraphs and binary relations – Directed paths- Euler Graph.					
		Unit-IV : MATRIX REPRESENTATION IN GRAPH: Introduction, Representing Graphs, Adjacency Matrices, Incidence Matrices, spanning Trees of Connected Relations, Prim’s Algorithm to construct Spanning Trees, Weighted Graphs, Minimal, Spanning Trees by Prim’s Algorithm & Kruskal’s Algorithm.					
		Unit-V: APPLICATIONS OF GRAPH: Traveling Sales Person Problem with Directed and Undirected Graph - Shortest path from one to many Cities with directed graph- Shortest Paths with Undirected Graphs - Connected Components.					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved(To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Graph Theory, has applications in various fields. Graph theory has been serving as an elegant tool to easily approach/solve several problems/concepts in other fields ranging from Science to Sociology. This course will enable the students to acquire skills by which they can model certain real-life problems as graph theoretical terms and can make inferences.
Text Book(s)	1. Narsingh Deo , “ Graph Theory with Application to Engineering and Computer Science” Prentice Hall of India 2010(Reprint) 2. Kenneth H. Rosen “Discrete Mathematics and Its Application “ Mc Graw Hill” , 2021 Unit I – T1: Chapter 1(1.1,1.3-1.5),Chapter 2(2.2, 2.4-2.6, 2.9), Chapter 3(3.1, 3.2, 3.4, 3.5) Unit II- T1: Chapter 4(4.1-4.8),Chapter 5(5.1, 5.2, 5.4) Unit III- T1: Chapter 8(8.1-8.6),Chapter 9(9.1-9.5) Unit IV- T1: Chapter 3(3.10) T2: Chapter 9(9.3.1-9.3.4),Chapter10(10.4.1,10.5) UnitV- T1: Chapter 2 (2.10), Chapter11(11.4,11.5) T2: Chapter 9 (9.6.3)
Reference Book(s)	1. Discrete Maths for Computer Scientists & Mathematicians by Mott, Kandel, Baker. 2. Clark J and Holton DA “ First look at Graph Theory” Allied Publishers 1995. 3. Discrete Maths for Computer Scientists & Mathematicians by Mott, Kandel, Baker.
Websites and e-Learning resources	Web resources from NDL Library, E-content from open source libraries https://d3gt.com/ https://www.coursera.org/courses?query=graph%20theory

COURSE OUTCOMES:

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

CO	Course learning outcome	K-level
CO1	To Introduce the fundamental concepts in graph theory Graphs, subgraphs, walks, Euler graphs, Hamiltonian Paths Tree Properties , Hamiltonian paths and circuits.	Upto K3
CO2	Understanding the concepts of Circuits, Cut set and its Properties, Network Flows, Isomorphism and Combinatorial and Planar Graphs.	Upto K2
CO3	Applying the concept of Colouring with Chromatic Number, Directed Graphs, Matching, Covering Pattern and Euler Graphs.	Upto K3
CO4	Analysing the Various Concepts of Representation of Graphs, Euler Paths Circuit, Kruskals and Prim's Algorithms, Connected Components.	Upto K4
CO5	Implementation of an application using all types of graphs and evaluate the Applications with travelling sales person Problem, K colour Problem with n vertices in a Graph and Shortest Path finding Problem using Directed and Undirected Graphs.	Upto K3

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
CLO1	3	2	3	3	3	2	2	2	3
CLO2	3	2	3	3	3	2	2	2	3
CLO3	3	2	3	3	3	2	2	2	3
CLO4	3	2	3	3	3	2	2	2	3
CLO5	3	2	3	3	3	2	2	2	3

Components of Assessment shall be

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1, CLO2, CLO3,CLO4,CLO5	Quiz	5	K1

SUMMATIVE ASSESSMENT - BLUE PRINT

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 K3	2	K1 & K2	1	K1	2(K2 & K2)	1(K3)
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 K3	2	K1 & K2	1	K2	2(K3 & K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of section wise marks with K level

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	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	30	50	41.67	41.67%
K4	-		10	10	20	16.67	16.66%
Total marks	10	10	50	50	120	100	100%

Lecture schedule

Unit	Topics	Hours	Mode
I	INTRODUCTION: Graph-mathematical definition- Introduction – sub graphs – Walks, paths, Circuits.	6	PPT, Chalk and Talk.
	Connectedness - Components- Euler Graphs- Hamiltonian paths and circuits	6	
	Trees- properties of Trees- Distance and centers in Tree- Rooted and Binary Trees.	6	
II	CONNECTIVITY AND PLANARITY: Introduction to circuits - cut set- properties of cut set.	6	PPT, Chalk and Talk, Assignments and GD
	All cut sets –connectivity and separability – Network Flows - 1- Isomorphism - 2-Isomorphism	6	
	Combinatorial and Geometric graphs- Planar Graphs – Different representation of planar graph.	6	
III	COLORING AND DIRECTED GRAPH: Basics of Colouring & Chromatic number – Chromatic partitioning.	6	PPT, Chalk and Talk, Assignments
	Graph Colouring – four colour Problem Chromatic polynomial - Matching – Covering.	6	
	Directed graphs - Types of Directed Graphs.	3	
	Diagraphs and binary relations – Directed paths- Euler Graph.	3	
IV	MATRIX REPRESENTATION IN GRAPH: Matrix representation of graphs, Sub graphs & Quotient Graphs.	6	PPT, Chalk and Talk, Assignments
	Transitive Closure digraph, Euler's Path & Circuit (only definitions and examples), spanning Trees of Connected Relations,	6	
	Prim's Algorithm to construct Spanning Trees, Weighted Graphs, Minimal, Spanning Trees by Prim's Algorithm & Kruskal's Algorithm.	6	
V	APPLICATIONS OF GRAPH: Traveling Sales Person Problem with Directed and Un directed Graph.	6	Assignments, Seminar and GD
	Graph with n vertices and k colours.	6	
	Shortest path from one to many Cities with directed graph -Shortest Paths with Un directed Graphs-Connected Components.	6	

Course Designer:

1. Dr.S.VALLIRANI, Assistant Professor, Department of Mathematics, The Madura College.
2. Dr.V.SANGEETHASUBHA, Assistant Professor, PG& Research Department of Mathematics, The Madura College..

THE MADURA COLLEGE
Department of Mathematics

VISION

To train the students so that they are strong in logic, which enables them to approach, analyze and solve any problem, both scientific and sociological, in an unbiased manner and to enhance the quantitative and analytical skill.

MISSION

- To provide an environment where students can learn and become an efficient and accurate problem solver of Mathematics and Mathematical applications.
- To make the students as Mathematical thinkers and enable them to become a long time learners of Mathematics.
- To make the students to have core knowledge and able to correlate this core mathematical knowledge with other disciplines

PROGRAMME OUTCOMES FOR M.Sc. GRADUATES:

At the end of the program the graduates will be able to

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an Post graduate programme of study.

PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse 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 & Scientific 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: Research related skills: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned research perspective; Sense of inquiry and capability for asking relevant questions / problem arising / synthesizing / articulating / ability to recognize cause and effect relationships / define problems. Formulate hypothesis, Test / analyse / Interpret the results and derive conclusion, formulation and designing mathematical models

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

PSO1: Acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.

PSO2: Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.

PSO3: To prepare the students who will demonstrate respectful engagement with other’s ideas, behaviours, and beliefs and apply diverse frames of references to decisions and actions.

PSO4: To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate start-ups and high potential organizations.

PSO5: To encourage practices grounded in research those comply with employment laws, leading the organization towards growth and development.



THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
DEPARTMENT OF MATHEMATICS
M.Sc. Mathematics Major – Course Structure

SEMESTER - I

Course Description	Course Code	Hours per week	Credit
Core I - ALGEBRAIC STRUCTURES	23P1MCCT1	6	5
Core II - REAL ANALYSIS I	23P1MCCT2	6	5
Core III - ORDINARY DIFFERENTIAL EQUATIONS	23P1MCCT3	6	4
Elective I - NUMBER THEORY AND CRYPTOGRAPHY	23P1MECT1	5	3
Elective II - PROGRAMMING IN PYTHON	23P1MECT2	3	2
Elective III - PRACTICAL IN PYTHON	23P1MECP1	2	1
Skill Enhancement Course - SEC 1 MATHEMATICAL DOCUMENTATION USING LATEX	23P1MSD1	2	2
Total		30	22

SEMESTER - II

Course Description	Course Code	Hours per week	Credit
Core IV – ADVANCED ALGEBRA	23P2MCCT4	6	5
Core V – REAL ANALYSIS II	23P2MCCT5	6	5
Core VI - PARTIAL DIFFERENTIAL EQUATIONS	23P2MCCT6	6	4
Elective IV - MATHEMATICAL STATISTICS	23P2MECT3	5	3
Elective V – ADVANCED LINEAR PROGRAMMING	23P2MECT4	3	2
Elective VI – NONLINEAR PROGRAMMING	23P2MECT5	2	1
NME I – FOUNDATIONAL MATHEMATICS	23P2MSD1	2	2
Total		30	22

SEMESTER – I

Title of the Course		ALGEBRAIC STRUCTURES					
TANSCHÉ Course type		CC1					
Course Category		CORE I					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23P1MCCT1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		--		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		UG level Modern Algebra					
Objectives of the Course		To introduce the concepts and to develop working knowledge on class equation, solvability of groups, finite abelian groups, linear transformations, real quadratic forms.					
Course Outline		UNIT-I: Counting Principle - Class equation for finite groups and its applications - Sylow's theorems (For theorem 2.12.1, First proof only).					
		UNIT-II: Solvable groups - Direct products - Finite abelian groups-Modules.					
		UNIT-III: Linear Transformations: Canonical forms –Triangular form - Nilpotent transformations.					
		UNIT-IV: Jordan form - rational canonical form.					
		UNIT-V: Trace and transpose - Hermitian, unitary, normal transformations, real quadratic form.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.					
Justification for nature of course		An algebraic structure may be based on other algebraic structures with operations and axioms involving several structures. Algebra helps to develop your critical thinking, Knowledge to find number of Sylow subgroups, Algebraic structures with their associated transformations form mathematical categories and given polynomial is solvable by radicals or not.					

Text Book(s)	I.N. Herstein, Topics in Algebra (II Edition) Wiley Eastern Limited, New Delhi, 1975. Unit I - Chapter 2: Sections 2.11 and 2.12 (Omit Lemma 2.12.5) Unit II - Chapter 5: Section 5.7 (Lemma 5.7.1, Lemma 5.7.2, Theorem 5.7.1), Chapter 2: Section 2.13 and 2.14 (Theorem 2.14.1 only), Chapter 4: Section 4.5 Unit III - Chapter 6: Sections 6.4 and 6.5 Unit IV - Chapter 6: Sections 6.6 and 6.7 Unit V - Chapter 6: Sections 6.8, 6.10 and 6.11 (Omit 6.9)
Reference Book(s)	1. M.Artin, Algebra, Prentice Hall of India, 1991. 2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition) Cambridge University Press, 1997. (Indian Edition) 3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. II Rings, Narosa Publishing House , New Delhi, 1999 4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of Abstract Algebra, McGraw Hill (International Edition), New York. 1997. 5. N.Jacobson, Basic Algebra, Vol. I & II W.H.Freeman (1980); also published by Hindustan Publishing Company, New Delhi.
Websites and e-Learning resources	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org, www.algebra.com

COURSE OUTCOMES:

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

CO	Course Outcome	K-level
CO1	Recall basic counting principle, define class equations to solve problems, explain Sylow's theorems and apply the theorem to find number of Sylow subgroups.	Up to K2
CO2	Define Solvable groups, define direct products, examine the properties of finite abelian groups, define modules.	Up to K3
CO3	Define similar Transformations, define invariant subspace, explore the properties of triangular matrix, to find the index of nilpotence to decompose a space into invariant subspaces, to find invariants of linear transformation, to explore the properties of nilpotent transformation relating nilpotence with invariants.	Up to K4
CO4	Define Jordan, canonical form, Jordan blocks, define rational canonical form, define companion matrix of polynomial, find the elementary devices of transformation, apply the concepts to find characteristic polynomial of linear transformation.	Up to K4
CO5	Define trace, define transpose of a matrix, explain the properties of trace and transpose, to find trace, to find transpose of matrix, to prove Jacobson lemma using the triangular form, define symmetric matrix, skew symmetric matrix, adjoint, to define Hermitian, unitary, normal transformations and to verify whether the transformation in Hermitian, unitary and normal.	Up to K5

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
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Components of Assessment

CLO	Component	Weight / Mark	K-Level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3

Blueprint for Semester Examination

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 & 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 K5	2	K3 & K4	1	K3	2(K4 & K4)	1(K4/K5)
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

K5 - Evaluate the mistakes in answers

Distribution of section wise marks with K levels.

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	10	32	26.67	27%
K5			-	10	10	8.33	8%
Total marks	10	10	50	50	120	100	100%

LESSON PLAN

Unit	Description	Hours	Mode
I	Counting Principle - Class equation for finite groups and its applications	9	Lecture, Quiz
	Sylow's theorems	9	Lecture, Tutorial
II	Solvable groups - Direct products	9	Lecture, Quiz
	Finite abelian groups- Modules	9	Lecture, Quiz
III	Linear Transformations: Canonical forms	9	PPT, Lecture
	Triangular form - Nilpotent transformations	9	Lecture, Quiz
IV	Jordan form	9	Lecture, Tutorial
	Rational canonical form	9	Lecture, Tutorial
V	Trace and transpose - Hermitian, unitary	9	PPT, Lecture
	Normal transformations, real quadratic form	9	Lecture, Quiz
Total Hours		90	

COURSE DESIGNERS:

1. Dr. S. USHA, Assistant Professor, Department of Mathematics.
2. Prof. S.MEENAKSHI, Assistant Professor, Department of Mathematics (SF).

Title of the Course		REAL ANALYSIS I						
TANSCHÉ Course type		CC2						
Course Category		CORE 2						
Nature of Course		Employability / Skill Development						
Category	Core	Year	I	Credits	5	Course Code	23P1MCCT2	
		Semester	I					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		5		1		-		6
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		UG –Core Subject- Real Analysis						
Objectives of the Course		• To learn about advanced topics in Riemann’s Stieltjes Integrals. • To understand the concepts of infinite series and products. • To impart the knowledge of Sequence and series of functions						
Course Outline:		UNIT – 1: Functions of bounded variation - Introduction - Properties of monotonic functions - Functions of bounded variation - Total variation - Additive property of total variation - Total variation on [a, x] as a function of x - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation. Infinite Series: Absolute and conditional convergence - Dirichlet's test and Abel's test - Rearrangement of series - Riemann's theorem on conditionally convergent series. UNIT – 2: The Riemann - Stieltjes Integral - Introduction - Notation - The definition of the Riemann - Stieltjes integral - Linear Properties - Integration by parts- Change of variable in a Riemann - Stieltjes integral - Reduction to a Riemann Integral – Euler’s summation formula - Monotonically increasing integrators, Upper and lower integrals - Additive and linearity properties of upper, lower integrals - Riemann's condition - Comparison theorems. UNIT – 3: The Riemann-Stieltjes Integral - Integrators of bounded variation- Sufficient conditions for the existence of Riemann-Stieltjes integrals- Necessary conditions for the existence of RS integrals- Mean value theorems -integrals as a function of the interval – Second fundamental theorem of integral calculus-Change of variable -Second Mean Value Theorem for Riemann integral- Riemann-Stieltjes integrals depending on a parameter- Differentiation under integral sign-Lebesgue criteriaon for existence of Riemann integrals.						

	UNIT – 4: Infinite Series and infinite Products - Double sequences - Double series - Rearrangement theorem for double series - A sufficient condition for equality of iterated series - Multiplication of series – Cesaro summability - Infinite products. Power series - Multiplication of power series - The Taylor's series generated by a function - Bernstein's theorem - Abel's limit theorem - Tauber's theorem UNIT – 5: Sequences of Functions – Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions - Uniform convergence and continuity - Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions - Riemann - Stieltjes integration – Non-uniform Convergence and Term-by-term Integration - Uniform convergence and differentiation - Sufficient condition for uniform convergence of a series - Mean convergence.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Real analysis is an area of analysis that studies concepts such as sequences and their limits, continuity, differentiation, integration and sequences of functions. By definition, real analysis focuses on the real numbers, often including positive and negative infinity to form the extended real line. Various ideas from real analysis can be generalized from the real line to broader or more abstract contexts. This course imparts theoretical knowledge & Problem Solving Skills to the students and is crafted to help the students to knowing the best techniques in a given theory. Theoretical learning gives the guidance to the mind and mind guides our body to convert that theoretical learning into practical performance. Theoretical knowledge explains the why factor at the back of any situation and technique of working

Text Book(s)	Tom M.Apostol : <i>Mathematical Analysis</i>, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974. UNIT – 1: Chapter – 6: Sections 6.1 to 6.8, Chapter 8: Sections 8.8, 8.15, 8.17, 8.18 Unit – 2: Chapter – 7: Sections 7.1 to 7.14 Unit – 3: Chapter - 7: Sections 7.15 to 7.26 Unit – 4: Chapter – 8: Sections 8.20, 8.21 to 8.26, Chapter - 9: Sections 9.14, 9.15, 9.19, 9.20, 9.22, 9.23 Unit – 5: Chapter - 9: Sections 9.1 to 9.6, 9.8,9.9,9.10,9.11, 9.13
Reference Book(s)	1. Bartle, R.G. <i>Real Analysis</i>, John Wiley and Sons Inc., 1976. 2. Rudin,W. <i>Principles of Mathematical Analysis</i>, 3rd Edition. McGraw Hill Company, New York, 1976. 3. Malik,S.C. and Savita Arora. <i>Mathematical Analysis</i>, Wiley Eastern Limited.New Delhi, 1991. 4. Sanjay Arora and Bansi Lal, <i>Introduction to Real Analysis</i>, Satya Prakashan, New Delhi, 1991. 5. Gelbaum, B.R. and J. Olmsted, <i>Counter Examples in Analysis</i>, Holden day, San Francisco, 1964. 6. A.L.Gupta and N.R.Gupta, <i>Principles of Real Analysis</i>, Pearson Education, (Indian print) 2003.
Websites and e-Learning resources	http://mathforum.org, http://ocw.mit.edu/ocwwweb/Mathematics, http://www.opensource.org

Course Learning Outcomes:

On the successful completion of the course. Students will be able to

Number	Course Learning outcome	Knowledge level
CLO1	Analyze and evaluate functions of bounded variation and functions	Upto K3
CLO2	Describe the concept of Riemann-Stieltjes integral and its properties.	Upto K3
CLO3	Demonstrate the concept of Riemann-Stieltjes integrand it conditions.	Upto K3
CLO4	Construct various mathematical proofs using the properties of infinite series and products	Upto K4
CLO5	Formulate the concept and properties of sequence of functions.	Upto K5

Mapping of Course Outcomes (CLOs) with Program Outcomes (POs)

CLO/ PO-PSO	POs						PSOs		
CLO1	2	3	3	2	3	2	3	2	2
CLO2	2	3	3	2	3	2	3	2	2
CLO3	2	3	3	2	3	2	3	2	2
CLO4	2	3	3	2	3	2	3	2	2
CLO5	2	3	2	2	3	2	3	2	2

1. Weekly

2. Medium

3. Strongly

Components of Assessment shall be

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K3
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3, K3

Blueprint for Semester Examination

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 K3	2	K1 & K1	1	K1	2(K1 & K1)	1(K2)
2	CLO 2	Up to K3	2	K2 & K2	1	K1	2(K2 & K2)	1(K3)
3	CLO 3	Up to K3	2	K3 & K3	1	K2	2(K3 & K3)	1(K3)
4	CLO 4	Up to K4	2	K3 & K3	1	K2	2(K4 & K4)	1(K4)
5	CLO 5	Up to K5	2	K4 & K4	1	K3	2(K4 & K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3 – Application oriented – solving problems

K4- Examining, analyzing, presentation and make inference with evidences.

Distribution of section wise marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
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	100%

LESSON PLAN

Units	Description	Hours	Total Hours	Pedagogy
I	Introduction - Properties of monotonic functions	3	18	Chalk and Talk
	Functions of bounded variation - Total variation - Additive property of total variation - Total variation on $[a, x]$ as a function of x	3		Chalk and Talk
	Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation.	3		Chalk and Talk
	Absolute and conditional convergence	3		Chalk and Talk
	Dirichlet's test and Abel's test - Rearrangement of series	3		Chalk and Talk & Seminar
	Riemann's theorem on conditionally convergent series.	3		Chalk and Talk & Group Discussion
II	Introduction - Notation - The definition of the Riemann - Stieltjes integral	3	18	Chalk and Talk
	Linear Properties - Integration by parts- Change of variable in a Riemann - Stieltjes integral	3		Chalk and Talk & Seminar
	Reduction to a Riemann Integral	3		Chalk and Talk
	Euler's summation formula -	2		Chalk and Talk
	Monotonically increasing integrators, Upper and lower integrals -	2		Chalk and Talk
	Additive and linearity properties of upper, lower integrals -	2		Chalk and Talk & Seminar
	Riemann's condition - Comparison theorems.	3		Chalk and Talk & Group Discussion
III	Integrators of bounded variation	3	18	Chalk and Talk
	Sufficient conditions for the existence of Riemann-Stieltjes integrals-Necessary conditions for the existence of RS integrals	3		Chalk and Talk
	Mean value theorems -integrals as a function of the interval – Second fundamental theorem of integral calculus	3		Chalk and Talk
	Change of variable -Second Mean Value Theorem for Riemann integral	3		Chalk and Talk

	Riemann-Stieltjes integrals depending on a parameter- Differentiation under integral sign	3		Chalk and Talk & Seminar
	Lebesgue criteriaon for existence of Riemann integrals.	3		Chalk and Talk& Group Discussion
IV	Double sequences - Double series -	3	18	Chalk and Talk
	Rearrangement theorem for double series	3		Chalk and Talk & Seminar
	A sufficient condition for equality of iterated series	3		Chalk and Talk & Group Discussion
	Multiplication of series – Cesaro summability - Infinite products.	3		
	Multiplication of power series - The Taylor's series generated by a function	3		
	Bernstein's theorem - Abel's limit theorem - Tauber's theorem	3		
V	Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions	3	18	Chalk and Talk
	Uniform convergence and continuity - Cauchy condition for uniform convergence	3		Chalk and Talk & Seminar
	Uniform convergence of infinite series of functions	3		Chalk and Talk
	Riemann - Stieltjes integration – Non-uniform Convergence and Term-by-term Integration	3		Chalk and Talk
	Uniform convergence and differentiation	3		Chalk and Talk & Seminar
	Sufficient condition for uniform convergence of a series - Mean convergence.	3		Chalk and Talk & Group Discussion

Course Designers:

1. Dr. U. KARTHIK RAJA, Assistant Professor, PG and Research Department of Mathematics, The Madura College (Autonomous).
2. Dr. M. REVATHI, Assistant Professor, Department of Mathematics (SF), The Madura College.

Title of the Course		ORDINARY DIFFERENTIAL EQUATIONS					
TANSICHE Course type		CC3					
Course Category		Core III					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23P1MCCT3
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		-		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		UG level Calculus and Differential Equations					
Objectives of the Course		• Develop strong background on finding solutions to linear differential equations with constant and variable coefficients and also with singular points. • Study the existence and uniqueness of the solutions of first order differential equations. • To solve the second order and n-th order Initial value problems. • Introduce the students to the technique of solving various problems of engineering and science. • Study the concepts relating to the order and linearity of ODEs, analytic and computational solution methods for ODEs					
Course Outline		UNIT 1: Linear equations with constant coefficients Second order homogeneous equations-Initial value problems-Linear dependence and independence-Wronskian and a formula for Wronskian-Non-homogeneous equation of order two.					
		UNIT II: Linear equations with constant coefficients Homogeneous and non-homogeneous equation of order n –Initial value problems- Annihilator method to solve non-homogeneous equation - Algebra of constant coefficient operators.					

	UNIT III: Linear equation with variable coefficients Initial value problems -Existence and uniqueness theorems – Solutions to solve a non-homogeneous equation – Wronskian and linear dependence – reduction of the order of a homogeneous equation – homogeneous equation with analytic coefficients-The Legendre equation.
	UNIT IV: Linear equation with regular singular points Euler equation – Second order equations with regular singular points – Exceptional cases – Bessel Function.
	UNIT V: Existence and uniqueness of solutions to first order equations: Equation with variable separated – Exact equation – method of successive approximations – the Lipschitz condition – convergence of the successive approximations and the existence theorem.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Ordinary differential equations have wide applications in various science disciplines. It is practically important for science students able to model physical problems using mathematical equations, then solve these equations so that the behaviour of the systems concerned can be studied.
Text Book(s)	E.A.Coddington, <i>A introduction to ordinary differential equations</i> (3 rd Printing) Prentice-Hall of India Ltd., New Delhi, 1987. Unit I - Chapter 2: Sections 1 to 6 Unit II - Chapter 2: Sections 7 to 12. Unit III - Chapter 3: Sections 1 to 8 (Omit Section 9) Unit IV - Chapter 4: Sections 1 to 4 and 6 to 8 (Omit sections 5 and 9) Unit V - Chapter 5: Sections 1 to 6 (Omit Sections 7 to 9)

Reference Book(s)	1. Williams E. Boyce and Richard C. DI Prima, <i>Elementary differential equations and boundary value problems</i>, John Wiley and sons, New York, 1967. 2. George F Simmons, <i>Differential equations with applications and historical notes</i>, Tata McGraw Hill, New Delhi, 1974. 3. N.N. Lebedev, <i>Special functions and their applications</i>, Prentice Hall of India, New Delhi, 1965. 4. W.T. Reid. <i>Ordinary Differential Equations</i>, John Wiley and Sons, New York, 1971 5. M.D.Raisinghania, <i>Advanced Differential Equations</i>, S.Chand & Company Ltd. New Delhi 2001 6. B.Rai, D.P.Choudary and H.I. Freedman, <i>A Course in Ordinary Differential Equations</i>, Narosa Publishing House, New Delhi, 2002.
Websites and e-Learning resources	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics , http://www.opensource.org , www.mathpages.com

Course Learning Outcomes:

On the successful completion of the course. Students will be able to

Number	Course Learning outcome	Knowledge level
CLO1	Establish the qualitative behaviour of solutions of systems of differential equations.	K2
CLO2	Recognize the physical phenomena modeled by differential equations and dynamical systems.	K3
CLO3	Analyze solutions using appropriate methods and give examples.	K4
CLO4	Formulate Green's function for boundary value problems.	K4
CLO5	Understand and use various theoretical ideas and results that underlie the mathematics in this course.	K5

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 inference with evidences.

K5 - Evaluating the ode problems

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).

CLOs/POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	1	2	3	3	3	3	3	2	1
CLO2	2	2	3	3	3	3	3	2	1
CLO3	1	3	3	3	3	3	3	2	1
CLO4	2	3	3	3	3	3	3	2	1
CLO5	2	2	2	3	2	3	3	2	1

Components of Assessment shall be

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1, CLO2, CLO3,CLO4,CLO5	Quiz	5	K2,K3

Blueprint for Semester Examination**Mapping 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 & K1	1	K1	2(K1& K1)	1(K2)
2	CLO 2	Up to K 3	2	K2& K3	1	K1	2(K2 & K2)	1(K3)
3	CLO 3	Up to K 4	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)
4	CLO 4	Up to K 4	2	K3 & K4	1	K2	2(K4& K4)	1(K4)
5	CLO 5	Up to K5	2	K3& K4	1	K3	2(K4& K4)	1(K5)
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	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	10	32	26.67	26.67%
K5	-	-	-	10	10	8.33	8.33%
Total marks	10	10	50	50	120	100	100%

Lesson Plan

Units	Description	Hours	Total Hours	Pedagogy
I	Introduction	2	18	Lecture
	Second order homogeneous equations	3		Lecture
	Initial value problem for second order equations	3		Lecture & PPT
	Linear dependence and independence	2		Lecture
	Problems on Linear dependence and independence	2		Lecture
	A formula for Wronskian	3		Lecture& Group Discussion
	The Non-Homogeneous equations of order two	3		Lecture
II	Homogeneous equations of order n	3	18	Lecture& Seminar
	Non-Homogeneous equation of order n	3		Lecture
	Initial value problems for n -th order equations	3		Lecture & PPT
	Annihilator method	3		Lecture
	Annihilator method to solve Non-Homogeneous equations	3		Lecture& Seminar
	Algebra of constant coefficient operators.	3		Lecture& Seminar
	Initial value problem	3	18	Lecture
	Existence and Uniqueness theorem and solutions to solve non-homogeneous equations.	3		Lecture & PPT
	The Wronskian and Linear independence	3		Lecture

III	Reduction of the order of a Homogeneous equation	2		Lecture
	Reduction of the order of a Homogeneous equation	2		Lecture & Seminar
	Homogeneous equations with analytic coefficients	2		Lecture & Group Discussion
	The Legendre equations.	3		
IV	The Euler equations	3	18	Lecture
	Second order equations with Regular singular points	3		Lecture
	Exceptional cases	4		Lecture & Seminar
	The Bessel equation	4		Lecture
	The Bessel equation continued.	4		Lecture & PPT
V	Equations with variable separated	2	18	Lecture
	Exact equations	3		Lecture & Seminar
	The method of successive approximation	2		Lecture
	The Lipschitz condition	2		Lecture & PPT
	Convergence of successive approximation	2		Assignment
	Non-local existence of solutions.	2		Lecture & Group Discussion
	Approximations to and uniqueness of solutions.	2		Lecture
Total			90	

Course Designers:

1. Dr.V. Ananthaswamy, Associate Professor, Research Centre & PG Department of Mathematics.
2. Prof. V.Vijayalakshmi, Assistant Professor, Department of Mathematics (SF).

Title of the Course		NUMBER THEORY AND CRYPTOGRAPHY					
TANSCHÉ Course type		EC 1					
Course Category		Discipline Elective					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	3	Course Code	23P1MECT1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		UG level Number theory					
Objectives of the Course		- To understand the fundamental number theoretical algorithms and techniques. - Able to identify number theoretical functions and study their properties. - To learn and analyze certain types of Diophantine equations. - To apply the number theoretic concepts in modern cryptography					
Course Outline:		UNIT - I: Divisibility – Division algorithm – GCD – Euclidean algorithm – LCM — Congruence’s – Euler’s Theorem – Fermat’s theorem – Wilson’s theorem – Solutions of congruence’s – The Chinese Remainder Theorem.					
		UNIT – 2: Quadratic residues – Lemma of Gauss – Gaussian reciprocity law – Jacobi symbol.					
		UNIT – 3: Greatest integer function - Arithmetic functions – The Moebius Inversion formula.					
		UNIT – 4: Diophantine Equation – The linear equation – Pythagorean Triangle - The equation $x^2 + y^2 = z^2$ - The equation $x^4 + y^4 = z^2$.					
		UNIT – 5: Discrete logarithm – Principles of public key – Cryptosystem – RSA algorithm – Elliptic curve cryptography.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Number theory helps to discover interesting relationship between different sorts of numbers. It also helps to learn the unique properties of prime or rational numbers. Understanding of the course helps to encrypt and decrypt using basic concept of number theory and to break the code using RSA carelessly.
Text Book(s)	1. An introduction to the theory of numbers by Ivan Niven and Herbert Zuckerman, 5th Edition 2008, Wiley Eastern Limited, New Delhi 2. Cryptography and Network Security Principles and Practice by William Stallings, Prentice Hall, Fifth Edition, New Delhi, 2011. UNIT-I : T1: Chapter 1: Sec 1.2, Chapter 2: Sec 2.1-2.3 UNIT-II : T1: Chapter 3: Sec 3.1- 3.3 UNIT-III : T1: Chapter 4: Sec 4.1- 4.3 UNIT-IV : T1: Chapter 5: Sec 5.1, 5.3 UNIT-V : T2: Chapter: 8(8.5), 9(9.1-9.2), 10(10.4)
Reference Book(s)	1. Tom Apostol, Introduction to Analytic Number theory, Narosa Publications, New Delhi 2. Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag, New York, 1987. 3. David M. Burton, Elementary Number Theory, Wm.C. Brown Publishers, Dubuque, Iowa, 1989.
Websites and e-Learning resources	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics http://www.opensource.org , https://onlinecourses.nptel.ac.in/noc20_ma42/preview

COURSE OUTCOMES:

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

CO	Course learning outcome	K-level
CO1	Understand the concept of divisibility and congruence.	Upto K3
CO2	Learn the idea of Quadratic residues and reciprocity.	Upto K3
CO3	Solve the number theoretical functions.	Upto K3
CO4	Identify and solve Diophantine equations.	Upto K4
CO5	Implement number theoretical concepts in cryptography.	Upto K4

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

MAPPING 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).

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

Components of Assessment shall be

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K4
CLO5	Seminar	5	K4
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3, K3, K4

Blueprint for Semester Examination

Unit	CLOs	K- Level	Section A		Section B Short answer	Section C (Either/or Choice)	Section D (Open Choice)
			MCQ				
			No of Questions	K Level			
1	CLO1	Up to K3	2	K1 & K2	K1	2(K1&K1)	1(K3)
2	CLO2	Up to K3	2	K1 & K2	K2	2(K2&K2)	1(K3)
3	CLO3	Up to K3	2	K1 & K2	K2	2(K2&K2)	1(K3)
4	CLO4	Up to K4	2	K1 & K2	K2	2(K3&K3)	1(K4)
5	CLO5	Up to K4	2	K1 & K2	K2	2(K4&K4)	1(K4)
No. of Questions to be asked			10			10	5
No. of Questions to be answered			10			5	3
Marks for each question			2			5	10
Total Marks for each section			20			25	30

Distribution of section wise marks with K levels

K Levels	Section A MCQ	Section B (No choice)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	5	2	10	-	17	14.16	42%
K2	5	8	20	-	33	27.50	
K3	-		10	30	40	33.33	33%
K4	-		10	20	30	25.00	25%
K5	-		-	-	-	-	
Total marks	10	10	50	50	120	100	100%

Lecture Schedule

UNIT	DESCRIPTION	HOURS		PEDAGOGY
I	Divisibility - Division algorithm	3	18	Chalk and Talk, Problem Solving, Tutorial
	GCD, Euclidean algorithm	3		
	LCM and Properties	3		
	Congruence's - Euler's Theorem	3		
	Fermat's theorem – Wilson's theorem	2		
	Solutions of congruence's – The Chinese Remainder Theorem	4		
II	Quadratic residues – Lemma of Gauss	6	12	Chalk and Talk, Problem Solving, Tutorial
	Gaussian reciprocity law – Jacobi symbol.	6		
III	Greatest integer function	5	15	Chalk and Talk, Problem Solving, quiz
	Arithmetic functions	5		
	The Moebius Inversion formula	5		
IV	Diophantine Equation – The linear equation – Pythagorean Triangle	7	12	Chalk and Talk, Problem Solving
	The equation $x^2 + y^2 = z^2$ - The equation $x^4 + y^4 = z^2$	5		
V	Discrete logarithm– Principles of public key	6	18	Chalk and Talk, Problem Solving
	Cryptosystem – RSA algorithm	6		
	Elliptic curve cryptography.	6		
	Total		75	

Course Designers:

1. Dr. I. PADMAVATHI, Assistant Professor, PG and Research Department of Mathematics.
2. Dr. S.VALLIRANI, Assistant Professor, Department of Mathematics (SF).

Title of the Course		PROGRAMMING IN PYTHON						
TANSICHE Course type		EC 2						
Course Category		Elective						
Nature of Course		Employability / Skill Development						
Category	Core	Year	I	Credits	2	Course Code	23P1MECT2	
		Semester	I					
Instructional Hours per week		Lecture	Tutorial		Practical	Total		
		3	-		-	3		
Marks		CIA		Semester		Total		
		25		75		100		
Pre-requisite(s)		UG level C, C++						
Objectives of the Course		- To impart the knowledge on basic components of computer programming using the Python language. - To acquire programming skills in core Python. - To compute basic Mathematics and Statistical models through python packages. - To emphasize features unique to Python such as tuples, array slices and output formatting. - To demonstrate significant experience with the Python program development environment.						
Course Outline:		Unit I: Introduction to Python - Features of Python - Flavors of Python – Python Virtual machine- Comparisons between C and Python- Comparisons between Java and Python Data types in Python - Comments in Python - Build-in datatype - bool Datatype - Sequences in Python - Sets - Literals in Python - Determining the Datatype of a Variable - User-defined data type - Constants, Identifier and Reserved words - Naming conventions in Python.						
		Unit II: Operators in Python –Operators - Operator Precedence and Associativity - Mathematical Functions Input and Output - statements						
		Unit III: Control Statements - if, if...else and if...elif...else statements - Loops : While - for - Infinite - Nested. The else Suite - break - continue - pass - assert - return statements. Arrays in Python -Array - Advantages of Arrays - Creating an Array - Importing the Array Module - Indexing and Slicing on Arrays - Processing the Arrays - Types of Arrays.						

	Unit IV: Strings and Characters –Creating Strings-Length of a string- Indexing in Strings- Slicing the Strings-Repeating the Strings- Concatenation of Strings-Checking Membership-Comparing Strings- Removing spaces from a string. Functions - Defining, calling function - Returning results
	Unit V: - Lists and Tuples- Lists - Special features of Lists Tuples - Creating - Assessing basic operations and functions to process Tuples - Operations on Tuples
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Python is an interpreter, object-oriented, high-level programming language with dynamic semantics. Python Programming is a general-purpose skill used in almost all fields, including Data Science, Scientific and Mathematical computing, Web development, Finance and trading, System automation and administration, computer graphics, basic game development, security and penetration testing, Mapping and geography (GIS Software), etc. This course imparts programming skill to the students. This course is both skill oriented and employability oriented because of the benefits of learning Python.
Text Book(s)	Nageswara Rao R , Core Python Programming, Second Edition 2018, Dreamtech Press, New Delhi. Unit I - Chapters 1, 3 Unit II - Chapters 4, 5 Unit III - Chapters 6, 7 Unit IV - Chapters 8, 9 Unit V - Chapter 10

Reference Book(s)	1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist , First Edition 2012, O-Reilly. 2. Wesley J. Chun, Core Python programming, Second Edition 2010, Pearson Publications. 3. Mark Lutz, Programming Python, Fourth Edition 2010, O-Reilly Media. 4. Mark Summerfield, Programming in Python 3, 2009, Pearson Addison-Wesley Professional. 5. HaslwanterT, An Introduction to Statistics with Python with Application in the Life Sciences, 2016, Springer, Switzerland.
Websites and e-Learning resources	1. https://nptel.ac.in/courses/106/106/106106182/ 2. https://www.python.org/about/gettingstarted/ 3. https://www.programiz.com/python-programming 2. https://www.tutorialspoint.com/python/index.htm

COURSE OUTCOMES:

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

CO	Course learning outcome	K-level
CO1	Explain basic principles of Python Programming Language	Upto K2
CO2	Apply operators, mathematical functions in Python.	Upto K3
CO3	Construct control statements in the Python programs.	Upto K4
CO4	Categorize types of Arrays and its advantages and functions.	Upto K4
CO5	Examine special features of Lists, tuples,	Upto K4

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

MAPPING 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).

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

Components of Assessment shall be

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K4
CLO5	Seminar	5	K4
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3, K4

Blueprint for Semester Examination

Unit	CLOs	K- Level	Section A		Section B Short answer	Section C (Either/or Choice)	Section D (Open Choice)
			MCQ				
			No of Questions	K Level			
1	CLO1	Up to K2	2	K1 & K2	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K1 &K2	K1	2(K2&K2)	1(K3)
3	CLO3	Up to K4	2	K1 &K2	K2	2(K4&K4)	1(K3)
4	CLO4	Up to K4	2	K1 &K2	K2	2(K3&K3)	1(K4)
5	CLO5	Up to K4	2	K1 &K2	K2	2(K4&K4)	1(K4)
No. of Questions to be asked			10			10	5
No. of Questions to be answered			10			5	3
Marks for each question			2			5	10
Total Marks for each section			20			25	30

K Levels	Section A MCQ	Section B (No choice)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	5	2	10	-	17	14.16	42%
K2	5	8	10	10	33	27.50	
K3	-			10	20	30	25.00
K4	-			20	20	40	33.33
K5	-		-	-	-	-	
Total marks	10	10	50	50	120	100	100%

Distribution of section wise marks with K levels
Lecture Schedule

UNIT	DESCRIPTION	HOURS		PEDAGOGY
I	Introduction to Python - Features of Python - Flavors of Python	2	9	Chalk and Talk / PPT / Tutorial
	Data types in Python - Comments in Python - Build-in datatype - bool Datatype	2		
	Sequences in Python - Sets - Literals in Python - Determining the Datatype of a Variable	3		
	User-defined data type - Constants, Identifier and Reserved words - Naming conventions in Python.	2		
II	Operators in Python - Operator Precedence and Associativity	3	9	Chalk and Talk / PPT Chalk and Talk / PPT / Tutorial Chalk and Talk / PPT / Tutorial / Quiz
	Mathematical Functions -	3		
	Input and Output statements -	3		
III	Control Statements - if, if...else and if...elif...else statements -	2	9	Chalk and Talk / PPT / Tutorial / Quiz
	Loops : While - for - Infinite - Nested. The else Suite - break - continue - pass - assert - return statements	2		
	Array - Advantages of Arrays - Creating an Array - Importing the Array Module - Indexing and Slicing on Arrays	3		
	Processing the Arrays - Types of Arrays	2		
IV	Strings and Characters - Length-indexing-slicing-	2	9	Chalk and Talk / PPT / /Group Discussion
	Repeating –Concatenation – Checking Membership- Comparing Strings- Removing spaces from a string	2		
	Functions Defining, calling function	2		
	Returning results	1		
V	Lists –Creating- Updating	2	9	Chalk and Talk / PPT
	Special features of Lists	3		
	Tuples - Creating -Accessing	3		
	Operations on Tuples	1		
Total			45	

Course Designers:

1. Dr. U. KARTHIK RAJA, Assistant Professor, PG and Research Department of Mathematics, The Madura College.
2. Dr. I. PADMAVATHI, Assistant Professor, PG and Research Department of Mathematics, The Madura College.

Title of the Course		PRACTICAL IN PYTHON						
TANSCHÉ Course type		EC 3						
Course Category		Elective						
Nature of Course		Employability / Skill Development						
Category	Core	Year	I	Credit	1	Course Code	23P1MECP1	
		Semester	I					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		-		-		2		2
Marks		CIA			Semester			Total
		40			60			100
Pre-requisite(s)		UG level C, C++						
Objectives of the Course		• To acquire programming skills in core Python. • To compute basic Mathematics and Statistical models through python packages. • To expose the students in the areas of applying the theoretically learned concepts of core Python and to provide hands on learning experience to nurture their programming skill. • To demonstrate significant experience with the Python program development environment.						

S. No.	List of Experiments	K-Level	CLO
1	A python program to convert numbers from octal, binary and hexadecimal systems into decimal number system	K2	CLO1
2	A python program to convert numbers from different number systems into decimal number system	K2	CLO1
3	A python program that displays stars in an equilateral triangular form using a single for loop	K2	CLO2
4	A python program to generate Fibonacci number series	K3	CLO2
5	A python program to evaluate Exponential series	K3	CLO2
6	A python program to storing students marks into an array and finding total marks and percentage of marks	K3	CLO3
7	A python program to sort the array elements using bubble sort technique.	K3	CLO3
8	A python program to perform some mathematical operations on a numpy array	K2	CLO3
9	A python program to calculate factorial values using recursion	K3	CLO4
10	A python program to solve Towers of Hanoi problem	K4	CLO4
11	A python program that uses the functions of employee module and calculates the gross and net salaries of an employee	K4	CLO4

Books for study:

Nageswara Rao R, Core Python Programming, Second Edition 2018, Dreamtech Press, New Delhi.

Books for Reference:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, First Edition 2012, O Reilly.
2. Wesley J. Chun, Core Python programming, Second Edition 2010, Pearson Publications.
3. Mark Lutz, Programming Python, Fourth Edition 2010, O.Reilly Media.
4. Mark Summerfield, Programming in Python 3, 2009, Pearson Addison-Wesley Professional.
5. Haslwanter T, An Introduction to Statistics with Python with Application in the Life Sciences, 2016, Springer, Switzerland.

Web Resources:

1. <https://nptel.ac.in/courses/106/106/106106182/>
2. <https://www.python.org/about/gettingstarted/>
3. <https://www.programiz.com/python-programming>
4. <https://www.tutorialspoint.com/python/index.htm>
5. <https://www.w3schools.com/python/>
6. <https://www.math.purdue.edu/~bradfor3/ProgrammingFundamentals/Python/>
7. <https://www.w3resource.com/python-exercises/>
8. <https://www.practicepython.org/>
9. <https://pynative.com/python/>
10. <https://cs231n.github.io/python-numpy-tutorial/>

Rationale for the nature of the course

Python is an interpreter, object-oriented, high-level programming language with dynamic semantics. Python Programming is a general-purpose skill used in almost all fields, including Data Science, Scientific and Mathematical computing, Web development, Finance and trading, System automation and administration, computer graphics, basic game development, security and penetration testing, Mapping and geography (GIS Software), etc. This course imparts programming skill to the students. This course is both skill oriented and employability oriented because of the benefits of learning Python.

Activities having direct bearing on Skill Development /Employability/Entrepreneurship

- Seminars
- Assignments
- Group discussion
- Quiz.

Pedagogy: Demonstration and Practical Session

COURSE LEARNING OUTCOMES

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

CLO	Description	K - Level
CLO1	Explain basic conversion of number systems in Python Programming Language	Up to K2
CLO2	Apply operators, mathematical functions in Python	Up to K3
CLO3	Construct control statements in the Python programs	Up to K3
CLO4	Construct arrays and apply NumPy in arrays and matrices for programs	Up to K4
CLO5	Explore the special features of Lists, tuples, functions and dictionaries in programs	Up to K4

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

MAPPING 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).

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

Course Designers:

1. Dr. U. KARTHIK RAJA, Assistant Professor, PG and Research Department of Mathematics.
2. Dr. I. PADMAVATHI, Assistant Professor, PG and Research Department of Mathematics.

SEMESTER – II

Title of the Course		ADVANCED ALGEBRA						
TANSCHÉ Course type		CC4						
Course Category		CORE IV						
Nature of Course		Employability / Skill Development						
Category	Core	Year	I	Credits	5	Course Code	23P2MCCT4	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		5		1		--		6
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Algebraic Structures						
Objectives of the Course		To study field extension, roots of polynomials, Galois Theory, finite fields, division rings, solvability by radicals and to develop computational skill in abstract algebra.						
Course Outline		UNIT-I: Extension fields – Transcendence of e.						
		UNIT-II: Roots of Polynomials - More about roots						
		UNIT-III: Elements of Galois theory.						
		UNIT-IV: Finite fields - Wedderburn's theorem on finite division rings.						
		UNIT-V: Solvability by radicals - A theorem of Frobenius - Integral Quaternions and the Four - Square theorem.						
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)						
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill						
Justification for nature of course		Advanced algebra is also used in most sciences and fields of engineering, because it allows modelling many natural phenomena, and computing efficiently with such models. This course imparts theoretical knowledge & Problem Solving Skills to the students and is crafted to help the students to knowing the best techniques for a given theory. Theoretical learning gives the guidance to the mind and mind guides our body to convert that theoretical learning into practical performance. Theoretical knowledge explains the why factor at the back of any situation and technique of working.						

Text Book(s)	I.N. Herstein. Topics in Algebra (II Edition) Wiley Eastern Limited, New Delhi, 1975. Unit I - Chapter 5: Section 5.1 and 5.2 Unit II - Chapter 5: Sections 5.3 and 5.5 Unit III - Chapter 5: Section 5.6 Unit IV - Chapter 7: Sections 7.1 and 7.2 (Theorem 7.2.1 only) Unit V - Chapter 5: Section 5.7 (omit Lemma 5.7.1, Lemma 5.7.2 and Theorem 5.7.1), Chapter 7: Sections 7.3 and 7.4
Reference Book(s)	1. M.Artin, Algebra, Prentice Hall of India, 1991. 2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition) Cambridge University Press, 1997. (Indian Edition) 3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. II Rings, Narosa Publishing House , New Delhi, 1999 4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of Abstract Algebra, McGraw Hill (International Edition), New York. 1997. 5. N.Jacobson, Basic Algebra, Vol. I & II Hindustan Publishing Company, New Delhi.
Websites and e-Learning resources	http://mathforum.org, http://ocw.mit.edu/ocwwweb/Mathematics, http://www.opensource.org, www.algebra.com

COURSE OUTCOMES:

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

CO	Course Outcome	K-level
CO1	Use the concept of extension fields and prove theorems applying algebraic ways of thinking.	Up to K2
CO2	Examine splitting field in rational fields, extension fields, splitting fields and understand the idea of roots of polynomials.	Up to K3
CO3	Compose clear and accurate proofs using the concepts of Galois Theory.	Up to K4
CO4	Bring out insight into Abstract Algebra with focus on axiomatic theories.	Up to K4
CO5	Demonstrate knowledge and understanding of fundamental concepts including extension fields, Algebraic extensions and Finite fields.	Up to K5

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
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Components of Assessment

CLO	Component	Weight / Mark	K-Level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2,K3

Blueprint for Semester Examination

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 & 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 K5	2	K3 & K4	1	K3	2(K4 & K4)	1(K4/K5)
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

K5 - Evaluate the mistakes in answers

Distribution of section wise marks with K levels.

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	10	32	26.67	27%
K5			-	10	10	8.33	8%
Total marks	10	10	50	50	120	100	100%

LESSON PLAN

Unit	Description	Hours	Mode
I	Extension fields	9	Lecture, Quiz
	Transcendence of e	9	Lecture, Tutorial
II	Roots of Polynomials	9	Lecture, Quiz
	More about roots	9	Lecture, Quiz
III	Elements of Galois theory.	9	PPT, Lecture
	Related Theorems	9	Lecture, Quiz
IV	Finite fields	9	Lecture, Tutorial
	Wedderburn's theorem on finite division rings.	9	Lecture, Tutorial
V	Solvability by radicals - A theorem of Frobenius	9	PPT, Lecture
	Integral Quaternions and the Four - Square theorem.	9	Lecture, Quiz
Total Hours		90	

COURSE DESIGNERS:

1. Dr. S. USHA, Assistant Professor, Department of Mathematics.
2. Prof. S. MEENAKSHI, Assistant Professor, Department of Mathematics (SF).

Title of the Course		REAL ANALYSIS II					
TANSCHÉ Course type		CC5					
Course Category		Core V					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23P2MCCT5
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		-		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Elements of Real Analysis					
Objectives of the Course		- To learn about advanced topics in Fourier series and Fourier Integrals. - To acquire idea to know functions of several variables. - To obtain the knowledge of the Lebesgue measure & integral. - To provide students with fundamental concepts and techniques of multivariable calculus and to develop student understanding and skills for its applications to other areas.					
Course Outline		UNIT-I: Measure on the Real line - Lebesgue Outer Measure - Measurable sets - Regularity - Measurable Functions - Borel and Lebesgue Measurability					
		UNIT-II: Integration of Functions of a Real variable - Integration of Non- negative functions - The General Integral - Riemann and Lebesgue Integrals					
		UNIT III: Fourier Series and Fourier Integrals - Introduction - Orthogonal system of functions - The theorem on best approximation - The Fourier series of a function relative to an orthonormal system - Properties of Fourier Coefficients - The Riesz-Fischer Thorem - The convergence and representation problems in for trigonometric series - The Riemann - Lebesgue Lemma - The Dirichlet Integrals - An integral representation for the partial sums of Fourier series - Riemann's localization theorem - Sufficient conditions for convergence of a Fourier series at a particular point – Cesaro summability of Fourier series- Consequences of Fejes's theorem - The Weierstrass approximation theorem					

	UNIT IV: Multivariable Differential Calculus - Introduction - The Directional derivative - Directional derivative and continuity - The total derivative - The total derivative expressed in terms of partial derivatives - The matrix of linear function - The Jacobian matrix - The chain rule - Matrix form of chain rule - The mean - value theorem for differentiable functions - A sufficient condition for differentiability - A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of $\mathbb{R}^n$ to $\mathbb{R}^1$
	UNIT-V: Implicit Functions and Extremum Problems: Functions with non-zero Jacobian determinants – The inverse function theorem-The Implicit function theorem-Extrema of real valued functions of severable variables-Extremum problems with side conditions.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved(To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Real analysis is an area of analysis that studies concepts such as sequences and their limits, continuity, differentiation, integration, functions of several variables and sequences of functions. Measure theory is the study of measures. It generalizes the intuitive notions of length, area, and volume. The earliest and most important examples are Jordan measure and Lebesgue measure, but other examples are Borel measure, probability measure, complex measure, and Haar measure. This course impart theoretical knowledge & Problem Solving Skills to the students and is crafted to help the students to knowing the best techniques for a given theory. Theoretical knowledge explains the why factor at the back of any situation and technique of working.

Text Book(s)	1. G. de Barra, <i>Measure Theory and Integration</i>, Wiley Eastern Ltd., New Delhi, 1981. (for Units I and II) 2. Tom M.Apostol : <i>Mathematical Analysis</i>, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974. (for Units III, IV and V) Unit I – T1: Chapter - 2 Sec 2.1 to 2.5 Unit II – T1: Chapter - 3 Sec 3.1,3.2 and 3.4 Unit III – T2: Chapter - 11: Sections 11.1 to 11.15 Unit IV – T2: Chapter - 12: Section 12.1 to 12.14 Unit V – T2: Chapter - 13: Sections 13.1 to 13.7
Reference Book(s)	1. Burkill,J.C. <i>The Lebesgue Integral</i>, Cambridge University Press, 1951. 2. Munroe,M.E. <i>Measure and Integration</i>. Addison-Wesley, Mass.1971. 3. Roydon,H.L. <i>Real Analysis</i>, Macmillan Pub. Company, New York, 1988. 4. Rudin, W. <i>Principles of Mathematical Analysis</i>, McGraw Hill Company, New York, 1979. 5. Malik,S.C. and Savita Arora. <i>Mathematical Analysis</i>, Wiley Eastern Limited. New Delhi, 1991. 6. Sanjay Arora and Bansi Lal, <i>Introduction to Real Analysis</i>, Satya Prakashan, New Delhi, 1991
Websites and e-Learning resources	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics , http://www.opensource.org

COURSE OUTCOMES:

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

CO	Course learning outcome	K-level
CO1	Identifying the concept of Lebesgue measure	Upto K3
CO2	Analyzing the concept of Lebesgue integral	Upto K4
CO3	Understand and describe the basic concepts of Fourier series and Fourier integrals with respect to orthogonal system. Analyze the representation and convergence problems of Fourier series.	Upto K3
CO4	Understand the concept of Multivariable Differential Calculus.	Upto K3
CO5	Understand the concept of Implicit functions and Extremum problems.	Upto K5

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
CLO1	1	2	3	1	3	3	3	1	2
CLO2	1	2	3	1	3	3	3	1	2
CLO3	1	2	3	1	3	3	3	1	2
CLO4	1	2	3	1	3	3	3	1	2
CLO5	1	2	3	1	3	3	3	1	2

Components of Assessment shall be

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3

Blueprint for Semester Examination

Unit	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No of Questions	K Level	No Of Questions	K Level		
1	CLO1	Up to K3	2	K2 & K2	1	K1	2(K1 & K1)	1(K3)
2	CLO2	Up to K4	2	K3 & K3	1	K2	2(K3 & K3)	1(K4)
3	CLO3	Up to K3	2	K3 & K3	1	K2	2(K4 & K4)	1(K3)
4	CLO4	Up to K3	2	K1 & K1	1	K1	2(K2 & K2)	1(K2)
5	CLO5	Up to K5	2	K4 & K4	1	K3	2(K3 & K3)	1(K5)
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	2	4	10	-	16	13.33	36%
K2	2	4	10	10	26	21.67	
K3	4	2	20	20	46	38.33	38%
K4	2	-	10	10	22	18.33	18%
K5	-	-	-	10	10	08.33	08%
Total marks	10	10	50	50	120	100	100%

Lecture Schedule

Unit	Topics	Hours	Mode
I	Measure on the Real line - Lebesgue Outer Measure	6	Lecture, Quiz.
	Measurable sets - Regularity - Measurable Functions	6	
	Borel and Lebesgue Measurability.	6	
II	Integration of Functions of a Real variable - Integration of Non- negative functions	6	Lecture, Quiz.
	The General Integral	6	
	Riemann and Lebesgue Integrals	6	
III	Fourier Series and Fourier Integrals - Introduction - Orthogonal system of functions - The theorem on best approximation - The Fourier series of a function relative to an orthonormal system.	6	PPT, Lecture, Quiz, GD
	Properties of Fourier Coefficients - The Riesz-Fischer Theorem - The convergence and representation problems in for trigonometric series - The Riemann - Lebesgue Lemma - The Dirichlet Integrals - An integral representation for the partial sums of Fourier series.	6	
	Riemann's localization theorem - Sufficient conditions for convergence of a Fourier series at a particular point –Cesaro summability of Fourier series- Consequences of Fejes's theorem - The Weierstrass approximation theorem.	6	
IV	Multivariable Differential Calculus - Introduction - The Directional derivative - Directional derivative and continuity - The total derivative - The total derivative expressed in terms of partial derivatives - The matrix of linear function.	6	PPT, Lecture, Quiz.
	The Jacobian matrix - The chain rule - Matrix form of chain rule - The mean - value theorem for differentiable functions - A sufficient condition for differentiability.	6	
	A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of R^n to R^1	6	
V	Implicit Functions and Extremum Problems: Functions with non-zero Jacobian determinants.	6	Assignments and Seminar,GD
	The inverse function theorem-The Implicit function theorem.	6	
	Extrema of real valued functions of severable variables-Extremum problems with side conditions.	6	

Course Designers:

1. Dr. M. REVATHI, Assistant Professor, Department of Mathematics (SF)
2. Dr. U. KARTHIK RAJA, Assistant Professor, PG and Research Department of Mathematics.

Title of the Course		PARTIAL DIFFERENTIAL EQUATIONS					
TANSCHÉ Course type		CC6					
Course Category		Core VI					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23P2MCCT6
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		--		6
Marks		CIA		Semester			Total
		25		75			100
Pre-requisite(s)		UG level partial differential equations					
Objectives of the Course		1. Develop strong background on finding various solutions to first order linear and nonlinear Partial Differential Equations (PDE's). 2. To solve the nonlinear PDE's by Charpit's method and Jacobi's method. 3. To focus the formulation of first and second orders PDE's. 4. To classify and solving for three basic types namely Hyperbolic, Parabolic and Elliptic PDE's. 5. Solving of PDEs which include heat, wave and Laplace' s equation that arise in various physical systems.					
Course Outline		UNIT-I: Mathematical Models and Classification of second order equation: Classical equations-Vibrating string – Vibrating membrane – waves in elastic medium – Conduction of heat in solids – Gravitational potential – Second order equations in two independent variables – canonical forms – equations with constant coefficients – general solution					
		UNIT-II: Cauchy Problem: The Cauchy problem – Cauchy-Kowalewsky theorem – Homogeneous wave equation – Initial Boundary value problem-Non-homogeneous boundary conditions – Finite string with fixed ends – Non-homogeneous wave equation – Riemann method – Goursat problem – spherical wave equation – cylindrical wave equation.					
		UNIT-III: Method of separation of variables: Separation of variable-Vibrating string problem – Existence and uniqueness of solution of vibrating string problem - Heat conduction problem – Existence and uniqueness of solution of heat conduction problem – Laplace and beam equations.					
		UNIT-IV: Boundary Value Problems: Boundary value problems – Maximum and minimum principles – Uniqueness and continuity theorem – Dirichlet Problem for a circle, a circular annulus, a rectangle – Dirichlet problem involving Poisson equation – Neumann problem for a circle and a rectangle.					

	UNIT-V: Green's Function: The Delta function – Green's function – Method of Green's function – Dirichlet Problem for the Laplace and Helmholtz operators – Method of images and eigen functions – Higher dimensional problem – Neumann Problem.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Partial differential equations have wide applications in various science disciplines. It is practically important for science students able to model physical problems using mathematical equations, then solve these equations so that the behaviour of the system concerned can be studied.
Recommended Text	TynMyint-U and Lokenath Debnath, <i>Partial Differential Equations for Scientists and Engineers</i> (Third Edition), North Hollan, New York, 1987. Unit I - Chapter 2: Sections 2.1 to 2.6, Chapter 3: Sections 3.1 to 3.4 (Omit 3.5) Unit II - Chapter 4: Sections 4.1 to 4.11 Unit III - Chapter 6: Sections 6.1 to 6.6 (Omit section 6.7) Unit IV - Chapter 8: Sections 8.1 to 8.9. Unit V - Chapter 10: Section 10.1 to 10.9
Reference Books	1. M.M.Smirnov, <i>Second Order partial Differential Equations</i>, Leningrad, 1964. 2. I.N.Sneddon, <i>Elements of Partial Differential Equations</i>, McGraw Hill, New Delhi, 1983. 3. R. Dennemeyer, <i>Introduction to Partial Differential Equations and Boundary Value Problems</i>, McGraw Hill, New York, 1968. 4. M.D.Raisinghania, <i>Advanced Differential Equations</i>, S.Chand & Company Ltd., New Delhi, 2001. 5. S, Sankar Rao, <i>Partial Differential Equations</i>, 2nd Edition, Prentice Hall of India, New Delhi. 2004
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics , http://www.opensource.org , www.mathpages.com

Course Learning Outcomes:

On the successful completion of the course. Students will be able to

CLO	Course Learning outcome	Knowledge level
CLO1	To understand and classify second order equations and find general solutions.	K2
CLO2	To analyse and solve wave equations in different polar coordinates	K3
CLO3	To solve Vibrating string problem, Heat conduction problem, to identify and solve Laplace and beam equations	K4
CLO4	To apply maximum and minimum principle's and solve Dirichlet, Neumann problems for various boundary conditions.	K4
CLO5	To apply Green's function and solve Dirichlet, Laplace problems, to apply Helmholtz operation and to solve Higher dimensional problem.	K5

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 inference with evidences.

K5 - Evaluating the pde problems

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).

CLOs/POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	1	2	3	3	3	3	3	2	1
CLO2	2	2	3	3	3	3	3	2	1
CLO3	1	3	3	3	3	3	3	2	1
CLO4	2	3	3	3	3	3	3	2	1
CLO5	2	2	2	3	2	3	3	2	1

Components of Assessment shall be

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3

Blueprint for Semester Examination

SL.No	CLOs	K-level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1 & 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 K5	2	K3& K4	1	K3	2(K4& K4)	1(K4/K5)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

Distribution of section wise marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	10	32	26.67	26.67%
K5	-	-	-	10	10	8.33	8.33%
Total marks	10	10	50	50	120	100	100%

Lesson Plan

Units	Description	Hours	Total Hours	Pedagogy
I	Classical equations – Introduction	3	18	Lecture
	Vibrating String and Vibrating String membrane	2		Lecture
	Waves in elastic medium	2		Lecture
	Conduction of heat in solids, Gravitational potential	3		Lecture
	Second order equations in two independent variables	3		Lecture & Group Discussion
	Canonical forms and equations with constant coefficients	3		Lecture
	General solution of equation with constant coefficients.	2		Lecture
II	The Cauchy problem	2	18	Lecture
	Cauchy -Kowalewsky theorem	2		Lecture & Seminar
	Homogeneous wave equation initial boundary value problem	2		Lecture
	Non homogeneous boundary conditions, finite string with fixed ends	2		Lecture & PPT
	Non homogeneous wave equation	2		Lecture
	Riemann method and Goursat problem	2		Lecture& Seminar
	Spherical wave equations	3		Lecture
	Cylindrical wave equations	3		Lecture
III	Separation of variables and vibrating string problem	4	18	Lecture
	Existence and uniqueness of solution of vibrating string problem	4		Lecture & PPT
	Heat conduction problem	4		Lecture
	Existence and uniqueness of solution of heat conduction problem,	3		Lecture
	Laplace and beam equations	3		Lecture & Seminar
IV	Boundary value problems	3	18	Lecture
	Maximum and minimum principles	3		Lecture
	Uniqueness and continuity theorem	2		Lecture & PPT
	Dirichlet problem for a circle and a circular annulus and a rectangle	4		Lecture
	Dirichlet problem involving poisson equation	4		Lecture

	Neumann problem for a circle and a rectangle	2		Lecture & Group Discussion
V	The Delta function and Green function	4	18	Lecture
	Method of Green's function	4		Lecture & Seminar
	Dirichlet Problem for the Laplace and Helmholtz operators	4		Lecture & PPT
	Method of images and eigen functions	3		Assignment
	Higher dimensional problem and Neumann problem	3		Lecture & Group Discussion
Total			90	

Course Designers:

1. Dr. V. Ananthaswamy, Associate Professor, Research Centre & PG Department of Mathematics.
2. Prof. V. Vijayalakshmi, Assistant Professor, Department of Mathematics (S.F).

Title of the Course		MATHEMATICAL STATISTICS					
TANSCHE Course type		EC4					
Course Category		Elective					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	3	Course Code	23P2MECT3
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Theory of Probability					
Objectives of the Course		• To know the desirable qualities for an estimator and learn a number of techniques for finding minimum variance. • To understands the elements of hypothesis test and be able to carry out a number of different hypothesis test. • To Formulate, test and interpret various hypothesis tests. • To Characterize, compare, and contrast different nonparametric hypothesis tests.					
Course Outline		UNIT-I: Distribution of Functions of Random Variables: Sampling Theory – Transformations of Variables of the Discrete Type – Transformations of Variables of the Continuous Type – The t and F Distributions.					
		UNIT II: Order Statistics: Distributions of Order Statistics - The Moment Generating Function Technique. The Distributions of $\bar{X}$ and ns^2/σ^2 – Expectations of Functions of Random Variables.					
		UNIT III: Estimation Theory: Point Estimation – Measures of Quality of Estimators – Confidence Intervals for Means – Confidence Intervals for Differences of Means - Confidence Intervals for Variances – Bayesian Estimates.					
		UNIT IV: Statistical Hypothesis: Some Examples and Definitions – Certain Best Tests – Uniformly Most Powerful Tests – Likelihood Ratio Tests.					
		UNIT V: Nonparametric Methods: Confidence Intervals for Distribution Quantiles – Tolerance Limits for Distributions – The sign Test – A Test of Wilcoxon – The Equality of Two Distributions – The Mann Whitney – Wilcoxon Test.					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	The modern theory of statistics has its foundations on the theory of probability which in turn is a particular branch of more advanced mathematical theory of Measure and Integration. Ever increasing role of Mathematics in statistics has resulted in the development of a new branch of statistics called ‘Mathematical Statistics’ We live in an uncertain and complex world, yet to make decisions in the present with uncertain future outcomes. While uncertainty makes decision –making difficult, the knowledge of probability theory and statistics help us to make informed -and hence better –decisions, essential skills for a lifetime of good decision making.
Text Book(s)	Robert V. Hogg and Allen T. Craig, “Introduction to Mathematical Statistics” (Fourth Edition), Mcmillan publishing Co., Inc., New York. UNIT I - Chapter 4: 4.1 – 4.4 UNIT II - Chapter 4: 4.6 – 4.9 UNIT III - Chapter 6: Sec 6.1 – 6.6 UNIT IV - Chapter 7: Sec 7.1 – 7.4 UNIT V - Chapter 9: Sec 9.1 – 9.6
Reference Book(s)	M. Fisz, Probability theory and Mathematical Statistics, John Wiley & Sons New York, 1963. E.J. Dudewiczn and S.N.Mishra, Modern Mathematical Statistics, John Wiley & Sons, New York, 1988. V.N. Rohatgi, An Introduction to Probability theory and Mathematical Statistics, Wiley Eastern Limited, New Delhi, 1988.
Websites and e-Learning resources	• http://mathforum.org, • http://ocw.mit.edu/ocwweb/Mathematics, • http://www.opensource.org • https://stat.ethz.ch/~geer/mathstat.pdf • https://sites.pitt.edu/~super1/ResearchMethods/Arabic/HypothesisTestingpart1.pdf

COURSE OUTCOMES:

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

CO	Course learning outcome	K-level
CO1	To determine transformations of variables of discrete and continuous types and t and F distributions.	Upto K3
CO2	To compute order statistics, moment generating function and expectation of function of random variables	Upto K3
CO3	To construct point and interval estimators and evaluate their goodness.	Upto K3
CO4	To decide as to which test of significance is to be applied for any given large sample problem.	Upto K4
CO5	To analyze the different nonparametric methods in estimation, testing, model fitting, and in analyses.	Upto 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).

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

Components of Assessment

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K4
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3,K4

Blueprint for Semester Examination

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 & K1	1	K1	2(K1 & K1)	1(K2)
2	CLO 2	Up to K 3	2	K2& K2	1	K1	2(K2& K2)	1(K3)
3	CLO 3	Up to K 3	2	K3& K3	1	K2	2(K3 & K3)	1(K3)
4	CLO 4	Up to K 4	2	K3& K3	1	K2	2(K4& K4)	1(K4)
5	CLO 5	Up to K 4	2	K4& K4	1	K3	2(K4 & K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3 – Application oriented – solving problems

K4- Examining, analyzing, presentation and make inference with evidences.

Distribution of section wise marks with K levels. *

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30.00	
K4	2		20	20	42	35.00	35%
Total marks	10	10	50	50	120	100	100%

Lecture Schedule

Unit	Topics	Hours		Mode
I	Sampling Theory – Transformations of Variables of the Discrete Type	5	15	Lecture, Quiz.
	Transformations of Variables of the Continuous Type	5		
	The t and F Distributions.	5		
II	Distributions of Order Statistics - The Moment Generating Function Technique.	5	15	Lecture, Quiz.
	The Distributions of $\bar{X}$ and ns^2/σ^2	5		
	Expectations of Functions of Random Variables.	5		
III	Point Estimation – Measures of Quality of Estimators .	5	15	PPT, Lecture, Quiz, GD
	Confidence Intervals for Means – Confidence Intervals for Differences of Means	5		
	Confidence Intervals for Variances – Bayesian Estimates.	5		
IV	Some Examples and Definitions – Certain Best Tests –	5	15	PPT, Lecture, Quiz.
	Uniformly Most Powerful Tests	5		
	Likelihood Ratio Tests.	5		
V	Confidence Intervals for Distribution Quantiles – Tolerance Limits for Distributions.	5	15	Assignments and Seminar.
	The sign Test – A Test of Wilcoxon	5		
	The Equality of Two Distributions – The Mann Whitney – Wilcoxon Test.	5		
	Total hours	75		

Course Designers:

1. Dr. I. Padmavathi, Assistant Professor, PG and Research Department of Mathematics, The Madura College.
2. Dr. B. Seethalakshmi, Assistant Professor, Department of Mathematics, The Madura College.

Title of the Course		ADVANCED LINEAR PROGRAMMING					
TANSCHÉ Course type		EC5					
Course Category		Elective (Discipline Specific)					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23P2MECT4
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		3	-		-		3
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic Optimization Techniques, Modeling with Linear Programming					
Objectives of the Course		- To introduce the revised simplex method and to make them perform parametric analysis. - To make them understand the limitations of simplex method in deriving integer solution to linear programming problems. - To illustrate various dynamic programming models and their applications in solving a decision-problem.					
Course Outline		Unit I: Revised Simplex method: Development of the Optimality and Feasibility conditions – Revised Simplex Algorithm – Bounded-Variables Algorithm					
		Unit II: Illustrative Applications: Capital Budgeting, Set-Covering Problem, Fixed-Charge Problem, Either-Or and If-Then Constraints					
		Unit III: Integer Programming Algorithms: Branch-and-Bound (B&B) Algorithm - Cutting-Plane Algorithm.					
		Unit IV: Recursive nature of Computations in Dynamic Programming – Forward and Backward Recursion - Dynamic Programming Applications: Knapsack/Fly-Away/Cargo-loading Model					
		Unit V: Work-Force Size Model - Equipment Replacement Model - Investment Model - Inventory Models – Problem of Dimensionality					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency and Transferrable Skill
Justification for nature of course	Linear programming concerns the optimum allocation of limited resources among competing activities, under a set of constraints imposed by the nature of the problem being studied. These constraints could reflect financial, technological, marketing, organizational, or many other considerations. In broad terms, linear programming can be defined as a mathematical representation aimed at programming the best possible allocation of scarce resources. The overarching goal of this course is to minimize or maximize a given function over a constraint set.
Text Book	Hamdy A. Taha, <i>Operations Research</i> , (Seventh edition) Pearson Prentice Hall of India Private Limited, New Delhi, 1997. UNIT I - Chapter 7 - Sec: 7.2 and 7.3 UNIT II - Chapter 9 - Sec: 9.1 UNIT III - Chapter 9 - Sec: 9.2.1, 9.2.2 UNIT IV - Chapter 10 - Sec: 10.1 10.2, 10.3.1 UNIT V - Chapter 10 - Sec: 10.3.2 to 10.3.5, 10.4
Reference Book(s)	1. J.K.Sharma, <i>Operations Research Theory and Applications</i> (Fourth Edition), Macmillan India Ltd, New Delhi, 2009. 2. F.S. Hillier & J.Lieberman <i>Introduction to Operation Research</i> (7th Edition) Tata McGraw Hill Company, New Delhi, 2001. 3. Beightler. C, D.Phillips, B. Wilde, <i>Foundations of Optimization</i> (2nd Edition) Prentice Hall Pvt Ltd., New York, 1979 4. S.S. Rao, <i>Optimization Theory and Applications</i>, Wiley Eastern Ltd. New Delhi. 1990
Websites and e-Learning resources	https://web.mit.edu/15.053/www/AppliedMathematicalProgramming.pdf http://www.dl.behinehyab.com/Ebooks/LP/LP015_800845_www.behinehyab.com.pdf https://coral.ise.lehigh.edu/~ted/teaching/ie406/

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

CO	Course Outcome	K-level
CO1	Solve a Linear Programming Problem using Revised Simplex method	K3
CO2	Appreciate application of integer LP problem in several areas of managerial decision-making.	K3
CO3	Apply various methods to solve Integer Linear Programming Problems	K4
CO4	Understand various dynamic programming models and their applications in solving a decision-problem	K4
CO5	Solve Linear Programming problems using dynamic programming approach.	K3

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
CLO1	3	1	3	2	3	3	2	2	1
CLO2	2	1	3	1	3	3	2	2	1
CLO3	3	2	3	1	3	3	2	2	1
CLO4	3	2	3	2	3	3	2	2	1
CLO5	3	1	2	3	3	3	2	2	1

Components of CIA

CLO	Component	Weight / Mark	K-Level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3

Blueprint for Semester Examination

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 K3	2	K1 & K1	1	K1	2(K2 & K2)	1(K3)
2	CLO 2	Up to K3	2	K2 & K3	1	K1	2(K1 & K1)	1(K3)
3	CLO 3	Up to K4	2	K2 & K3	1	K2	2(K3 & K3)	1(K4)
4	CLO 4	Up to K4	2	K2 & K3	1	K3	2(K4 & K4)	1(K4)
5	CLO 5	Up to K3	2	K2 & K3	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	4	10	-	16	13.33	28%
K2	4	4	10	-	18	15	
K3	4	2	20	30	56	46.67	47%
K4	-	-	10	20	30	25	25%
K5	-	-	-	-	-	-	-
Total marks	10	10	50	50	120	100	100%

LESSON PLAN

Unit	Description	Hours	Mode
I	Revised Simplex method: Development of the Optimality and Feasibility conditions Revised Simplex Algorithm	3	Lecture, Discussion, Tutorial, Quiz
	Revised Simplex Algorithm	3	
	Bounded variables Algorithm	3	
II	Illustrative Applications: Capital Budgeting, Set-Covering Problem.	3	Lecture, Quiz Group Discussion, Tutorial
	Fixed-Charge Problem	3	
	Either-Or and If-Then Constraints	3	
III	Integer Programming Algorithms: Branch-and-Bound (B&B) Algorithm	5	PPT, Lecture, Quiz, Tutorial
	Cutting-Plane Algorithm.	4	
IV	Recursive nature of Computations in Dynamic Programming	3	PPT, Lecture, Quiz, Tutorial
	Forward and Backward Recursion	3	
	Dynamic Programming Applications: Knapsack/Fly-Away/Cargo-loading Model	3	
V	Work-Force Size Model	2	Assignment, Seminar, Group Discussion, Tutorial
	Equipment Replacement Model	2	
	Investment Model - Inventory Models	3	
	Problem of Dimensionality	2	
Total Hours		45	

COURSE DESIGNERS:

1. Dr. U. KARTHIK RAJA, Assistant Professor, PG and Research Department of Mathematics.
2. Prof. S. MEENAKSHI SELVARAJ, Assistant Professor, Department of Mathematics (SF).

Title of the Course		NONLINEAR PROGRAMMING					
TANSCHÉ Course type		EC6					
Course Category		Elective (Discipline Specific)					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	1	Course Code	23P2MECT5
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2	-		-		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic Optimization Techniques, Modeling with Linear Programming					
Objectives of the Course		- To introduce the concept of classical optimization techniques. - To appreciate the use of some of the non-linear programming techniques such as quadratic and separable programming.					
Course Outline		Unit I: Classical Optimization Theory: Unconstrained Problems: Necessary and Sufficient Conditions – The Newton-Raphson Method.					
		Unit II: Constrained Problems: Equality Constraints – Inequality Constraints (Karush-Kuhn-Tucker Conditions)					
		Unit III: Nonlinear Programming Algorithms: Unconstrained Algorithms: Direct search method – Gradient method					
		Unit IV: Constrained Algorithm: Separable Programming – Separable convex programming - Problems					
		Unit V: Constrained Algorithm: Introduction - Quadratic Programming -- Problems					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency and Transferrable Skill					
Justification for nature of course		The usual simplex method cannot be used to solve an LP model when there is any nonlinear change in the value of objective function and other parameters. In such circumstances, nonlinear programming methods are used.					

Text Book	Hamdy A. Taha, <i>Operations Research</i>, (Seventh edition) Pearson Prentice Hall of India Private Limited, New Delhi, 1997. UNIT I - Chapter 18 - Sec: 18.1 UNIT II - Chapter 18 - Sec: 18.2 UNIT III - Chapter 19 - Sec: 19.1 UNIT IV - Chapter 19 - Sec: 19.2.1 UNIT V - Chapter 19 - Sec: 19.2.2
Reference Book(s)	1. J.K.Sharma, <i>Operations Research Theory and Applications</i> (Fourth Edition), Macmillan India Ltd, New Delhi, 2009. 2. F.S. Hillier & J.Lieberman <i>Introduction to Operation Research</i> (7th Edition) Tata McGraw Hill Company, New Delhi, 2001. 3. Beightler. C, D.Phillips, B. Wilde, <i>Foundations of Optimization</i> (2nd Edition) Prentice Hall Pvt Ltd., New York, 1979 4. S.S. Rao, <i>Optimization Theory and Applications</i>, Wiley Eastern Ltd. New Delhi. 1990
Websites and e-Learning resources	https://web.mit.edu/15.053/www/AppliedMathematicalProgramming.pdf http://www.dl.behinehyab.com/Ebooks/LP/LP015_800845_www.behinehyab.com.pdf https://coral.ise.lehigh.edu/~ted/teaching/ie406/

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

CO	Course Outcome	K-level
CO1	Obtain optimal solution of problems involving continuous and differentiable function.	K3
CO2	Obtain optimal value of an objective function with equality and inequality constraints.	K3
CO3	Solve nonlinear programming models that involve unconstrained problems.	K4
CO4	Apply the technique of separable programming for solving non-linear programming problems.	K4
CO5	Solve certain mathematical optimization problems involving quadratic functions	K3

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
CLO1	3	1	3	2	3	3	2	2	1
CLO2	2	1	3	1	3	3	2	2	1
CLO3	3	2	3	1	3	3	2	2	1
CLO4	3	2	3	2	3	3	2	2	1
CLO5	3	1	2	3	3	3	2	2	1

Components of CIA

CLO	Component	Weight / Mark	K-Level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3

Blueprint for Semester Examination

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 K3	2	K1 & K1	1	K1	2(K2 & K2)	1(K3)
2	CLO 2	Up to K3	2	K2 & K3	1	K1	2(K1 & K1)	1(K3)
3	CLO 3	Up to K4	2	K2 & K3	1	K2	2(K3 & K3)	1(K4)
4	CLO 4	Up to K4	2	K2 & K3	1	K3	2(K4 & K4)	1(K4)
5	CLO 5	Up to K3	2	K2 & K3	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	4	10	-	16	13.33	28%
K2	4	4	10	-	18	15	
K3	4	2	20	30	56	46.67	47%
K4	-	-	10	20	30	25	25%
K5	-	-	-	-	-	-	-
Total marks	10	10	50	50	120	100	100%

LESSON PLAN

Unit	Description	Hours	Mode
I	Classical Optimization Theory: Unconstrained Problems: Necessary and Sufficient Conditions	3	Lecture, Discussion, Tutorial, Quiz
	The Newton-Raphson Method	3	
II	Constrained Problems: Equality Constraints.	3	Lecture, Quiz Group Discussion, Tutorial
	Inequality Constraints (Karush-Kuhn-Tucker Conditions)	3	
III	Nonlinear Programming Algorithms: Unconstrained Algorithms: Direct search method	3	PPT, Lecture, Quiz, Tutorial
	Gradient method	3	
IV	Constrained Algorithm: Separable Programming	3	PPT, Lecture, Quiz, Tutorial
	Separable convex programming -- Problems	3	
V	Constrained Algorithm: Introduction	2	Assignment, Seminar, Group Discussion, Tutorial
	Quadratic Programming -- Problems	4	
Total Hours		30	

Course Designers:

1. Dr. U. KARTHIK RAJA, Assistant Professor, PG and Research Department of Mathematics.
2. Prof. S. MEENAKSHI SELVARAJ, Assistant Professor, Department of Mathematics (SF).

Title of the Course		MATHEMATICAL DOCUMENTATION USING LATEX					
TANSCHÉ Course type		SEC 1					
Course Category		Skill based Elective					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23P1MSED1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2	-		-		2
Marks		CIA		Semester			Total
		25		75			100
Pre-requisite(s)		12 standard computer knowledge					
Objectives of the Course		- To enable the students to understand LaTeX -a document preparation system. - To learn the complicated Mathematical typesetting with Latex. - To create tables, figures, diagrams using graphical packages. - To build bibliographic and cross reference to citations.					
Course Outline:		UNIT-I: Introduction to LaTeX – preparing an Input file – Install miktex and latex file - Running LaTeX – Resources.					
		UNIT – 2: Sample document and Key Concepts – Type Style – Environments: Lists, Centering, Tables, Verbatim – Vertical and Horizontal spacing					
		UNIT – 3: Examples – Equation Environments – Fonts, hats and underling – Braces – Arrays and Matrices – Customized Commands – Theorem-like Environments – Math Miscellany: maths styles, bold math, symbols for number sets, binomial coefficient.					
		UNIT – 4: Document Classes and Overall Structure – Titles for Documents – Sectioning Commands – Miscellaneous Extras: spacing, accented character, dashes and hyphens, quotation marks.					
		UNIT – 5: Packages – Inputting Files – Inputting Pictures – Making a Bibliography – Making an sample article- making a sample report – Making presentation using beamer					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, to test the students to type a document in article form, thesis form and make presentation in beamer.					
Skills acquired from this course		Knowledge, professional documentation and presentation.					
Justification for nature of course		Ability to develop a document which includes mathematical formulae, tables, figures, bibliographic and cross reference using LaTeX. Ability to make a presentation using beamer.					
Text Book(s)		Learning LaTeX by David F. Griffiths and Desmond J. Higgham, SIAM					

Reference Book(s)	• A Document Preparation System LaTeX by Leslie Lamport, Addison-Wesley, second Edition, 2009. • LATEX Tutorials - A PRIMER, Indian TEX Users Group, Trivandrum, India, 2003
Websites and e-Learning resources	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics , http://www.opensource.org

COURSE OUTCOMES:

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

CO	Course learning outcome	K-level
CO1	Learn how to install miktex and latex software, learn to type and compile an input file in latex software.	Upto K2
CO2	Define listing, tabular and table environment, to know the different type styles, Spacing options in both vertical and horizontal.	Upto K3
CO3	Discuss about environments in equation, eqnarray, theorem and math styles, to know define fonts, hats, braces, array and matrices.	Upto K3
CO4	Learn to insert sections, tiles, chapters, tables with and without numbering in a document	Upto K3
CO5	Learn to insert a picture, graphs, images, to make index, table of contents, reference and a presentation in beamer	Upto 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).

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

Components of Assessment shall be

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K3
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2, K3, K3

Blueprint for Semester Examination

Unit	CLOs	K- Level	Section A		Section B Short answer	Section C (Either/or Choice)	Section D (Open Choice)
			MCQ				
			No of Questions	K Level			
1	CLO1	Up to K3	2	K1 & K2	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K1 &K2	K2	2(K2&K2)	1(K3)
3	CLO3	Up to K3	2	K1 &K2	K2	2(K2&K2)	1(K3)
4	CLO4	Up to K4	2	K1 &K2	K2	2(K3&K3)	1(K3)
5	CLO5	Up to K4	2	K1&K2	K2	2(K3&K3)	1(K4)
No. of Questions to be asked			10			10	5
No. of Questions to be answered			10			5	3
Marks for each question			2			5	10
Total Marks for each section			20			25	30

Distribution of section wise marks with K levels

K Levels	Section A MCQ	Section B (No choice)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	5	2	10	-	17	14.16	50%
K2	5	8	20	10	43	35.83	
K3	-		20	30	50	41.67	42%
K4	-		-	10	10	08.33	8%
K5	-		-	-	-	-	
Total marks	10	10	50	50	120	100	100%

Lecture Schedule

Units	Topics	Hours		Mode
I	Introduction to LaTeX. Installing miktek and Latex	2	6	Lecture, Quiz.
	preparing an Input file : preambles, a dcoument	2		
	Running LaTeX ,Resources.	2		
II	Sample document and Key Concepts.	2	6	PPT, Lecture, Quiz
	Type Style :Bold, Italic, etc.,	1		
	Environments: Lists, Centering, Tables,	2		
	Verbatim and Vertical and Horizontal spacing.	1		
III	Equation Environments, Fonts, hats and underling, Braces, Arrays and Matrices	2	6	PPT, Lecture
	Customized Commands – Theorem-like Environments.	2		
	Math Miscellany: maths styles, bold math, symbols for number sets, binomial coefficient.	2		
IV	Document Classes and Overall Structure	2	6	PPT, Lecture, Quiz, GD
	Titles for Documents, Sectioning Commands, Miscellaneous Extras:	2		
	spacing, accented character, dashes and hyphens, quotation marks.	1		
	Troubleshooting: pinpointing the error, common errors, warning messages.	1		
V	Packages, Inputting Files, Inputting Pictures	2	6	Assignments and Seminar.
	Making a Bibliography, Making an Index	2		
	Making presentation in beamer. Sample Article, Report and presentation.	2		
	Total		30	

Course Designers:

1. Dr. I. Padmavathi, Assistant Professor, PG and Research Department of Mathematics, The Madura College.
2. Prof.G.K.Lakshmi, Assistant Professor, Department of Mathematics (SF).

Title of theCourse		FOUNDATIONAL MATHEMATICS					
Paper Number		NME					
Category	NME	Year	I	Credits	2	Course Code	23P2MSEN1
		Semester	II				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		2		-		--	2
Pre-requisite		12 th Standard Mathematics					
Objectives of the Course		• To obtain the knowledge of ratios and proportions. • To gain knowledge about solving linear equation by matrix. • To acquire idea about Measures of central tendency andMeasures of dispersion. • To understand concept of probability.					
Course Outline		Unit I: Positive integral indices – Law of indices – Zero and negative indices – Fractional indices.					
		Unit II: Logarithm – Properties of Logarithms – Common Logarithm.					
		Unit III: Sequence of Numbers – Arithmetic Progression – Geometric Progression – Arithmetic and Geometric means.					
		Unit IV: Ratio – Compounding, Duplicate, Triplicate and Sub-duplicate of ratio’s – Proportion – Rules of Proportion – Direct, Inverse, Compound and Continued proportion.					
		Unit V: Simple interest – Compound interest – Annuities – Percentage – Discount –True discount, Banker’s discount and Banker’s gain.					
Extended Professional Component (isa part of finternal component only, not to beincluded in theExternal Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill.					
Recommended Text		1. G.K.Ranganath, C.S.Sampagiram and Y.Rajaram, “Business Mathematics”, Third edition, 2019, Himalaya Publishing House, Mumbai. 2. M.Manokaran & Elango, “Business Mathematics”, Paramount Publications, Palani.					

COURSE OUTCOMES:

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

CO	Course Outcome	K-level
CO1	Understand the concepts of Law of indices and Fractional indices	Up to K2
CO2	Recall the concept of Logarithm, Properties of Logarithms and learn Common Logarithm.	Up to K2
CO3	Understand the concept of sequence of Numbers, Arithmetic Progression, Geometric Progression.	Up to K2
CO4	Understand the concepts of Ratio, Compounding, Duplicate, Triplicate and Sub-duplicate of ratio's and Proportion	Up to K2
CO5	Understand the concept of Simple interest, Compound interest, Annuities, Percentage and Discount	Up to K2

Mapping with Course Learning Outcomes (CLOs)

CLO/PO	Pos					
	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	-	-	1	-	-
CLO2	3	-	-	1	-	-
CLO3	3	-	-	1	-	-
CLO4	3	-	-	3	-	-
CLO5	3	-	-	3	-	-

BLUE PRINT – External Exam

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%

LESSON PLAN

Unit	Description	Hours		Mode
I	Positive integral indices	2	5	Lecture, Quiz
	Zero and negative indices – Fractional indices	3		Problem Solving
II	Logarithm – Properties of Logarithms – Common Logarithm	5	5	Lecture, Quiz, Problem Solving
III	Sequence of Numbers – Arithmetic Progression – Geometric Progression	4	7	Lecture
	Arithmetic and Geometric means.	3		Tutorial
IV	Ratio – Compounding, Duplicate, Triplicate and Sub-duplicate of ratio's	3	6	Lecture, Tutorial
	Proportion – Rules of Proportion – Direct, Inverse, Compound and Continued proportion.	3		Problem Solving
V	Simple interest – Compound interest – Annuities – Percentage	4	7	Lecture
	Discount – True discount, Banker's discount and Banker's gain.	3		Problem Solving
Total Hours		30		

Course Designer:

1. Dr. V. SANGEETHASUBHA, Assistant Professor, Department of Mathematics.
2. Dr. S. VALLIRANI, Assistant Professor, Department of Mathematics (SF).

Title of the Course	MATHEMATICAL TRANSFIGURATION			
Course type	CERTIFICATE COURSE			
Nature of Course	Employability / Skill Development			
Instructional Hours per week	Lecture	Tutorial	Practical	Total
	2	-	-	2
Marks	CIA		Semester	Total
	50		50	100
Pre-requisite(s)	Basic Calculus			
Objectives of the Course	- To enable the students to learn mathematical concepts. - To build mathematical models of real-world systems, analyze them and make predictions about behavior of these systems.			
Course Outline:	UNIT-I: Mathematical Modelling: Simple situations requiring Mathematical Modelling – Classification of Mathematical Models – Some Characteristics of Mathematical Models.			
	UNIT – 2: Linear growth and Decay Models – Non-linear growth and Decay Models - Compartment Models - Dynamics Problems - Geometrical Problems.			
	UNIT – 3: The need for Mathematical Modelling through Difference equations – Some simple models – Basic theory of Linear Difference equations with constant coefficients – Mathematical Modelling through difference equations in Economics and Finance.			
	UNIT – 4: Mathematical Modelling through difference equation in population dynamics and genetics - Mathematical modeling through difference equations in probability theory.			
	UNIT – 5: Mathematical Modelling through graphs - Mathematical Models in terms of directed graphs - Mathematical models in terms of signed graphs - Mathematical models in terms of weighted graphs.			
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved			
Skills acquired from this course	Construct a mathematical model of a given system, analyze it and make predictions.			

Justification for nature of course	To Study how the real systems and occurrences transfigured into math formulas, descriptions and approaches, we use the concept of Mathematical modelling. Nearly any industry can benefit from mathematical modelling, but it's most commonly used in areas such as engineering, computer science and natural science. Depending on your career and job responsibilities, this technique can be used to solve problems, explain why things happen and make predictions.
Text Book(s)	Kapur J N, Mathematical Modeling, II Edition, New Age International Publishers, New Delhi, Reprint –2018.
Reference Book(s)	1. Frank R. Giordano, William P. Fox, Steven B. Horton, A First Course in Mathematical Modeling, V Edition, Cengage Learning, 2015. 2. Reinhard Illner, Mathematical Modeling, AMS Publications, 2016.
Websites and e-Learning resources	https://ncert.nic.in/textbook/pdf/kemh1a2.pdf https://archive.nptel.ac.in/courses/111/107/111107113/ https://www.math.colostate.edu/~gerhard/331book.pdf

COURSE OUTCOMES:

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

CO	Course learning outcome	K-level
CO1	Understand the different processes involved in Mathematical Modelling.	Upto K3
CO2	Acquire modelling skills to transform the situations through differential equations.	Upto K3
CO3	Assess and articulate what type of modelling techniques are appropriate for a given system.	Upto K3
CO4	Compose the findings from the methods applied for the problem using difference equations.	Upto K3
CO5	Formulate, analyze the mathematical models through graphs.	Upto K3

Course Designers:

1. Dr.R.CHITRA, Coordinator/ Assistant Professor, Department of Mathematics & Statistics (SF).
2. Prof.S.MEENAKSHI SELVARAJ, Assistant Professor, Department of Mathematics (SF).

Course code	Course Title	C	H	I	E	T
	REASONING ENHANCEMENT	2	30	40	60	100
Pre-requisite	12 th Standard Mathematics					
Objectives of the Course	- At the end of the course the student will be able to i. predicts the relation with verbal reasoning. ii. predict the relation with non-verbal reasoning. iii. analyze the sense of directions. iv. use logical deductions to verify the validity of the conclusion. v. differentiates cause and effect, derive conclusions from passage.					
Course Outline	UNIT-I: Blood relation - Deciphering jumbled up descriptions, Relation puzzle and coded relations.					
	UNIT-II: Coding and Decoding - Letter decoding, Direct letter coding, Number/symbol coding - Matrix coding – Substitution - Deciphering message word codes – Deciphering number and symbol codes for messages - Jumbled coding.					
	UNIT-III: Puzzle test: Classification type - Seating/placing arrangements - Comparison type - Sequential order of things - Selection based on given conditions - Family based puzzles.					
	UNIT-IV: Logical deduction - Arguments- Assumptions - Courses of Actions - Conclusions.					
	UNIT-V: Deriving conclusions from passages - Theme deduction - Cause and effect reasoning.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC // TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text	1. Aggarwal. R. S, A Modern Approach to verbal & non-verbal reasoning, S.chand & company Ltd., 2006. Unit 1: section 1: 5 Unit 2: section 1: 4 Unit 3: section 1: 6 Unit 4: section 2: 1, 2,3,4,5					

	Unit 5: section 2: 6, 7, 8
Reference Books	1. Aggarwal. R. S, A Modern Approach to verbal reasoning, S. Chand & company Ltd., 2006. 2. Aggarwal. R. S, A Modern Approach to non-verbal reasoning, S.Chand & company Ltd., 2006. 3. Aggarwal. R. S, A Modern Approach to logical reasoning, S. Chand & company Ltd., 2006.
Website and e-Learning Source	https://nptel.ac.in

DEPARTMENT OF MATHEMATICS				CLASS: III B.Sc. Mathematics				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective-II	20U6MME2(A)	Numerical Methods	4	4	25	75	100

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

COURSE OBJECTIVES:

On completion of this course, the learner will

- To demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
- To apply numerical methods to obtain approximate solutions to mathematical problems.
- To derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- To analyze and evaluate the accuracy of common numerical methods.
- Apply various numerical methods in real life problems.
- To develop the mathematical skills of the students in the areas of numerical methods.

Unit	Description	Hours	K-level	CLO
I	Solution of Numerical Algebraic and Transcendental Equations: The bisection method – Newton's method - Criterion of order of convergence of Newton's method - Regula false method. Solution of simultaneous linear algebraic equations: Gauss Elimination method- Gauss Jordan method- Gauss Jacobi - Gauss Seidal method.	12	Upto K2	CLO1
II	Finite Differences: First and higher order differences - Forward and backward differences - Properties of operator - Differences of a polynomial - Factorial polynomial - Error propagation Operator E and E-1 Relation among Δ , E , ∇ , δ , E and D - summation of series.	12	Upto K4	CLO2
III	Interpolation with equal intervals: Newton's forward - backward interpolation formula - Gauss forward - backward interpolation formula - Bessel's formula. Interpolation with unequal intervals: Divided differences - Newton's divided difference formula - Lagrange's interpolation formula - Inverse interpolation.	12	Upto K3	CLO3

IV	Numerical Differentiation and Integration: Newton's forward and backward differences to compute derivatives - Derivatives using Bessel's formula - Newton - Cote's formula - Trapezoidal rule - Simpson's 1/3 and 3/8th rule - Weddle's rule – Romberg's Integration.	12	Upto K4	CLO4
V	Numerical solution of ODE: Power series-Taylor's series method –Point wise method- Euler's Modified method - Runge-Kutta method, Numerical solution of ODE and some problems.	12	Upto K3	CLO5

Books for Study:

1. Numerical Methods by Kandasamy, P. K. Thilagavathy, and K. Gunavathy ,S.Chand& Company Ltd., Edn. 2006.
Unit-I Chapter 3(3.1- 3.4), 4(4.1 - 4.5,4.7 - 4.9)
Unit-II Chapter 5(5.1 - 5.7)
Unit-III Chapter 6(6.1 - 6.6), 7(7.3,7.4,7.6), 8(8.1,8.2,8.5 - 8.7)
Unit-IV Chapter 9(9.1 - 9.16)
Unit-V Chapter 11(11.1 - 11.3, 11.4, 11.5, 11.9 - 11.12).

Books for Reference:

1. Venkataraman, M.K - Numerical Methods in Science and Engineering - National Publishing company V Edition 1999.
2. Hamming, R.W. Numerical Methods for Scientists and Engineers, Dover Publications, USA. 1987.
3. Richard L. Burden and J. DouglasFaires.Numerical Analysis, 9thedn.Brooks/Cole, Cengage Learning, USA. 2011.
4. Arumugam, Issac and Somasundaram, Numerical Analysis with Programming in C, New Gamma Publishing House, June 2015.
5. Gerald, G. F., and Wheatley, P. O., *Applied Numerical Analysis*, Fourth Edition, Addison-Wesley Publishing Company, 1989.

Web resources:

1. <https://theengineeringmaths.com/wp-content/uploads/2017/11/num-solutions.pdf>
2. <http://nitkkr.ac.in/docs/13-%20Finite%20Differences%20and%20Interpolation,%20Numerical%20Differentiation%20and%20Integration.pdf>
3. <https://www.geeksforgeeks.org/newton-forward-backward-interpolation/>
4. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032250571912siddharth_bhatt_engg_Numerical_Differentiation_and_Integration.pdf
5. <https://www.cfm.brown.edu/people/sg/AM35odes.pdf>

Rationale for nature of the Course

Knowledge and Skill and Employability

This course provides an introduction to the basic concepts and techniques of numerical solution of algebraic equation, system of algebraic equation, numerical solution of differentiation, integration, statistical and ANOVA methods and their inter- relations and applications to computer science and engineering, and science areas and develops problem solving skills with both theoretical and computational oriented problems.

Activities having directed bearing on Skill Development / Employability / Entrepreneurship

- Seminar
- Assignment Preparation
- Group Discussion
- Quiz

Pedagogy

Chalk and Talk, PPT, Quiz, Group discussion, Seminar, Interaction, Tutorial sessions.

Course Designer(S):

1. Dr.S.MUTHUKUMAR, Head, Department of Mathematics.
2. Dr.R.CHITRA, Coordinator, Department of Mathematics& Statistics.

Course learning Outcomes

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

CLO #	Description	K- level
CLO 1	Understand the numerical methods to find the solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.	Upto K2
CLO 2	Explain about various interpolation methods and finite difference concepts.	Upto K4
CLO 3	Solve a differential equation using an approximate numerical method	Upto K3
CLO 4	Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.	Upto K4
CLO 5	Acquire understanding the knowledge of difference equation, linear difference equation and Simple applications.	Upto K3

K1- Recall, K2 – Understanding, K3 – Applying, K4- Analyzing K5-Evaluating

Mapping of Course Outcomes (CLOs) with Program Outcomes & Program Specific Outcomes (PSOs)

CLOs/Pos & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CLO1	3	2	2		3		3	2	3	1	3	1	1
CLO2	3	2	2		3		3	2	3	2	1	2	2
CLO3	3	2	2		3		3	2	3	2	2	2	1
CLO4	3	2	2		3		3	2	3	2	3	1	1
CLO5	3	2	2		3		3	2	3	1	1	3	2

Advance application– 3

Intermediate level–2

Basic level–1

LESSON PLAN

Unit	Description	Hours	Mode
I	Introduce the concept of solution of numerical algebraic and transcendental equations-The bisection method – Newton's method - Criterion of order of convergence of Newton's method - Regula false method.	6	Lecture, Quiz
	Finding the Solution of simultaneous linear algebraic equations-Gauss Elimination method- Gauss Jordan method- Gauss Jacobi - Gauss Seidal method.	6	Problem Solving
II	Finite Differences definition-First and higher order differences - Forward and backward differences related problems- Properties of operator	6	Lecture, PPT
	Differences of a polynomial - Factorial polynomial - Error propagation Operator E and E-1 Relation among Δ , E, ∇ , δ , E and D - summation of series and some problems.	6	Lecture, Problem Solving, Quiz
III	Newton's forward - backward interpolation formula - Gauss forward - backward interpolation formula - Bessel's formula.	6	Lecture, Problem Solving
	Divided differences - Newton's divided difference formula - Lagrange's interpolation formula - Inverse interpolation.	6	Lecture, PPT
IV	Introduction of Numerical Differentiation and Integration and Newton's forward and backward differences to compute derivatives	6	Lecture, Problem Solving
	Derivatives using Bessel's formula - Newton - Cote's formula - Trapezoidal rule - Simpson's 1/3 and 3/8th rule - Weddle's rule and problems – Romberg's Integration .	6	Lecture, PPT
V	Introduction of Numerical solution of ODE-definition-Taylor's series method and related problems	6	Lecture, Assignment
	Explain the concept of Euler's Modified method- Runge-Kutta method and some problems.	6	Lecture, Assignment
Total Hours		60	

Learning Outcome Based Education (LOBE) & Assessment
Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses 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 K4	2	(K1&K2)	1	K1	2(K4& K4)	1(K3)
3	CLO 3	Up to K3	2	(K1&K2)	1	K2	2(K3& K3)	1(K3)
4	CLO 4	Up to K4	2	(K1&K2)	1	K2	2(K2& K2)	1(K4)
5	CLO 5	Up to K3	2	(K1&K2)	1	K2	2(K3 & K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3 – Application oriented – solving problems

K4- Examining, analyzing, presentation and make inference with evidences.

BLUE PRINT - Formative Examination - I

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	41.66	42%
K4	-	-	10	10	20	16.66	16%
Total marks	10	10	50	50	120	100	100%

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

Distribution of section wise marks with K levels

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	K2	2(K1 & K1)	1(K2)
2	CLO 2	Up to K4	2	K1 & K2	2	K1 & K1	2(K3 & K3)	2(K3& K4)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each question			1		2		5	10
Total Marks for each Section			4		6		10	20

Distribution of Section-wise Marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	26.67	50.00%
K2	2	2	-	10	14	23.33	
K3	-	-	10	10	20	33.33	33.33%
K4	-	-	-	10	10	16.67	16.67%
Total marks	4	6	20	30	60	100	100%

BLUE PRINT - Formative Examination - II
Articulation Mapping K-level 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 3	Up to K3	2	(K1&K2)	1	(K1)	2(K3& K3)	2(K3&K3)
2	CLO 4	Up to K4	2	(K1&K2)	2	(K2&K2)	2(K4& K4)	1(K4)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each question			1		2		5	10
Total Marks for each Section			4		6		10	20

Distribution of Section-wise Marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	2	-	-	4	6.67	16.67%
K2	2	4	-	-	6	10	
K3	-	-	10	20	30	50.00	50.00%
K4	-	-	10	10	20	33.33	33.33%
Total marks	4	6	20	30	60	100	100%

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

M.Sc. Mathematics - First Semester

Department of Mathematics				Class : I M.Sc Mathematics				
Semester	Course Type	Course Code	Course Title	Credits	Hrs	CIA	Ext	Total
II	Major	21P2MMC7	Linear Algebra	5	5	25	75	100

NATURE OF THE COURSE:

Knowledge and Skill ☒ Skill oriented ☐ Employability oriented ☐
 Entrepreneurship oriented ☐ Percentage of revision

COURSE OBJECTIVES:

1. To acquire idea to know linear transformation and its algebra.
2. To understand the concepts of polynomials, Determinants with properties
3. To impart the knowledge of Rational forms and Jordan forms

UNIT I: Linear transformations

Linear transformations –The Algebra of Linear transformations– Isomorphism of vector spaces – Representations of linear transformations by matrices – Linear functionals.

UNIT II: Algebra of polynomials

Algebras-The algebra of polynomials –Polynomial ideals - The prime factorization of a polynomial –Commutative rings - Determinant functions.

UNIT III: Determinants

Permutations and the uniqueness of determinants – Classical adjoint of a (square) matrix – Inverse of an invertible matrix using determinants – Characteristic values – Annihilating polynomials.

UNIT IV: Diagonalization

Invariant subspaces – Simultaneous triangulations – Simultaneous diagonalization –Direct - Sum decompositions – Invariant direct sums – Primary decomposition theorem.

UNIT V: The Rational and Jordan forms

Cyclic subspaces – Cyclic decompositions theorem (Statement only) –Generalized Cayley – Hamilton theorem - Rational forms – Jordan forms.

BOOK FOR STUDY:

1. Kenneth M Hoffman and Ray Kunze, Linear Algebra, 2nd Edition, Prentice-Hall of India Pvt. Ltd, New Delhi, 2013.

Chapters: 3(3.1-3.5),4(4.1,4.2,4.4,4.5),5(5.1-5.4),6,7(7.1-7.3).

BOOKS FOR REFERENCES:

1. M. Artin, “Algebra”, Prentice Hall of India Pvt. Ltd., 2005.
2. I.N. Herstein, “Topics in Algebra”, 2nd Edition, Wiley Eastern Ltd, New Delhi, 2013.

WEB RESOURCES:

<https://nptel.ac.in/courses/111/106/111106051/>

<https://www.khanacademy.org/math/linear-algebra>

<https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/>

Rationale and activities having direct bearing on Nature of the course:

Linear algebra is central to almost all areas of mathematics. For instance, linear algebra is fundamental in modern presentations of geometry, including for defining basic objects such as lines, planes and rotations. Linear algebra is also used in most sciences and fields of engineering, because it allows modeling many natural phenomena, and computing efficiently with such models.

This course impart theoretical knowledge & Problem Solving Skills to the students and is crafted to help the students to knowing the best techniques for a given theory. Theoretical learning gives the guidance to the mind and mind guides our body to convert that theoretical learning into practical performance. Theoretical knowledge explains the why factor at the back of any situation and technique of working

Pedagogy :

Chalk and Talk, Seminar, Quiz, Problem Solving, Tutorial, Group Discussion, PPT.

COURSE LEARNING OUTCOMES:

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

Number	Course Outcome	Knowledge level
CLO 1	Remembering the basic concepts of Linear transformation	Upto K2
CLO 2	Understand the idea of algebra of polynomials	Upto K3
CLO 3	Understand the concept of Determinants and matrix with various conditions	Upto K4
CLO 4	Identifying the concept of diagonalization and its properties	Upto K4
CLO 5	Analyzing the concept of Rational and Jordan forms	Upto K5

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

K5 – Evaluate the mistakes in answers

Mapping with Courses Learning Outcomes (CLOs)

CLO/ PO	PO				
	PO1	PO2	PO3	PO4	PO5
CLO 1	2	3	2	1	3
CLO 2	2	3	2	1	3
CLO 3	2	3	2	1	3
CLO 4	2	3	2	1	3
CLO 5	2	3	2	1	3

3 – Advance Application

2 - Intermediate Level

1- Basic Level

M.Sc. Mathematics - Second Semester

Sem	Course Type	Course Code	Course Title	Credits	Hrs	CIA	Ext	Total
II	Major	21P2MMC7	Linear Algebra	5	5	25	75	100

BLUE PRINT – External Exam

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 & K1	1	K1	2(K1 & K1)	1(K2)
2	CLO 2	Up to K3	2	K2 & K3	1	K1	2(K2 & K2)	1(K3)
3	CLO 3	Up to K3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)
4	CLO 4	Up to K4	2	K3 & K3	1	K2	2(K4 & K4)	1(K4)
5	CLO 5	Up to K5	2	K4 & K4	1	K3	2(K4 & K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

K5 - Evaluate the mistakes in answers

Distribution of section wise marks with K levels.

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
K5			-	-	-	-	-
Total marks	10	10	50	50	120	100	100%

The Components of assessment shall be

S.No	CLO	Test Component	Marks	K Level
1	5	Assignment	5 Marks	K5
2	5	Seminar	5 Marks	K2
3	5	Quiz	5 Marks	K1

BLUE PRINT – CIA - I

Sl.No	CLOs	Klevel	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	KLevel		
1	CLO 1	Up to K2	2	K1, K2	2(K1 & K1)	1(K2)
2	CLO 2	Up to K3	3	K1, K1, K2	2(K2 & K2)	2(K3, K3)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each Section			10		10	20

Distribution of Section-wise Marks with K levels

K Levels	Section A (No choice)	Section B (Either/ or)	Section C (Open choice)	Total marks	% of marks without choice	Consolidated
K1	6	10	-	16	26.67	67
K2	4	10	10	24	40	
K3	-	-	20	20	33.33	33%
K4	-	-	-	-	-	-
K5	-	-	-	-	-	-
Total Marks	10	20	30	60	100	100%

BLUE PRINT – CIA - II

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

Distribution of Section-wise Marks with K levels

K Levels	Section A (No choice)	Section B (Either/ or)	Section C (Open choice)	Total marks	% of marks without choice	Consolidated
K1	-	-	-	-	-	30%
K2	8	10	-	18	30	
K3	2	10	20	32	53.33	53%
K4	-	-	10	10	16.67	17%
K5		-	-	-	-	-
Total Marks	6	20	30	60	100	100%

LESSON PLAN

Units	Description	Hours	Total Hours	Pedagogy
I	Linear transformations	3	15	Chalk and Talk
	The Algebra of Linear transformations	3		Chalk and Talk
	Isomorphism of vector spaces	3		Chalk and Talk
	Representations of linear transformations by matrices	3		Chalk and Talk & Seminar
	Linear Functionals.	3		Chalk and Talk & Group Discussion
II	Algebras	2	15	Chalk and Talk
	The algebra of polynomials	3		Chalk and Talk & Seminar
	Polynomial ideals	3		Chalk and Talk
	The prime factorization of a polynomial	3		Chalk and Talk
	Commutative rings	2		Chalk and Talk & Group Discussion
	Determinant functions.	2		Chalk and Talk & Seminar
III	Permutations and the uniqueness of determinants	3	15	Chalk and Talk
	Classical adjoint of a (square) matrix	3		Chalk and Talk
	Inverse of an invertible matrix using determinants	3		Chalk and Talk
	Characteristic values	3		Chalk and Talk
	Annihilating polynomials	3		Chalk and Talk & Seminar
IV	Invariant subspaces	2	15	Chalk and Talk
	Simultaneous triangulations	3		Chalk and Talk & Seminar
	Simultaneous Diagonalization	3		Chalk and Talk & Group Discussion
	Direct-sum decompositions	3		
	Invariant direct sums	2		
	Primary decomposition theorem	2		
V	Cyclic subspaces	2	15	Chalk and Talk
	Cyclic decompositions theorem (Statement only)	3		Chalk and Talk & Seminar
	Generalized Cayley	3		Chalk and Talk
	Hamilton theorem	3		Chalk and Talk
	Rational forms	2		Chalk and Talk & Seminar
	Jordan forms	2		Chalk and Talk & Group Discussion

Course Designer:

1. Dr. S. USHA, Assistant Professor, Department of Mathematics.



DEPARTMENT OF STATISTICS

**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 semesters (B.Sc. Statistics)
I and II semesters (M.Sc. Statistics)
Certificate Courses
Ratification**



THE MADURA COLLEGE, MADURAI

DEPARTMENT OF STATISTICS

VISION

Vision of the Statistics department is to develop student's ability to think analytically, speculatively and imaginatively and to encourage them to pursue higher education for the purpose of continuous curriculum innovations.

MISSION

- To help students develop their intellect and faith.
- To provide excellent training in scientific data collections, data management, methods and procedure of data analysis.
- To facilitate students to see themselves as professional, as part of a discipline with skills and abilities valuable in business, teaching and publishing.

PROGRAMME OUTCOMES FOR B.Sc STATISTICS GRADUATES:

At the end of the program the graduates will be able to

PO 1: Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the science & humanities stream.

PO 2: Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship

PO 3: Students will possess basic subject knowledge required for higher studies, professional and applied courses.

PO 4: The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modeling and solving real life problems.

PO 5: Utilize Statistics to solve theoretical and applied problems by critical understanding, analysis and synthesis.

PO 6: Develop students into responsible citizens in a rapidly changing interdependent society.

Programme Specific Outcomes of B.Sc Degree programme in Statistics

PSO -1: Familiarize the students with suitable tools of statistical analysis to handle issues and problems in Statistics and related sciences.

PSO -2: Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.

PSO -3: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Statistics.

PSO -4: Develop a range of generic skills helpful in employment, internships & societal activities.

PSO -5: Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of Mathematical sciences.



The Madura College (Autonomous), Madurai – 625 011

Department of Mathematics

B.Sc., Statistics – Course 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 - 1 (CC1)-DESCRIPTIVE STATISTICS	23U1SCCT1	4	4
	Core Course - 2 (CC2)-PROBABILITY THEORY	23U1SCCT2	4	4
	Generic Elective – 1(EC1) STATISTICAL METHODS AND ITS APPLICATION-I (INFORMATION TECHNOLOGY)	23U1SGET1	6	5
IV	Skill Enhancement Course(SEC1) Statistical Practical – I(Calculator based)	23U1SSED1	2	2
	Foundation course BRIDGE STATISTICS	23U1SFCT1	2	2
	Total		30	23

Semester – II				
Part	Course description	Course Code	Hours	Credits
I	Language - II Tamil / Hindi / Sanskrit	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	6	3
II	Language - II English	23U2NENG2	6	3
III	Core Course - 3(CC3)-MATRIX AND LINEAR ALGEBRA	23U2SCCT3	4	4
	Core Course - 4(CC4)- DISTRIBUTION THEORY	23U2SCCT4	4	4
	Generic Elective - 2 (EC2) STATISTICAL METHODS AND ITS APPLICATION-II (INFORMATION TECHNOLOGY)	23U2SGET2	6	5
IV	Skill Enhancement Course (SEC2) – Statistical Practical – II (Calculator based)	23U2SSED2	2	2
	SEC - Major (SEC3) LAB PRACTICAL IN R	23U2SSED3	2	2
	Total		30	23

Title of the Course		Descriptive Statistics					
TANSCHÉ Course type		CC1					
Course Category		Core					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23U1SCCT1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	-		--		4
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic arithmetic					
Objectives of the Course		The main objectives of this course are: It explains the important concepts of statistics and statistical data. It provides to formulate the visualization of frequency distribution. Also they measure the averages, dispersions, lack of symmetry, moments, and relationship among variables. Estimate and predict the unknown and future values. Study of non-linear and consistency of the data.					
Course Outline		Unit-I Statistics: Introduction - Definition – Functions - Applications - Limitations. Organising a Statistical Survey: Planning the survey - Executing the survey- Collection of Data: Primary and secondary data - Methods of collecting primary data - Sources of secondary data. Sampling: Census and Sample methods. Classification-Types - Formation of frequency distribution- Tabulation - parts of a Table - Types. Diagrammatic representation – Types. Graphical representation - Graphs of frequency distributions. Merits and Limitations of diagrams and graphs. Book: 1 Chapter - 2: 2.1 – 2.5 Chapter - 3: 3.1 – 3.2 Chapter – 4: 4.1 – 4.2 Chapter - 5: 5.1 – 5.15 Chapter - 6: 6.36 – 6.41					

	Unit-II Measures of Central tendency: Introduction-Definitions-Types - Mean-Median-Mode-Geometric mean-Harmonic Mean-Weighted mean - Merits and Demerits-Measures of Dispersion: Introduction – Definition – Types – Range - Quartile deviation - Mean deviation - Standard deviation - Co-efficient of variation – Lorenz curve - Merits and Demerits. Book: 1 Chapter – 7 & 8.
	Unit-III Skewness: Introduction-Definition-Types-Karl Pearson’s – Bowley’s - Kelly’s methods – Their merits and demerits. Kurtosis: Introduction-Definition-Types-Its merits and demerits. Moments: Introduction - Definition-Types - Raw, Central moments and their relations. Book: 1 Chapter - 9: 9.1 – 9.19
	Unit-IV Correlation analysis: Introduction - Definition - Types – Ungrouped and Grouped data – Probable error – properties - Rank correlation – Partial and Multiple correlations - Regression analysis: Introduction - Definition – Regression Equations -Multiple regression - Principle of least squares for first degree, Second degree, Exponential and Power curves. Book: 2 Chapter – 10 & 11
	Unit-V Theory of Attributes: Introduction – Definition-Classes and Class frequencies-Consistency of data-Independence of attributes-Association of attributes-Yule’s coefficient and -Coefficient of Colligation. Book: 2 Chapter – 13
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved(To be discussed during the Tutorial hour)

Skills acquired from this course	Knowledge, Problem Solving, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Descriptive statistics encapsulates or characterises the fundamental characteristics of the data in a study. They serve as the foundation for nearly all quantitative analyses of data, along with basic graphical analysis. To offer quantitative descriptions in a format that is manageable, descriptive statistics are used.
Text Book(s)	Gupta, S.P. (2017): Statistical Methods, Sultan Chand & Sons Pvt Ltd, New Delhi, 35 th Revised Edition. Gupta S.C and Kapoor, V.K. (2002). Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd., New Delhi
Reference Book(s)	Goon A.M. Gupta. A.K. and Das Gupta, B (1987). Fundamental of Statistics, vol.2 World Press Pvt. Ltd., Kolkatta G.U.Yule and M.G. Kendall (1956). An introduction to the theory of Statistics, Charles Griffin. M.R. Spiegel (1961). Theory and problems of Statistics, Schaum's outline series. Anderson, T.W. and Sclove SL. (1978). An introduction to statistical analysis of data, Houghton Mifflin&co. Pillai, R.S., and Bagavathi (2003): Statistics, S. Chand and Company Ltd., New Delhi.
Websites and e-Learning resources	e-books, tutorials on MOOC/SWAYAM courses on the subject https://en.wikipedia.org/wiki/Statistics https://en.wikipedia.org/wiki/Descriptive_statistics https://socialresearchmethods.net/kb/statdesc.php http://onlinestatbook.com/2/introduction/descriptive.html

Note: Chapter's listed in the course outline.

COURSE OUTCOMES:

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

CO	Description	K-level
CO1	Give an explanation of the statistical survey, data collecting, sampling, and data presentation, as well as its scope, purposes, applications, and constraints.	Up toK2
CO2	Talk about the significance and applications of central values and dispersion for various data types.	Up toK3
CO3	Check out the skewness, moments, and types.	Up toK3
CO4	Depict correlation and Regression.	Up toK4
CO5	Explain Attributes and Types.	Up toK3

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	1	3	3	2	2	-	3	2	3	1	1
CLO2	1	3	3	2	2	-	3	2	3	1	1
CLO3	1	3	3	2	2	-	3	2	3	1	1
CLO4	1	3	3	2	2	-	3	2	3	1	1
CLO5	1	3	3	2	2	-	3	2	3	1	1

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

Assessment Schema Components of CIA

CLO	Component	Weight / Mark	K- Level
CLO 1 –CLO 4	CIA	10	K1- K4
CLO 5	Assignment	5	K3
CLO 5	Seminar	5	K3
CLO 1, CLO 2, CLO 3, CLO 4, CLO 5	Quiz	5	K1,K2

Blueprint for Semester Examination
BLUE PRINT - External Exam

Units	CLOs	K. Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of questions	K. Level	No. of questions	K. level			
1	CLO 1	Up to K2	2	K1&K2	1	K1	2(K1& K1)	1(K2)	
2	CLO 2	Up to K3	2	K1&K2	1	K2	2(K2& K2)	1(K3)	
3	CLO 3	Up to K3	2	K1&K2	1	K2	2(K3& K3)	1(K3)	
4	CLO 4	Up to K4	2	K1&K2	1	K1	2(K4& K4)	1(K4)	
5	CLO 5	Up to K3	2	K1&K2	1	K2	2(K3& K3)	1(K3)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

Distribution of section wise marks with K levels.

K 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	41.66%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	41.67%
K4	-	-	10	10	20	16.67	16.67%
Total	10	10	50	50	120	100	100%

LESSON PLAN

UNIT	Description	Hours		Mode
I	Statistics: Introduction - Definition – Functions - Applications - Limitations. Organising a Statistical Survey: Planning the survey - Executing the survey-Collection of Data: Primary and secondary data.	3	12	Lecture
	Methods of collecting primary data - Sources of secondary data. Sampling: Census and Sample methods. Classification-Types.	5		Tutorial
	Formation of frequency distribution-Tabulation - parts of a Table - Types. Diagrammatic representation – Types. Graphical representation - Graphs of frequency distributions. Merits and Limitations of diagrams and graphs.	4		Seminar
II	Measures of Central tendency: Introduction-Definitions - Types - Mean-Median-Mode-Geometric mean-Harmonic Mean-Weighted mean	6	12	PPT
	Merits and Demerits-Measures of Dispersion: Introduction – Definition – Types – Range - Quartile deviation - Mean deviation - Standard deviation - Co-efficient of variation – Lorenz curve - Merits and Demerits.	6		Lecture
III	Skewness: Introduction-Definition-Types-Karl Pearson's – Bowley's - Kelly's methods –	3	12	Problem solving
	Their merits and demerits. Kurtosis: Introduction-Definition-Types-Its merits and demerits.	4		Lecture
	Moments: Introduction - Definition-Types - Raw, Central moments and their relations.	5		PPT
IV	Correlation analysis: Introduction - Definition - Types – Ungrouped and Grouped data – Probable error – properties -	6	12	Lecture
	Rank correlation – Partial and Multiple correlations -	3		Problem solving
	Regression analysis: Introduction - Definition – Regression Equations -Multiple regression - Principle of least squares for first degree, Second degree, Exponential and Power curves.	3		Lecture

V	Theory of Attributes: Introduction – Definition-Classes and Class frequencies-	5	12	Tutorial
	Consistency of data-Independence of attributes-Association of attributes-	3		Seminar
	Yule's coefficient and -Coefficient of Colligation.	4		PPT
	Total	60		

Course Designer: Prof. N. Sriviveka Saratha, Assistant Professor, Department of Mathematics.

Title of the Course		Probability Theory					
TANSCHÉ Course type		CC2					
Course Category		Core II					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23U1SCCT2
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		3	1		-		4
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Mathematics/Business Mathematics					
Objectives of the Course		To describe the importance and scope of probability theory and to predict the chance of an experimental outcomes. It provides the study of random variable, distribution function, mathematical expectation, Generating function and law of large numbers. Two-dimentional variables and its distributions					
Course Outline		UNIT-I: Theory of Probability: Introduction-Basic terminology- Definition - Axiomatic approach – Types of Events - Conditional Probability - Addition and Multiplication theorems of Probability for ‘two’ and ‘n’ events (Statement and Proof) - Boole’s inequality (Statement and Proof)- Bayes’ theorem of Probability (Statement and Proof with numerical illustration -very simple problems) Chapters 3(3.1 - 3.3, 3.8 - 3.13), 4(4.2)					
		Unit-II: Random variables and Distribution functions: Introduction - Discrete random variable: Probability mass function- Discrete distribution function, Properties. Continuous random variable : Probability density function and properties, measures of central tendency, dispersion, Skewness and kurtosis for continuous Probability distribution. Chapters 5(5.1 – 5.4), 2(2.12 – 2.17)					
		Unit-III : Two dimensional random variables - Joint probability mass function- Marginal probability function, Conditional probability function. Two dimensional distribution functions - Marginal distribution functions - Joint density function-Marginal density function - Conditional distribution function - Conditional probability density function. Transformation of One - Dimensional and Two Dimensional random variable (concept only). Chapters 5(5.5 - 5.7)					

	Unit-IV: Mathematical Expectations: Introduction- Expected value of a random variable (Discrete and Continuous)-Expected value of function of a random variable - Properties of Expectation-Properties of variance - Covariance. Inequalities involving expectation: Cauchy Schwartz and Markov inequalities. Chapters 6(6.1 - 6.7) Unit-V: Generating functions: M.G.F- Properties - Uniqueness theorem - C.G.F-Properties- P.G.F-Properties. Characteristic Function: Properties–Inversion theorems (Statement only)-Uniqueness theorem (Statement only). Chebychev’s Inequality (Statement and Proof). Law of Large Numbers (L.L.N): Convergence in probability - Properties: Weak L.L.N - properties-Bernoulli’s L.L.N (Statement and Proof) - Khinchin’s theorems (Statement only). Chapters 7(7.1 - 7.7)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved(To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	As a mathematical foundation for statistics, probability theory is essential to many human activities that involve quantitative analysis of data. Methods of probability theory also apply to descriptions of complex systems given only partial knowledge of their state as in statistical mechanics or sequential estimation. Probability theory is the branch of mathematics concerned with probability. Although there are several different probability interpretations, probability theory treats the concept in a rigorous mathematical manner by expressing it through a set of axioms. Central subjects in probability theory include discrete and continuous random variables, probability distributions, and stochastic processes. Although it is not possible to perfectly predict random events, much can be said about their behaviour. Two major results in probability theory describing such behaviour are the law of large numbers and the central limit theorem.
Text Book(s)	Gupta S.C. and Kapoor V.K (2015): Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
Reference Book(s)	Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics. Hogg, R.V. and Craig, A.T. (1978) : Introduction to Mathematical Statistics, McGraw Hill Publishing Co. Inc. New York. Mood A.M. Graybill, F.A. and Bose. D.C. (1974): Introduction to the theory of Statistics, McGraw Hill Publishing Co. Inc. New York. Sanjay Arora and Bansilal (1989): New Mathematical Statistics, Satyaprakashan, New Delhi

Websites and e-Learning resources	e-books, tutorials on MOOC/SWAYAM courses on the subject www.khanacademy.org/math/statistics-probability/random-variables-stats-library https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/

COURSE OUTCOMES:

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

CO	Course learning outcome	K-level
CO1	Understand concepts of probability and Identify the different approaches of probability theory.	Upto K3
CO2	Define the random variable and its respective probability values and to compare a discrete and continuous random variable.	UptoK2
CO3	Calculate the expected value of a random variable variance, covariance, moments and find the conditional expectation and variance of bi-variate random variable.	UptoK3
CO4	Understand the concept of Discrete and Continuous type random variables.	UptoK4
CO5	Understand the concept of convergence of probability.	UptoK3

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	3	3	3	2	2	2	3	1	3
CLO2	3	2	3	3	3	2	2	2	3	1	3
CLO3	3	2	3	3	3	2	2	2	3	1	3
CLO4	3	2	3	3	3	2	2	2	3	1	3
CLO5	3	2	3	3	3	2	2	2	3	1	3

SUMMATIVEASSESSMENT-BLUEPRINT

S.No.	CLOs	K-Level	Section A		Section B		Section C (Either /or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. Of questions	K-Level	No. Of questions	K- Level		
1	CLO1	UptoK3	2	K1&K2	1	K1	2(K2& K2)	1(K3)
2	CLO2	UptoK2	2	K1&K2	1	K1	2(K2&K2)	1(K2)
3	CLO3	UptoK3	2	K1&K2	1	K2	2(K3& K3)	1(K3)
4	CLO4	UptoK4	2	K1&K2	1	K2	2(K4& K4)	1(K4)
5	CLO5	UptoK3	2	K1&K2	1	K2	2(K3& K3)	1(K3)
No.of Questions to be asked			10		5		10	5
No.of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of section wise marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	5	4	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	30	50	41.67	41.67%
K4	-		10	10	20	16.67	16.66%
Total marks	10	10	50	50	120	100	100%

Components of Assessment shall be

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K2
CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2,K3

Lecture schedule

Unit	Topics	Hours	Mode
I	Theory of Probability: Introduction-Basic terminology- Definition - Axiomatic approach – Types of Events.	2	PPT, Chalk and Talk.
	Conditional Probability - Addition and Multiplication theorems of Probability for ‘two’ and ‘n’ events (Statement and Proof).	4	
	Boole’s inequality (Statement and Proof)- Bayes’ theorem of Probability (Statement and Proof with numerical illustration -very simple problems).	6	
II	Random variables and Distribution functions: Introduction - Discrete random variable: Probability mass function	4	PPT, Chalk and Talk, Assignments and GD
	Discrete distribution function, Properties. Continuous random variable : Probability density function and properties	4	
	measures of central tendency, dispersion, Skewness and kurtosis for continuous Probability distribution.	4	
III	Two dimensional random variables - Joint probability mass function- Marginal probability function, Conditional probability function.	3	PPT, Chalk and Talk, Assignments
	Two dimensional distribution functions-Marginal distribution functions - Joint density function-Marginal density function	3	
	Conditional distribution function - Conditional probability density function.	3	
	Transformation of One Dimensional and Two Dimensional random variable (concept only).	3	
IV	Mathematical Expectations: Introduction- Expected value of a random variable (Discrete and Continuous)	3	PPT, Chalk and Talk, Assignments
	Expected value of function of a random variable - Properties of Expectation-Properties of variance.	4	
	Covariance. Inequalities involving expectation: Cauchy Schwartz and Markov inequalities.	5	
V	Generating functions: M.G.F-Properties-Uniqueness theorem - C.G.F- Properties- P.G.F-Properties. Characteristic Function: Properties–Inversion theorems (Statement only)- Uniqueness theorem (Statement only). Chebychev’s Inequality (Statement and Proof).	6	Assignments, Seminar and GD
	Law of Large Numbers (L.L.N): Convergence in probability - Properties: Weak L.L.N - properties-Bernoulli’s L.L.N (Statement and Proof) - Khinchin’s theorems (Statement only).	6	

Course Designer: Dr. M. REVATHI, Assistant Professor, Department of Statistics, The Madura College.

Title of the Course		Statistical Methods and Its Application-I					
TANSCHÉ Course type		EC1 (INFORMATION TECHNOLOGY)					
Course Category		Elective I (Generic / Discipline Specific)					
Nature of course		Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23U1SGET1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Lab Practice		Total
		5	1		--		6
Pre-requisite		Basic arithmetic					
Objectives of the Course		The main objectives of this course are: 1. To introduce the concepts of random variable and distribution functions, expectation, conditional expectation and variance, generating function, law of large numbers. 2. To illustrate general properties of the expectation and variance operators.					
Course Outline		Unit-I: Theory of Probability: Introduction – Basic terminology – Mathematical probability – Statistical probability – Mathematical tools – Random experiment, sample space and elementary events – Axiomatic probability – Algebra of events – Some theorem on probability(without proof) - Problems.					
		Unit-II: Conditional Probability and Independence: Conditional probability – Multiplication theorem of probability (without proof) – Independent events – Multiplication theorem of probability for independence events (without proof) – Pairwies and Mutually independent events – Baye’s theorem(without proof) – Problems.					
		Unit-III: Random Variable: Introduction – Distribution function – Discrete random variable – Continuous random variable – Mathematical expectation of a random variable – Expected value of function of a random variable – Properties of expectation and variance (statement only) – Problems.					
		Unit-IV: Generating Functions and Law of Large Numbers: Moment generating function – Properties of moments generating function – Cumulants – Characteristic function – Properties of characteristic function (statement only) – Convergence in probability – Weak law of large numbers (statement only).					

	Unit-V: Discrete Probability Distributions: Introduction – Discrete uniform distribution – Bernouli distribution – Binomial distribution – Factorial moments, mean deviation, mode, recurrence relation, moment generating function, characteristic function, additive property(statement only) – Poisson distribution – definition, moments, mode, recurrence relation, moment generating function, characteristic function, cumulants, additive property (statement only) – Problems.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Recommended Text	1. Gupta S.C. and Kapoor V.K. (2002) Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi. Chapters: 3(3.1, 3.3 - 3.5(3.5.1), 3.7(3.7.2, 3.7.3), 3.8(3.8.1, 3.8.2, 3.8.5, 3.8.6), 3.9(3.9.1 - 3.9.3), 3.10 - 3.15(3.15.1, 3.15.2)), 4(4.2(4.2.1)), 5(5.1 - 5.3(5.3.1, 5.3.2), 5.4(5.4.1, 5.4.3)), 6(6.3 - 6.5), 7(7.1(7.1.2), 7.2(7.2.1), 7.3(7.3.1), 7.6, 7.7), 8(8.1, 8.2(8.2.1), 8.3(8.3.1), 8.4(8.4.1 - 8.4.7), 8.5(8.5.2 - 8.5.8)).
Reference Books	1. Sheldon Ross, A first course in Probability, Pearson Education 2. Goon A.M., Gupta M.K. and Das Gupta B. (1991) Fundamentals of Statistics, Vol.1, World Press, Calcutta. 3. Mood, A.M. Graybill, F.A. and Bose, D.C, (1974) introduction to Theory of Statistics, Tata McGraw Hill, New Delhi.
Website and e-Learning Source	e-books, tutorials on MOOC/SWAYAM courses on the subject

COURSE OUTCOMES:

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

CO1	Learn about theory of probability.	Up to K3
CO2	Construct conditional probability and independent events.	Up to K4
CO3	Construct discrete and continuous random variable.	Up to K3
CO4	Apply general properties of generating function and law of large number.	Up to K3
CO5	Describe the main properties of probability distribution and random variables.	Up to K4

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented solving problems

K4 - Examining, analyzing, presentation and make inference with evidences.

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	-	-	-
CLO2	3	2	2	-	1	1	2	3	-	-	3
CLO3	3	2	2	-	1	1	2	3	-	-	3
CLO4	3	2	1	-	-	1	1	3	-	-	2
CLO5	3	2	1	-	-	1	1	3	-	-	2

Assessment Schema Components of CIA

CLO	Component	Weight / Mark	K – Level
CLO 1 – 4	CIA	10	K1 – K4
CLO 5	Assignment	5	K3
CLO 5	Seminar	5	K3
CLO 1 – 5	Quiz	5	K1, K2

BLUE PRINT - External Exam

Mapping with Course Learning Outcomes(CLOs)

S.No	CLOs	K-level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K-Level	No. of Questions	K- Level			
1	CLO 1	Up to K2	2	K1 & K2	1	K1	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	K2	2(K2 & K2)	1(K3)	
4	CLO 4	Up to K4	2	K1 & K2	1	K1	2(K3& K3)	1(K4)	
5	CLO 5	Up to K3	2	K1 & K2	1	K2	2(K2 & K2)	1(K3)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

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	-	-	9	7.5	50.00%
K2	5	6	30	10	51	42.50	
K3	-	-	20	30	50	41.67	41.67%
K4	-	-	-	10	10	8.33	8.33%
Total marks	10	10	50	50	120	100	100%

Lesson Plan

S. NO.	UNIT	DESCRIPTION	TAKING HOURS	TOTAL	PEDAGOGY
1.	I	Introduction – Basic terminology	4	18	Chalk and Talk, problem solving, Tutorials
		Mathematical probability – Statistical probability – Mathematical tools	3		
		Random experiment, sample space and elementary events	3		
		Axiomatic probability – Algebra of events	4		
		Some theorem on probability (without proof) - Problems.	4		
2.	II	Conditional probability – Multiplication theorem of probability (without proof)	6	18	Chalk and Talk, Problem Solving
		Independent events – Multiplication theorem of probability for independence events (without proof)	7		
		Pairwise and Mutually independent events – Baye's theorem(without proof) – Problems.	5		
3.	III	Introduction – Distribution function – Discrete random variable – Continuous random variable – Mathematical expectation of a random variable	9	18	Chalk and Talk, Quiz
		Expected value of function of a random variable – Properties of expectation and variance (statement only) – Problems.	9		
4.	IV	Moment generating function – Properties of moments generating function	6	18	Chalk and Talk, quiz, group discussion
		Cumulants – Characteristic function – Properties of characteristic function (statement only)	6		
		Convergence in probability – Weak law of large numbers (statement only).	7		
5.	V	Introduction – Discrete uniform distribution – Bernoulli distribution – Binomial distribution	7	18	Chalk and Talk, Quiz
		Factorial moments, mean deviation, mode, recurrence relation, moment generating function, characteristic function, additive property (statement only)	8		
		Poisson distribution – definition, moments, mode, recurrence relation, moment generating function, characteristic function, cumulants, additive property (statement only) – Problems.	3		
		Total		90	

Course Designer: Prof. G. K. LAKSHMI, Assistant Professor, Department of Mathematics & Statistics (SF)

Title of the Course		Statistical Practical – 1 (Calculator based)					
TANSCHÉ Course type		CC 2A					
Course Category		Skill Enhancement Course					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23U1SSED1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		2	-			2	
Marks		CIA		Semester		Total	
		40		60		100	
Pre-requisite(s)		Basic ideas of 12 th standard statistics					
Objectives of the Course		1. It provides to formulate the visualization of frequency distribution using graphs and diagrams. 2. Also they measure the central tendency, dispersions, moments, and relationship among variables. 3. Analysis the data relationship using correlation and Predict the variation using regression also fitting the curve estimation. 4. To describe the importance and scope of discrete and continuous random variables. 5. It provides the study of two dimensionalrandom variables and its expectations.					
Course Outline		List of Problems					
		Frequency distribution					
		Vertical and horizontal bar diagram					
		Comparitive bar diagram					
		Histogram and frequency polygon					
		Line graph and pie chart					
		Measures of central tendency					
		Measures of dispersion					
		Measures of skewness and kurtosis					
		Coefficient of skewness					
		Calculation of correlation coefficient.					
		Calculation of partial correlation coefficient					
		Fitting of simple Regression lines					
		Fitting of Multiple regression lines					
		Curve Fitting : (i) $y=ax+b$ (ii) $y=ax^2+bx+c$ (iii) $y= ae^{bx}$					
		Calculation of Conditional Probability					
		Calculation of distribution function of discrete random variables					
		Calculation of distribution function of continuous random variables					

	Calculation of Joint probability mass function, Mathematical Expectation
	Calculation of Marginal probability density function
	Calculation of expected value of a random variable (Discrete and Continuous)
	Calculation of expected value of function of a random variable .
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical and Practical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	It provides a framework for quantifying uncertainty and making informed decisions based on the available data. It allows us to calculate the likelihood of different outcomes and assess the potential impact of different scenarios..
Text Book(s)	1. Gupta, S.P. (2017): Statistical Methods, Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition. 2. Gupta S.C and Kapoor, V.K. (2002). Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd., New Delhi.
Reference Book(s)	6. Anderson, T.W. and Sclove SL. (1978). An introduction to statistical analysis of data, Houghton Mifflin & co. 7. Pillai, R.S., and Bagavathi (2003): Statistics, S. Chand and Company Ltd., New Delhi. 8. Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics. 9. Hogg. R.V. and Craig. A.T. (1978) : Introduction to Mathematical Statistics, McGraw Hill Publishing Co. Inc. New York.
Websites and e-Learning resources	1. https://en.wikipedia.org/wiki/Statistics 2. https://en.wikipedia.org/wiki/Descriptive_statistics 3. https://socialresearchmethods.net/kb/statdesc.php 4. www.khanacademy.org/math/statistics-probability/random-variables-stats-library 5. https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/

COURSE OUTCOMES:

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

Number	Course Learning Outcomes	Knowledge Level
CLO 1	Define the statistical terms & its frequency also Construction of charts and graphs using various data	Upto K3
CLO 2	Discuss the importance and uses of central values and dispersions for the various types of data.	Upto K3
CLO 3	Analysis the data relationship using correlation and Predict the variation using regression also fitting the curve estimation.	Upto K3
CLO 4	Demonstrate the one dimensional random variable and its distributions.	Upto K3
CLO 5	Understand bivariate random variables and its distributions.	Upto K3

K1- Remembering and recalling facts with specific answers

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

K3 –Application oriented – solving problems

K4- Examining, analyzing, presentation and make inference with evidences.

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes(PSO)

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

STRONG(3), MEDIUM(2) LOW(1).

Course Designer Name : Prof. V.Vijayalakshmi, Assistant Professor, Department of Mathematics and Statistics, The Madura College(Autonomous) – S.F

Title of the Course		Foundation course - Bridge Statistics					
Paper Number		FOUNDATION 1					
Category	Core	Year	I	Credits	2	Course Code	23U1SFCT1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Lab Practice		Total
		2	-		--		2
Pre-requisite		12 th Standard Mathematics					
		To bridge the gap and facilitate transition from higher secondary to tertiary education; To instil confidence among stakeholders and inculcate interest for Mathematics;					
Course Outline		UNIT-I: Algebra: Binomial theorem, General term, middle term, problems based on these concepts					
		Unit II: Sequences and series (Progressions). Fundamental principle of counting. Factorial n.					
		Unit III: Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups.					
		Unit IV: Calculus: Limits, standard formulae and problems, differentiation, first principle, uv rule, u/v rule, methods of differentiation, application of derivatives.					
		UnitV: Calculus: integration,product rule, substitution method ,Bernouli’s formula, integration by parts, definite and indefinite integrals, application of integrations.					
Recommended Text		1. NCERT class XI and XII text books. 2. Any State Board Mathematics text books of class XI and XII					
Website and e-Learning Source		https://nptel.ac.in					

Course Learning Outcome

After completion of this course successfully, the students will be able to

Number	Course Learning Outcomes	Knowledge Level
CLO 1	Prove the binomial theorem and apply it to find the expansions of any $(x + y)^n$ and also, solve the related problems.	Upto K2
CLO 2	Find the various sequences and series and solve the problems related to them. Explain the principle of counting.	Upto K2
CLO 3	Find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations.	Upto K2
CLO 4	Find the limit and derivative of a function at a point. Find the product and division rule.	Upto K2
CLO 5	Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae	Upto K2

K1- Remembering and recalling facts with specific answers

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

K3 –Application oriented – solving problems

K4- Examining, analyzing, presentation and make inference with evidences.

Mapping of Course Learning Outcomes (CLOs) with Programme Learning Outcomes (PLOs) and Programme Specific Outcomes (PSOs)

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

Assessment Schema Components of CIA

Component	Weight / Mark
Assignment	5
Quiz	5

BLUE PRINT - External Exam

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 K4	2	K1 & K2	1	K2	2(K4 & K4)	1(K4)
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(K1& K1)	1(K3)
4	CLO 4	Up to K3	2	K1 & K2	1	K1	2(K3 & K3)	1(K3)
5	CLO 5	Up to K2	2	K1 & K2	1	K2	2(K2& K2)	1(K2)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	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%

Lesson Plan

Units	Description	Hours	Total Hours	Pedagogy
I	Algebra-Introduction,	1	6	Lecture
	Binomial theorem	1		Lecture
	Binomial theorem- General term, middle term	2		Lecture & Presentation
	Problems based on these concepts	1		Lecture
	Problems based on these concepts	1		Lecture
II	Sequences and series introduction	2	6	Lecture & Group Discussion
	Fundamental principle of counting,	2		Lecture
	Factorial n.	2		Lecture Presentation
III	Permutations and combinations	1	6	Lecture
	Derivation of formulae and their connections	1		Lecture & Presentation
	Simple applications	2		Lecture
	Combinations with repetitions, arrangements within groups formation of groups	2		Lecture
IV	Calculus –Differentiation	1	6	Lecture
	Limits, standard formulae and problems	1		Lecture
	Differentiation, first principle, uv rule, u/v rule,	2		Lecture & Seminar
	Methods of differentiation, application of derivatives	2		Lecture
V	Calculus- integration, product rule, substitution method	2	6	Lecture
	Bernouli's formula, integration by parts,	2		Lecture & Group Discussion
	Definite and indefinite integrals, application of integrations.	2		Lecture
Total			30	

Course Designer Name : Prof. V.Vijayalakshmi, Assistant Professor, Department of Mathematics and Statistics, The Madura College(Autonomous) – SF

Title of the Course		MATRIX AND LINEAR ALGEBRA					
TANSCHÉ course type		CC3					
Course Category		Core					
Nature of the course		Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23U2SCCT3
		Semester	II				
Instructional Hours Perweek		Lecture	Tutorial		LabPractice		Total
		4	-		--		4
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite		Basic vector and matrix theory					
Objectives of theCourse		• To study the basic operations of transpose and inverse of matrices • To know the structure of orthogonal and unitary matrices • To learn the invariance properties of ranks • To know and to apply the concepts of vector space and matrix polynomials.					
CourseOutline		Unit I Matrices-Transpose-Conjugate transpose- Reversal law for the transpose and conjugate transpose. Adjoint of a matrix, Inverse of a matrix, Singular and Non -Singular matrices. Chapters: 1(1.16 – 1.19), 3(3.1 – 3.3)					
		Unit II Reversal law for the inverse of product of two matrices. Commutativity of inverse and transpose of matrix, Commutativity of inverse and conjugate transpose of matrix,Orthogonal and Unitary Matrices,Product of unitary matrices, Partitioning of matrices. Chapters: 3(3.4, 3.6, 3.7)					
		Unit III Rank of a matrix, Echelon form, Rank of transpose, Elementary transformations, Elementary matrices, Invariance of rank through elementary transformations, Reduction to Normal form, Equivalent matrices. Chapters: 4(4.2 - 4.6, 4.8 - 4.10)					
		Unit-IV Vector space – Linear Dependence - Basis of a vector space – Sub-space - Properties of Linearly Independent and Dependent systems, Row and Column spaces, Equality of Row and Column ranks, Rank of Sum and Product of matrices. Chapters: 5(5.1 - 5.2, 5.4, 5.6, 5.7, 5.8, 5.13, 5.14, 5.15)					
		Unit-V Matrix polynomials, Characteristic roots and vectors,Relation between characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity, Nature of characteristic roots in case of special matrices, Cayley- Hamilton theorem. Chapters: 7(7.1,7.2, 7.3,7.4,7.5,7.7)					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations U PSC/TRB/NET/UGC–CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	This course covers matrix theory and linear algebra, emphasizing useful topics. Linear algebra is a type of math that deals with a diverse set of topics ranging from vectors and matrices to linear transformations. The tools in linear algebra are an important foundation for understanding data. Its theories and techniques include Fourier series, matrix theory, Euclidean vector spaces, eigenvalues and eigenvectors, and linear transformations. Linear algebra forms the building blocks crucial to understanding higher levels of math, such as calculus.
Text Book(s)	1. Vasishtha.A.R (1972) : Matrices, Krishnaprakashan Mandir, Meerut.
Reference Book(s)	2. Shanthinarayan, (2012) : A Text Book of Matrices, S.Chand & Co, New Delhi 3. M.L.Khanna (2009), Matrices, Jai Prakash Nath & Co
Website and e-Learning resources	e-books, tutorials on MOOC/SWAYAM courses on the subject • https://samples.jbpub.com/9781556229114/chapter7.pdf • https://www.vedantu.com/maths/matrix-rank • https://textbooks.math.gatech.edu/ila/characteristic-polynomial.html • https://www.aitude.com/explain-echelon-form-of-a-matrix/

Note: Chapters mentioned in the course outline.

COURSE OUTCOMES

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

CLOs	Course Learning Outcomes	K- Level
CLO1	Explain the basic operations of matrices.	UptoK2
CLO2	Compute inverse of product of two matrices, commutativity of inverse, transpose, conjugate transpose of matrix, orthogonal and unitary matrices.	UptoK3
CLO3	Using elementary transformation construct echelon form, finding rank of matrix, transpose.	UptoK3
CLO4	Compare independent and dependent systems in the vector space.	UptoK3
CLO5	Predict the characteristic roots and vectors of the matrices using Cayley Hamilton theorem.	UptoK4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (CLO) with Program 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	1	2	3	-	2	-	2	3	2	3	1
CLO2	1	2	3	-	2	-	2	3	2	3	1
CLO3	1	2	3	-	2	-	2	3	3	3	1
CLO4	1	2	3	-	1	-	2	3	3	3	1
CLO5	1	2	3	-	1	-	2	3	3	3	1

3-AdvanceApplication

2-IntermediateLevel

1-BasicLevel

Components of Assessment

CLO	Component	Weight / Mark	K-level
CLO5	Assignment	5	K3
CLO5	Seminar	5	K4
CLO1,CLO2,CLO3,CLO4,CLO5	Quiz	5	K2,K3,K4

Blueprint for Semester Examination

S.No.	CLOs	K–Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. Of questions	K-Level	No. Of questions	K-Level		
1	CLO1	UptoK2	2	K1&K2	1	K1	2(K1& K1)	1(K2)
2	CLO2	UptoK3	2	K1&K2	1	K1	2(K2&K2)	1(K3)
3	CLO3	UptoK3	2	K1&K2	1	K2	2(K3& K3)	1(K3)
4	CLO4	UptoK3	2	K1&K2	1	K2	2(K3& K3)	1(K3)
5	CLO5	UptoK4	2	K1&K2	1	K2	2(K4& K4)	1(K4)
No.of Questions to be asked			10		5		10	5
No.of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3 –Application oriented – solving problems

K4- Examining, analyzing, presentation and make inference 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	41.67%
K2	5	6	10	10	31	25.84	
K3	-	-	20	30	50	41.67	41.67%
K4	-		10	10	20	16.67	16.66%
Total marks	10	10	50	50	120	100	100%

Lecture Schedule

Unit	Topics	Hours	Mode
I	Matrices-Transpose-Conjugate transpose.	4	Lecture, Quiz.
	Reversal law for the transpose and conjugate transpose. Adjoint of a matrix.	4	
	Inverse of a matrix, Singular and Non -Singular matrices.	4	
II	Reversal law for the inverse of product of two matrices. Commutativity of inverse and transpose of matrix.	4	Lecture, Quiz.
	Commutativity of inverse and conjugate transpose of matrix, Orthogonal and Unitary Matrices.	4	
	Product of unitary matrices, Partitioning of matrices.	4	
III	Rank of a matrix, Echelon form, Rank of transpose.	4	PPT, Lecture, Quiz, GD
	Elementary transformations, Elementary matrices, Invariance of rank through elementary transformations.	4	
	Reduction to Normal form, Equivalent matrices.	4	
IV	Vector space – Linear Dependence - Basis of a vector space.	4	PPT, Lecture, Quiz.
	Sub-space - Properties of Linearly Independent and Dependent systems.	4	
	Row and Column spaces, Equality of Row and Column ranks, Rank of Sum and Product of matrices	4	
V	Matrix polynomials, Characteristic roots and vectors,	4	Assignments and Seminar.
	Relation between characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity.	4	
	Nature of characteristic roots in case of special matrices, Cayley-Hamilton theorem.	4	
	Total hours	60	

Course Designer:

Dr. B.SEETHALAKSHMI, Assistant Professor, Department of Mathematics & Statistics

Title of the Course		Distribution Theory					
TANSCHÉ Course type		CC4					
Course Category		Core IV					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23U2SCCT4
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4			--		4
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Calculus					
Objectives of the Course		• To learn discrete distributions • To learn continuous distributions • To understand Distributions generated from mathematical functions • Learn normal distribution and its properties • Understand about sampling distributions					
Course Outline		Unit I: Binomial distribution – moments, recurrence relation, mean deviation, mode, moment generating function, characteristic function, cumulants. Fitting of Binomial Distribution. Poisson distribution – moments, mode, recurrence relation, moment generating function, characteristic function, cumulants. Fitting of Poisson distribution. Negative binomial distribution – m.g.f., cumulants. Fitting of Negative binomial distribution.					
		Unit II: Geometric distribution – lack of memory, moments, m.g.f.-Hypergeometric distribution – mean, variance, approximation to Binomial, recurrence relation – Multinomial distribution – m.g.f., mean and variance, Discrete Uniform Distribution.					
		Unit III: Normal Distribution – chief characteristics of the normal distribution and normal probability curve, mean, median, mode, m.g.f. characteristic function, moments, points of inflexion, mean deviation, Area property – Rectangular distribution – moments, m.g.f., characteristic function, mean deviation about mean.					
		Unit IV: Exponential distribution – m.g.f., characteristic function, memory less property – Gamma distribution – m.g.f., cumulants and central moments, reproductive property – Beta distribution – First kind and second kind – constants.					

	Unit V: Functions of Normal random variables leading to t, Chi-square and F-distributions (derivations, properties and interrelationships).
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/ TRB/NET/UGC–CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Distribution Theory is the mathematical function that gives the probabilities of occurrence of different possible outcomes for an experiment.
Text Book(s)	- Gupta, S.C. Kapoor, V.K. (2019) Fundamentals of Mathematical Statistics, Eleventh Thoroughly Edition Sultan Chand and Sons, New Delhi Unit-I Chapter: 8(8.4, 8.5, 8.6) Unit-II Chapter: 8(8.7, 8.8) Unit-III Chapter: 9(9.2, 9.3) Unit-IV Chapter: 9(9.5, 9.6, 9.7, 9.8) Unit-V Chapter: 15(15.5) 16(16.2, 16.5, 16.7, 16.8) - Goon, A.M. Gupta M.K. and Das Gupta B (1977) An Outline of Statistical Theory, Vol I, 6/e, World Press, Calcutta. - Hogg, R.V. and Graig, A.T. (1978) : Introduction to Mathematical Statistics, A/e, Mc.Graw Hill Publishing Co. Inc., New York.
Reference Book(s)	Mood, A.D. Graybill, F.A. and Boes, D.C (1974): Introduction to the Theory of Statistics, 3/e, Mc.Graw Hill, New York.
Websites and e-Learning resources	e-books, tutorials on MOOC/SWAYAM courses on the subject

COURSE OUTCOMES:

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

CO	Course Learning Outcome	K-level
CO1	Identify discrete distributions appeared in real life situations	UptoK2
CO2	Understand some continuous distributions and its applications	Up toK3
CO3	Real values connection between some of the mathematical functions and its application in distribution theory	UptoK4
CO4	Understand normal distribution and its properties	UptoK4
CO5	Identify probability models in real data and estimate population parameters	UptoK4

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	1	2	3	3	1	1	1	2	2	1	3
CLO2	1	2	3	3	1	1	1	2	2	1	3
CLO3	1	2	3	3	1	1	1	2	2	1	3
CLO4	1	2	3	3	1	1	1	2	2	1	3
CLO5	1	2	3	3	1	1	1	2	2	1	3

The Components of Assessment Shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1,CLO2,CLO3, CLO4,CLO5	Quiz	5	K1

SUMMATIVE ASSESSMENT - BLUEPRINT

S.No.	CLOs	K-Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. Of questions	K-Level	No. Of questions	K- Level		
1	CLO1	UptoK2	2	K1&K2	1	K1	2(K2&K2)	1(K2)
2	CLO2	UptoK3	2	K1&K2	1	K1	2(K2&K2)	1(K3)
3	CLO3	UptoK4	2	K1&K2	1	K2	2(K3&K3)	1(K4)
4	CLO4	UptoK4	2	K1&K2	1	K2	2(K4&K4)	1(K3)
5	CLO5	UptoK4	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			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 inference 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	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	10	30	25	25%
K4	-		10	30	40	33.33	33.33%
Total marks	10	10	50	50	120	100	100%

Lecture Schedule

Unit	Topics	Hours	Mode
I	Binomial distribution – moments, recurrence relation, mean deviation, mode, moment generating function, characteristic function, cumulants.	5	Presentation, Chalk and Talk.
	Fitting of Binomial Distribution. Poisson distribution – moments, mode, recurrence relation, moment generating function, characteristic function, cumulants.	4	
	Fitting of Poisson distribution. Negative binomial distribution – m.g.f., cumulants. Fitting of Negative binomial distribution.	3	
II	Geometric distribution – lack of memory, moments, m.g.f..	3	Presentation, Chalk and Talk and Assignments
	Hypergeometric distribution – mean, variance, approximation to Binomial, recurrence relation .	6	
	Multinomial distribution – m.g.f., mean and variance.	3	
III	Normal Distribution – chief characteristics of the normal distribution and normal probability curve, mean, median, mode, m.g.f., uniform discrete distribution	4	Presentation, Chalk and Talk, Assignments
	Characteristic function, moments, points of inflexion, mean deviation, Area property	4	
	Rectangular distribution – moments, m.g.f., characteristic function, mean deviation about mean.	4	
IV	Exponential distribution – m.g.f., characteristic function, memory less property .	4	Presentation, Chalk and Talk, Assignments
	Gamma distribution – m.g.f., cumulants and central moments, reproductive property .	4	
	Beta distribution – First kind and second kind – constants.	4	
V	Functions of Normal random variables leading to t.	4	Assignments and Seminar
	Chi-square distributions (derivations, properties and interrelationships).	4	
	F-distributions (derivations, properties and interrelationships).	4	

Course Designer: Prof.KRISHNA JAYANTHI.S, Assistant Professor, Department of Mathematics & Statistics-SF.

Title of the Course		Statistical Methods and Its Application-II					
TANSICHE Course type		EC2 (INFORMATION TECHNOLOGY)					
Course Category		Elective II (Generic Specific)					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23U2SGET2
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		-		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basics of Mathematical Statistics, Basic differentiation and Integration.					
Objectives of the Course		- To make them understand the concept of continuous probability distributions. - To study about important inferential aspects such as point estimation, test of hypothesis and associated concepts. - To make them understand the meaning and uses of interpolation and extrapolation.					
Course Outline		Unit I: CONTINUOUS PROBABILITY DISTRIBUTIONS: Rectangular distribution: Moments, M.G.F, Mean deviation about Mean, Problems – Gamma distribution: M.G.F, Additive property(Statement only), Problems – Normal distribution: Definition, Chief Characteristics,Mode, Median, M.G.F, Mean deviation about the Mean, Problems. Chapter 9 – Sections 9.3(9.3.1, 9.3.2,9.3.4), 9.5(9.5.1, 9.5.3), 9.2(9.2.2 – 9.2.5, 9.2.10)					
		Unit II: LARGE SAMPLE THEORY: Introduction - Types of Sampling – Parameter and Statistic – Tests of Significance – Procedure for Testing of Hypothesis – Tests of Significance of Lage Samples – Sampling of variables. Chapter 14 – Sections 14.1 to 14.8 (Except 14.7)					
		Unit III: EXACT SAMPLING DISTRIBUTIONS – I: Introduction – M.G.F of χ^2 distribution – Applications of χ^2 distribution: Inferences about a population variance, Goodness of fit test, Test of independence of Attributes. Chapter 15 – Sections 15.1, 15.3.1, 15.6(15.6.1, 15.6.2, 15.6.3)					
		Unit IV: EXACT SAMPLING DISTRIBUTIONS - II: Introduction – Student’s t- distribution: Derivation – Applications of t-distribution – F-distribution: Derivation – Applications of F-distribution. Chapter 16: Sections 16.1, 16.2(16.2.1), 16.3, 16.5(16.5.1), 16.6					

	Unit V: NUMERICAL ANALYSIS: Introduction – Finite difference Table: Finite difference operator, Properties -Interpolation: Assumptions, Uses, Gregory Newton's interpolation for equal intervals – Interpolation with arguments at unequal intervals: Divided differences, Divided difference table, Newton's divided difference formula, Lagrange's interpolation formula. Chapter 19: Sections 19.1, 19.2(19.2.1, 19.2.3), 19.3(19.3.1, 19.3.2, 19.3.4, 19.3.5), 19.4(19.4.1, 19.4.2, 19.4.4, 19.4.5)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC /TRB/NET/UGC–CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Mathematical statistics is the application of probability theory, a branch of mathematics, to statistics, as opposed to techniques for collecting statistical data. Many computer algorithms are mathematical in nature, and many include randomness in order to speed things up. Statistical methods are also used to train computers to improve speech recognition capabilities. In robotics, mathematical and statistical methods are used to help robots work independently and yet still be able to navigate and make decisions.
Text Book(s)	Gupta S.C. and Kapoor.V.K. (2002) <i>Fundamentals of Mathematical Statistics</i>, Sultan Chand and Sons, New Delhi.
Reference Book(s)	1. Sheldon Ross, <i>A First Course in Probability</i>, Pearson Education 2. Goon A.M., Gupta M.K. and Das Gupta B. (1991) <i>Fundamentals of Statistics</i>, Vol.1, World Press, Calcutta. 3. Mood, A.M. Graybill, F.A. and Bose, D.C, (1974) <i>Introduction to Theory of Statistics</i>, Tata McGraw Hill, New Delhi.
Websites and e-Learning resources	https://archive.nptel.ac.in/courses/111/105/111105090/ https://archive.nptel.ac.in/courses/111/105/111105077/ https://guides.jstor.org/mathstats

COURSE OUTCOMES:

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

CO	COURSE OUTCOMES	K-level
CO1	Apply various continuous probability distributions to a variety of problems.	Upto K3
CO2	Understand the meaning and utility of sampling in statistics.	Upto K3
CO3	Test the goodness of fit and the independence of attributes.	Upto K4
CO4	Test the population mean and variance of a sample.	Upto K4
CO5	Apply interpolation technique for finding missing data.	Upto K3

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	-	-	1
CLO2	3	2	2	-	1	1	2	3	-	-	3
CLO3	3	2	2	-	1	1	2	3	-	-	3
CLO4	3	2	1	-	-	1	1	3	-	-	2
CLO5	3	2	1	-	-	1	1	3	-	-	2

Assessment Schema Components of CIA

CLO	Component	Weight / Mark	K – Level
CLO1 –CLO 4	CIA	10	K1 – K4
CLO5	Assignment	5	K3
CLO5	Seminar	5	K3
CLO1 - CLO5	Quiz	5	K1, K2

Blueprint for Semester Examination

Mapping with Course Learning Outcomes(CLOs)

S.No	CLOs	K-level	Section A		Section B		Section C(Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. Of Questions	K-Level	No. Of Questions	K-Level			
1	CLO1	Upto K3	2	K1&K2	1	K1	2(K2& K2)	1(K2)	
2	CLO2	Upto K3	2	K1&K2	1	K2	2(K3& K3)	1(K3)	
3	CLO3	Upto K4	2	K1&K2	1	K2	2(K2& K2)	1(K4)	
4	CLO4	Upto K4	2	K1&K2	1	K1	2(K3&K3)	1(K4)	
5	CLO5	Upto K3	2	K1&K2	1	K2	2(K2& K2)	1(K3)	
No.of Questions to be asked			10		5		10	5	30
No.of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total			10		10		25	30	75

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 with out choice	Consolidated
K1	5	4	-	-	9	7.5	50%
K2	5	6	30	10	51	42.50	
K3	-	-	20	20	40	33.33	33.33%
K4	-	-	-	20	20	16.67	16.67%
Total marks	10	10	50	50	120	100	100%

LESSON PLAN

Unit	Description	Hours	Mode
I	CONTINUOUS PROBABILITY DISTRIBUTIONS: Rectangular distribution: Moments, M.G.F, Mean deviation about Mean, Problems	4	Lecture, Discussion, Tutorial, Quiz
	Gamma distribution: M.G.F, Additive property (Statement only), Problems	6	
	Normal distribution: Definition, Chief Characteristics, Mode	4	
	Median, M.G.F, Mean deviation about the Mean, Problems	4	
II	LARGE SAMPLE THEORY: Introduction - Types of Sampling	2	Lecture, Quiz Group Discussion, Tutorial
	Parameter and Statistic – Tests of Significance	3	
	Procedure for Testing of Hypothesis	4	
	Tests of Significance of Large Samples	5	
	Sampling of variables.	4	
III	EXACT SAMPLING DISTRIBUTIONS – I: Introduction – M.G.F of χ^2 distribution	4	Presentation, Lecture, Quiz, Tutorial
	Applications of χ^2 distribution: Inferences about a population variance	6	
	Goodness of fit test	4	
	Test of independence of Attributes.	4	
IV	EXACT SAMPLING DISTRIBUTIONS - II: Introduction	2	Presentaion, Lecture, Quiz, Tutorial
	Student's t- distribution: Derivation	4	
	Applications of t-distribution	4	
	F-distribution: Derivation	4	
	Applications of F-distribution	4	
V	NUMERICAL ANANLYSIS: Introduction – Finite difference Table: Finite difference operator, Properties	4	Assignment, Seminar, Group Discussion, Tutorial
	Interpolation: Assumptions, Uses, Gregory Newton's interpolation for equal intervals	6	
	Interpolation with arguments at unequal intervals: Divided differences, Divided difference table	4	
	Newton's divided difference formula, Lagrange's interpolation formula	4	
Total Hours		90	

COURSE DESIGNER:

Prof. S.MEENAKSHI SELVARAJ, Assistant Professor, Department of Mathematics (SF).

Title of the Course		Statistical Practical-II(Calculator Based)						
TANSCHE Course type		CC4A						
Course Category		Core Practical						
Nature of Course		Employability / Skill Development						
Category	Core	Year	1	Credits	2	Course Code	23U2SSED2	
		Semester	2					
Instructional Hours per week		Lecture	Tutorial		Practical		Total	
		2					2	
Marks		CIA		Semester		Total		
		40		60		100		
Pre-requisite(s)		Basic Vector, Matrix Theory and Calculus						
Objectives of the Course		- To study the basic operations of transpose and inverse of matrices - To know the structure of orthogonal and unitary matrices - To learn discrete distributions - To learn continuous distributions						
Course Outline		UNIT	LIST OF PROBLEMS				K-LEVEL	HOURS
		I	1.Problems on Addition of Matrices.				Up to K3	6
			2.Problems on product of Matrices.					
			3.Finding the Transpose of a Matrix					
			4.Finding theAdjoint of a Matrix.					
			5.Finding the Inverse of a Matrix.					
		II	1.Problems on Commutativity of inverse and transpose of matrix.				Up to K3	6
			2. Problems on conjugate transpose of matrix.					
			3.Problems on Orthogonal and Unitary Matrices.					
			4.Problems on Product of unitary matrices.					
			5.Problems on Partitioning of matrices.					
		III	1.Fitting of Binomial Distribution.				Up to K3	6
			2.Finding Moments in Binomial Distribution.					
			3.Finding the Recurrence Relation in in Binomial Distribution.					
			4.Finding the MGF in Binomial Distribution.					
			5. Finding Characteristic Function in Binomial Distribution					
		IV	1.Fitting of Poisson distribution.				Up to	6

		2.Fitting of Negative binomial distribution.	K3	
		3. Finding the Characteristic Function in binomial distribution.		
		4. Finding the MGF in Poisson distribution.		
		5.Finding themoments, mode, recurrence relation in Poisson distribution.		
	V	1. Fitting of Normal distribution.	Up to K3	6
		2. Problems on normal probability curve in Normal distribution.		
		3. Problems on mean, median, mode inNormal distribution.		
		4. Problems on points of inflexion, mean deviation in Normal distribution.		
		5. Finding the MGF and Characteristic Function in Normal Distribution		
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved (TobediscussedduringtheTutorialhour)			
Skills acquired from this course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrableSkill			
Justification for nature of course	To understand vector and matrix applications and also to identify probability models in real data and estimate population parameters			
Reference Book(s)	1. Vasishtha.A.R (1972) : Matrices, KrishnaprakashanMandir, Meerut. 2. Gupta, S.C. Kapoor, V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi 3. Goon, A.M. Gupta M.K. and Das Gupta B (1977) An Outline of Statistical Theory, Vol I, 6/e, World Press, Calcutta. 4. Hogg, R.V. and Graig, A.T. (1978) : Introduction to Mathematical Statistics, A/e, Mc.Graw Hill Publishing Co.Inc., New York.			
Websites and e-Learning resources	e-books, tutorials on MOOC/SWAYAM courses on the subject			

COURSE OUTCOMES:

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

Number	Course Learning outcome	K-level
CO1	Do basic operations of matrices	Upto K3
CO2	Understand various transactions of matrices and its applications	Upto K3
CO3	Identify discrete distributions appeared in real life situations	Upto K3
CO4	Understand some continuous distributions and its applications	Upto K3
CO5	Understand normal distribution and its properties	Upto K3

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	2	2	1	3	2	1	3	2	1
CLO2	3	1	2	2	1	3	2	1	3	2	1
CLO3	3	1	2	2	1	3	2	1	3	2	1
CLO4	3	1	2	2	1	3	2	1	3	2	1
CLO5	3	1	2	2	1	3	2	1	3	2	1

Course Designer Name : Prof.KRISHNA JAYANTHI.S, Assistant Professor,Department of Mathematics & Statistics-SF

Title of the Course		LAB:Practical in R					
TANSCHE Course type		SEC 3					
Course Category		Skill Enhancement Course					
Nature of Course		Employability / Skill Development					
Category	Core	Year	1	Credits	2	Course Code	23U2SSED3
		Semester	2				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
					2		2
Marks		CIA		Semester		Total	
		40		60		100	
Pre-requisite(s)		Basic ideas of graphs and plots that are used for visualization.					
Objectives of the Course		• To learn the syntax and semantics of the Rprogramming language. • To learn how to design Rclasses for codere use. • To learn how to various functions and operators in R. • To learn diagrammatic representation Bar Chart, Pie Diagram					
Course Outline		S.NO	LIST OF PROGRAMS				
		1.	Using R as a Calculator.				
		2.	Write a R Program to compute Matrix Operation.				
		3.	Compute aR Program for Missing data, Duplicates, Unique Values and Mode.				
		4.	Write a R Program for Sorting and Ordering.				
		5.	Compute a R Program for Constructing Frequency Graphs.				
		6.	Write a R Program for Construction of Plots.				
		7.	Write a R Program for Computation of Measures of central tendency				
		8.	Write a R Program for Calcuation of Measures of Dispersion.				
		9.	Write a R Program for Computation of Quartile Deviation,Mean Deviation and Construction of Box Plot.				
		10.	Write a R Program for Computation of Coefficient of Variation, Coefficient of Skewness and Kurtosis.				
		11.	Write a R Program for Construction of 2D &3DPlots				
		12.	Write a R Program for computing and plotting Uniform,Binomial and Poisson Distribution				
		13.	Write a R Program for Computation of correlation Coefficient, Covariance, Karl Pearson’s and Spearman’s rank correlation				
		14.	Write a R Program for Graphical Representation of Two Nominal of Ordinal Variables.				
15.	Compute a R Program for Fitting Simple and Multiple Linear Regression.						

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPS C/TRB/NET/UGC–CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	‘R’ Programming course covers the basics of this open source language, including vectors, factors, lists, and data frames. useful coding skills and be ready to start your own data analysis in R.
Justification for nature of course	Thinking in an object-oriented manner involves envisioning program components as objects that belong to classes and are similar to concrete objects in the real world
Reference Book(s)	1. Brian Everitt and Torsten Hothorn. A Handbook of Statistical Analysis Using R, 2nd Edition Chapman and Hall/CRC, 2009. 2. Everitt, B.S., and Hothorn T. (2010), A. Handbook of Statistical Analyses Using R, Second Edition, Chapman and Hall, CRC Press. 3. Peter Dalgaard. Introductory Statistics with R (Paperback) 1st Edition Springer- Verlag New York, Inc. 4. Purohit, S. G. Gore, S.D., and Deshmukh, S.R. (2009), Statistics Using R, Narosa Publishing House, New Delhi 5. Quick, J.M. (2010) Statistical Analysis with R, Packt Publishing Ltd., UK. 6. Robert I. Kabacoff, R in Action Data Analysis and Graphics with R, Manning Publications, 2011.
Websites and e-Learning resources	http://cran.r-project.org/manuals.html

COURSE OUTCOMES:

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

Number	Course Learning outcome	K-level
CO1	Know how these data types are used in data structures which helps to handle all aspects of statistical software Create and manipulate matrices and arrays. Understand vectors of different types. Get familiar with the different data structures (lists, matrices, data frames)	Upto K3
CO2	Demonstrate an understanding of R for importing and exporting our data to ensure compatibility across our entire workflow	Upto K3
CO3	Explain grouping, loops and conditional execution	Upto K3
CO4	Learn about missing data and other special values Go through data cleaning with its application and its technique for implementation in the R programming	Upto K3
CO5	Learn various matrix operations which helps to handle all aspects of statistical software.	Upto K3

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).

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

Course Designer Name:

Prof. KRISHNA JAYANTHI.S, Assistant Professor, Department of Mathematics & Statistics-SF.



The Madura College (Autonomous), Madurai – 625 011

Department of Statistics

Sem.	Sub. Code	Title of the paper	Hours	Credits	Nature of Course (Employability/ Entrepreneurship/ Skill Development)				Scope of focus (Local / National / Global developmental needs)			Percentage of Syllabus Revision/ New
					Know	Empl	Ent	Skill	Local	National	Global	
I	20U1TLA1/ 20U1HLA1/ 20U1SLA1	Language-I (Tamil/Hindi/Sanskrit)	6	3								
	20U1NEN1	English –I	6	3								
	20U1VEN1	VE and PE	3	3								
	20U1MAC1	Allied Mathematics – I	6	5	YES	YES		YES	YES			57%
	20U1SMC1	Descriptive Statistics	5	4	YES	YES		YES			YES	11%
	20U1SMC2	Probability Theory	4	4	YES	YES		YES			YES	15.38%
	Total		30									
II	20U2TLA2/ 20U2HLA2/ 20U2SLA2	Language-II (Tamil/Hindi/Sanskrit)	6	3								
	20U2NEN2	English-II	6	3								
	20U2EVS1	EVS and Gender Studies	3	3								
	20U2MAC2	Allied Mathematics – II	6	5	YES	YES		YES	YES			17%
	20U2SMC3	Probability Distributions	5	4	YES	YES		YES			YES	18%
	20U2SMC4	Matrix Theory	4	4	YES	YES		YES			YES	87%
		Extension	-	1								
	Total		30									
III	20U3TLA3/ 20U3HLA3/ 20U3SLA3	Language-III (Tamil/Hindi/Sanskrit)	6	3								

	20U3NEN3	English-III	6	3								
	20U3SAC3	Advanced Excel Techniques	4	4	YES	YES	YES	YES			YES	54.30%
	20U3SAP1	Advanced Excel Techniques- Lab	2	1	YES	YES	YES	YES			YES	70%
	20U3SNM1	NME-I: Applications of Statistics	2	2	YES	YES		YES		YES		100%
	20U3SSBE1	SBE-I: Statistical Practical - I	2	2		YES		YES		YES		100%
	20U3SMC5	Optimization Techniques	4	3	YES	YES		YES			YES	34%
	20U3SMC6	Sampling Techniques	4	2	YES	YES		YES			YES	39%
		Add on: Combinatorics		2	YES			YES				
	Total		30									
IV	20U4TLA4/ 20U4HLA1/ 20U4SLA1	Language-IV (Tamil/Hindi/Sanskrit)	6	3								
	20U4NEN4	English-IV	6	3								
	20U4SAC4	Programming in C++	4	4	YES	YES		YES			YES	57.65%
	20U4SAP2	Programming in C++ - Lab	2	1	YES	YES		YES			YES	100%
	20U4SNM2	NME-II: Matrix Algebra	2	2	YES					YES		100%
	20U4SSBE2	SBE-II: Statistical Forecasting	2	2	YES	YES		YES		YES		56.50%
	20U4SMC7	Statistical Estimation Theory	5	4	YES	YES		YES			YES	46%
	20U4SMP1	Data Analysis using SPSS	3	3	YES	YES					YES	23.52%
		Add on: Statistics for Big Data		2	YES	YES		YES				
		Self-Study: Time Series Analysis		2								
	Total		30									

V	20U5SSM1	Skill based Elective-III: Queuing Theory	2	2								
	20U5SMC8	Testing of Hypothesis	6	5								
	20U5SMC9	Design of Experiments	6	5								
	20U5SMC10	Real Analysis	6	5								
	Major Elective I (One to be chosen)											
	20U5SME1(A)	Econometrics	6	5								
	20U5SME1(B)	Reliability theory and survival	6	5								
	Major Elective II (One to be chosen)											
	20U5SIDC	Economic Statistics	4	4								
	Total		30									
VI	20U6SSP2	SBE-IV: Statistical Practical-II	2	2								
	20U6SMC11	Statistical Quality Control	6	5								
	20U6SMC12	Stochastic Processes	6	5								
	20U6SMC13	Applied Statistics	6	5								
	Major Elective III (One to be chosen)											
	20U6SME2(A)	Introduction to R Programming	4	4								
	20U6SME2(B)	Introduction to Python Programming	4	4								
	20U6SMP2(A)	Practical in R	2	2								
	20U6SMP2(B)	Practical in Python	2	2								
	Major Elective IV (One to be chosen)											
	20U6SME3(A)	Demography	4	4								
	20U6SME3(B)	Numerical Methods	4	4								
		Total	30									

Know – Knowledge; Empl- Employability; Ent- Entrepreneurship; Skill- Skill Development

DEPARTMENT OF STATISTICS				CLASS: III B.Sc., STATISTICS				
Semester	Course Type	Course Code	Course Title	Credits	Hrs	CIA	Ext	Total
V	SKILL BASED ELECTIVE-III	20U5SSM1	Queuing Theory	2	2	25	75	100

NATURE OF THE COURSE

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives:

1. This course aims to introduce topics in queuing theory.
2. Build insights into best practices for designing service systems.

Unit	Description	Hours	K-level	CLO
I	Introduction: The structure of a queuing system – Calling population characteristic – Queuing process – Queue Discipline – Service process.	6	Up to K3	1
II	Performance Measures of a Queuing System and Probability Distributions in Queuing Systems: Transient-state and Steady state – Relationship among performance Measures – Distribution of Arrivals – Distribution of Inter arrival times - Distribution of Departures – Distribution of Service times.	6	Up to K3	2
III	Classification of Queuing Models: Solution of Queuing Models – Single server Queuing Models – Model I: $\{(M/M/1)(\infty/FCFS)\}$ - Exponential Service-Unlimited Queue – Model II: $\{(M/M/1)(\infty/SIRO)\}$ – Problems.	6	Up to K3	3
IV	Exponential Service Finite (or limited) Queue: Exponential Service Finite (or limited) Queue : $\{(M/M/1)(N/FCFS)\}$ – Performance Measures for Model – Problems.	6	Up to K4	4
V	Multi-server Queuing Models: Exponential Service – Unlimited Queue $\{(M/M/1)(\infty/FCFS)\}$ - Performance Measures for Model – Exponential Service-Limited(finite) Queue $\{(M/M/1)(N/FCFS)\}$ - Performance Measures for Model – Problems.	6	Up to K3	5

Books for study:

J. K. Sharma, Operation Research Theory and Applications, 6th Edition, Trinity press-Laxmi Publication Provided Limited.

Chapters:

Unit I - Chapter 16 (16.1, 16.2 (16.2.1-16.2.4)).

Unit II - Chapter 16 (16.3 (16.3.1, 16.3.2), 16.4 (16.4.1-16.4.4)).

Unit III - Chapter 16 (16.5 (16.5.1)).

Unit IV - Chapter 16 (16.6)

Unit IV - Chapter 16 (16.7)

Books for Reference:

1. Hamdy A. Taha, Operations Research, An Introduction, 8th Edition, Prentice Hall India, 2006.
2. P.K. Gupta and D.S. Hira, Operations Research, S. Chand and Company.

Web Resources

1. <https://www.youtube.com/watch?v=4H9dMn919cs>
2. <https://www.youtube.com/watch?v=rSZWig173xM>
3. https://www.youtube.com/watch?time_continue=12&v=uHQuJFx1-RA&feature=emb_title

Rationale for nature of the course:

Understand basic concepts and aspects related queuing systems, queuing process and models. Thinking critically and Applying basic mathematics skills to interpret queuing models, and solve problems.

Activities having direct bearing on Skill Development / Employability / Entrepreneurship

Exercise , Assignment and Quiz.

Pedagogy:

Lecture, power point Presentation, Group Discussion, Quiz, Seminar, Problem solving, Tutorial and LMS(CANVAS, FLICKERS).

Lecture Schedule

Unit	Description	Contact Hours	Total	Pedagogy
I	Introduction: The structure of a queuing system – Calling population characteristic	3	7	ICT tools
	Queuing process – Queue Discipline – Service process.	4		Lecture
II	Performance Measures of a Queuing System and Probability Distributions in Queuing Systems: Transient-state and Steady state	2	7	Lecture
	Relationship among performance Measures – Distribution of Arrivals	2		ICT tools
	Distribution of Interarrival times - Distribution of Departures – Distribution of Service times.	3		Lecture
III	Classification of Queuing Models: Solution of Queuing Models	1	5	Lecture
	Single server Queuing Models – Model I: $\{(M/M/1)(\infty/FCFS)\}$	2		Lecture
	Exponential Service-Unlimited Queue – Model II: $\{(M/M/1)(\infty/SIRO)\}$ - Problems.	2		Lecture
IV	Exponential Service Finite (or limited) Queue: Exponential Service Finite (or limited) Queue : $\{(M/M/1)(N/FCFS)\}$	2	6	Lecture
	Performance Measures for Model	2		Lecture
	Problems	2		Lecture
V	Multi-server Queuing Models: Exponential Service – Unlimited Queue $\{(M/M/1)(\infty/FCFS)\}$	1	55	Lecture
	Performance Measures for Model – Problems.	1		Lecture
	Exponential Service-Limited(finite) Queue $\{(M/M/1)(N/FCFS)\}$	2		Lecture
	Performance Measures for Model – Problems.	1		Lecture
Total Hours			30	

COURSE OUTCOMES

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

CLO1	Understand the theory of queuing system, queuing process and service process.	Up to K2
CLO2	Understanding the concepts of a performance measures of a Queuing system and probability distribution in queuing systems.	Up to K3
CLO3	To understand the single server queuing model and be able to calculate and interpret the operating characteristic associated with the model.	Up to K3
CLO4	Analyze basic queuing models including $\{(M/M/1)(N/FCFS)\}$	Up to K4
CLO5	Learn about Multi-server Queuing models.	Up to K3

Mapping of Course Learning Outcomes (CLOs) with Program Outcomes (POs) and Program Specified Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	3	3	2	1	3	2	2	1	2	3	3	2
CLO2	1	2	3	3	3	2	2	1	2	3	3	1
CLO3	3	1	3	2	3	1	1	1	2	3	3	3
CLO4	2	3	2	3	1	1	1	1	2	3	2	3
CLO5	3	3	3	2	2	1	1	1	2	3	2	1

3- Advanced Applications

2- Intermediate Level

1- Basic Level

The Components of Assessment shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K1

SUMMATIVE EXAMINATION – BLUE PRINT

Units	CLOs	K. Level	Section A		Section B		Section C (Either/or Choice)	Section D(Open Choice)	Total
			MCQs		Short Answers				
			No. of questions	K Level	No. of questions	K level			
1	CLO 1	Up to K2	2	(K1&K2)	1	K2	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	K1	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	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

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	41.66%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.66	41.66%
K4	-	-	10	10	20	16.66	16.66%
Total marks	10	10	50	50	120	100	100%

Course Designer: Prof. G. K. LAKSHMI, Assistant Professor, Department of Mathematics and Statistics.

DEPARTMENT OF STATISTICS				CLASS: III B.Sc. Statistics				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core	20U5SMC8	TESTING OF HYPOTHESIS	5	6	25	75	100

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

Course Objectives:

1. To enrich and enhance the fundamental knowledge of formulating and testing a hypothesis, Using critical values to draw conclusions and determining probability of making errors in hypothesis tests
2. Knowledge about various tests based on Likelihood ratio test, Test for equality of Variances
3. Understand and analyse the various methods of Non-parametric tests
4. Explain the purpose of null hypothesis testing, including the role of sampling error in large sample
5. Knowledge about large sample tests determining statistical significance and its applications.

Unit	Description	Hours	K-level	CLO(s)
I	Statistical Hypothesis– Simple and composite hypotheses – Null and Alternative hypotheses — Critical region – Type-I and Type-II errors – level of significance, size and power of test – Optimum test under different situations - Most powerful test-Uniformly most powerful test – Neyman-Pearson fundamental lemma – Simple problems.	18	K3	1
II	Likelihood ratio test –Properties of Likelihood ratio test- Test for the mean and variance of normal populations- Tests for equality of means of two normal populations – Test for equality of variances of two normal populations.	18	K2	2
III	Non-Parametric methods – Advantages and Drawbacks of Non – Parametric methods over parametric methods –Basic distribution – Wald Wolfowitz Run Test – Test for randomness – Median Test – Sign test - Mann Whitney Wilcoxon U tests – Sequential analysis – Sequential probability ratio test – Average sample number – Simple problems	18	K4	3

IV	Large Sample Tests – Introduction – Types of sampling - Sampling distribution of a statistic- Standard error – Test of Significance – Procedure for testing of Hypothesis-Test of significance of large samples- Test of significance for single proportion – Simple problems.	18	K3	4
V	Large sample tests concerning difference of proportions – Sampling of variables – Test of significance for single mean – Test of significance for difference of means-Test of Significance for the difference of standard deviation.	18	K3	5

Books for Study:

1. Gupta. S.C, and Kapoor, V. K. (2017) Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Revised Edition
2. 2002, New Delhi Chapters : 18(18.1 – 18.5), 18(18.6) , 18(18.7,18.8), 14(14.1 – 14.7),14(14.7.2-14.8.5)

Books for References:

1. A.M. Graybill, F.A. and Boes, D.C. (1974) Introduction to the theory of Statistics, Tata McGraw Hill, New Delhi.
2. Introduction to Mathematical Statistics third edition, Amerind, New Delhi. Hoel, P.G. (1971) Rajagopalan, M. and Dhanavanthan, P. (2012). Statistical Inference. PHI Learning Pvt. Ltd., New Delhi. Conover, W. J. (1999).
3. Rohatgi, V.K. and Saleh, A.K.Md.E.(2001). An Introduction to Probability and Statistics (Second Edition), John Wiley & Sons, New York. (Reprint, 2009).
4. Manoj Kumar Srivastava, Abdul Hamid Khan, Namita Srivastava, (2014), Statistical Inference: Theory of Estimation, PHI Learning, New Delhi.

Web Resources :

- <https://www.youtube.com/watch?v=9j7u6dfvFrs>
- <https://www.scribbr.com/statistics/hypothesis-testing/>
- <https://www.vedantu.com/maths/hypothesis-testing>
- <https://www-statisticshowto-com.webpkgcache.com/doc/-/s/www-statisticshowto-com/probability-and-statistics/hypothesis-testing/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996198/>

Rationale and activities having direct bearing on nature of course

Hypothesis testing is the process used to evaluate the strength of evidence from the sample and provides a framework for making determinations related to the population. It provides a method for understanding how reliably one can extrapolate observed findings in a sample under study to the larger population.

A hypothesis is used in an experiment to define the relationship between two variables. A key function of a hypothesis is to derive predictions about the results of future experiments and then perform those experiments to see whether they support the predictions. The most significant benefit of hypothesis testing is it allows you to evaluate the strength of our claim or assumption before implementing it in our data set. It is a specific, testable prediction about what you expect to happen in your study. It is the interpretation of the data that we are interested in. Using Hypothesis Testing,

Activities having direct bearing on Skill development / Employability / Entrepreneurship

This course imparts Problem Solving Skills to the students by the following activities such as Exercise, Assignment and Quiz

Pedagogy :

Lecture, Seminar, Quiz, Group Discussion, Assignment, PPT, LMS (CANVAS).

Mapping of Course Learning Outcomes (CLOs) with Program Outcomes (POs) and Program Specified Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	3	3	2	1	3	2	2	1	2	3	3	2
CLO2	1	2	3	3	3	2	2	1	2	3	3	1
CLO3	3	1	3	2	3	1	1	1	2	3	3	3
CLO4	2	3	2	3	1	1	1	1	2	3	2	3
CLO5	3	3	3	2	2	1	1	1	2	3	2	1

3- Advanced Applications

2- Intermediate Level

1- Basic Level

The Components of Assessment shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1, CLO2, CLO3,CLO4, CLO5	Quiz	5	K1

SUMMATIVE ASSESSMENT - BLUE PRINT

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 K3	2	K1 & K2	1	K1	2(K2 & K2)	1(K3)
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 K3	2	K1 & K2	1	K2	2(K3 & K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 - Remembering and recalling facts with specific answers.

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

K3 - Application oriented - Solving Problems.

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

Distribution of section wise marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	5	4	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	30	50	41.67	41.67%
K4	-	-	10	10	20	16.67	16.66%
Total marks	10	10	50	50	120	100	100%

LESSON PLAN

UNIT	Description	Hours	Total Hours	Mode
I	Statistical Hypothesis – Introduction	1	18	Lecture
	Simple and Composite hypotheses	2		Lecture
	Null and Alternative Hypotheses - Critical region	3		Lecture / Presentation
	Type-I and Type-II errors – level of significance, size and Power of test	2		Lecture
	Optimum test under different situations	3		Lecture / Presentation / Group Discussion
	Most powerful test-Uniformly Most Powerful test	2		Lecture
	Neyman-Pearson fundamental Lemma – Simple problems.	3		Lecture
	Neyman-Pearson fundamental Lemma – Simple problems.	2		Quiz
II	Likelihood ratio test - Introduction	2	18	Lecture
	Properties of Likelihood ratio test	2		Lecture / Seminar
	Test for the mean and variance of normal populations.	3		Lecture / Group Discussion
	Tests for equality of means of two normal populations.	3		Lecture
	Test for equality of variances of two normal populations.	3		Lecture
	Simple problems based on equality of variances.	2		Lecture
	Tests for equality of means of two normal populations- problems.	3		Quiz
III	Non-Parametric Methods - Introduction	3	18	Lecture / Presentation
	Advantages and Drawbacks of Non – parametric methods over parametric methods	2		Lecture
	Basic Distribution – Wald Wolfowitz Run Test	3		Lecture
	Test for Randomness – Median Test	3		Lecture
	Sign Test - Mann Whitney Wilcoxon U tests	3		Lecture
	Sequential Analysis – Sequential probability	2		Lecture

	ratio test			
	Average Sample Number – Simple Problems	2		Lecture/ Quiz
IV	Large Sample Tests – Introduction	2	18	Lecture / Seminar
	Types of sampling - Sampling distribution of a statistics	3		Lecture / Seminar
	Standard error –simple problems	3		Lecture
	Test of significance of procedure for testing of Hypothesis	2		Lecture
	Test of significance of large samples-simple problems.	4		Lecture
	Test of significance for single Proportion – Simple Problems.	4		Lecture
V	Large sample tests concerning difference of proportions	5	18	Lecture
	Sampling of variables – Test of significance for Single Mean	5		Lecture / Seminar
	Test of significance for difference of Means	4		Lecture / Quiz
	Test of Significance for the difference of Standard Deviation	4		Lecture / Assignment
	Total		90	

Course Designers:

Mrs. V. Vijayalakshmi, Assistant professor, Department of Mathematics and Statistics (S.F)

DEPARTMENT OF STATISTICS				CLASS: III B.Sc., Statistics				
Semester	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
V	Core	20U5SMC9	Design of Experiments	5	6	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

COURSE OBJECTIVES

1. To expose the essential ideas about designing and interpreting statistical field experiments.
2. To Establish optimal process performance by finding the right settings for key process input variables.
3. To know how to select the best agricultural inputs best fertilizers and reap the maximum yield.

Unit	Description	Hours	K-level	CLO(s)
I	Introduction - Terminology in Experimental Designs – Principles of an Experimental Design – Replication – Randomization and Local Control – Size of the Plot - Assumption of ANOVA Test – One Way Classification – ANOVA for fixed effect model – Variance of the Estimated parameters – ANOVA for random effect model for one way classified data - Derivations and Problems.	18	Up to K2	1
II	Two way Classification – ANOVA for fixed effect model – Variance of the Estimated parameters – ANOVA for random effect model for two way classified data with one observation per cell – Completely Randomised Design(C.R.D) – Statistical Analysis of C.R.D - Derivations and problems	18	Up to K3	2
III	Randomised Block Design(R.B.D) – Statistical Analysis of R.B.D – Efficiency of R.B.D relative to C.R.D – Estimation of missing value in R.B.D – Latin Square Design (L.S.D) – Statistical Analysis of $m \times m$ L.S.D for one Observation per Experimental Unit – Least Square Estimates of Parameters – Expectation of sum of squares.	18	Up to K3	3

IV	Factorial Experiments – 2^2 -Factorial Design – Statistical analysis of 2^2 design – Yates' method of computing Factorial Effect Totals – 2^3 - Factorial Experiment – Statistical analysis of 2^3 -Design – Confounding in factorial designs - Confounding in 2^3 Experiment – Partial confounding.	18	Up to K3	4
V	Balanced Incomplete Block Designs(B.I.B.D) – Parameters of B.I.B.D – Incidence Matrix – Symmetric (B.I.B.D) – Resolvable Design – Affine Resolvable Design – Intra block Analysis of BIBD – Comparison of Two Treatments.	18	Up to K4	5

Books for study:

Kapoor V.K. and Gupta S.C., Fundamentals of Applied Statistics, 3rd extensively revised edn, Sultan Chand & Sons, New Delhi.

Chapters:

Unit I – Chapter 6 (6.1 – 6.3), Chapter 5.1 (5.1.1), 5.2 (5.2.1,5.2.2,5.2.3);

Unit II – Chapter 5.3 (5.3.1, 5.3.2,5.3.3), Chapter 6.4 (6.4.1,6.4.2,6.4.3,6.4.4,6.4.5);

Unit III – Chapter 6.5 (6.5.1,6.5.2,6.5.3,6.5.4,6.5.5,6.5.6,6.5.7), 6.6 (6.6.1,6.6.2);

Unit IV – Chapter 6.9 (6.9.1,6.9.2, 6.9.3), 6.10 (6.10.1,6.10.2);

Unit V – Chapter 6.13(6.13.1,6.13.2,6.13.3, 6.13.4,6.13.5,6.13.6,6.13.7).

Books for References:

1. Dean A.M., and Voss D.,(2006) Design and Analysis of Experiments, Springer, New York.
2. Montgomery D.C(2012), Design and Analysis of Experiments, John Wiley & Sons, New Delhi.
3. Panneerselvam, R. (2012), Design and Analysis of Experiments, Prentice Hall.
4. Rangaswamy R, (2006), Agricultural statistics, New age international Pvt. New Delhi.
5. Das M.N. and Giri N.C(1986), Design and Analysis of Experiments, Wiley Eastern, New Delhi.

Web Resources:

1. <https://www.youtube.com/watch?v=VnuWpEvY41s>
2. <https://egyankosh.ac.in/bitstream/123456789/20710/1/Unit-7.pdf>
3. <https://quantifyinghealth.com/randomized-block-design/>
4. <https://home.iitk.ac.in/~shalab/anova/chapter8-anova-factorial-experiment.pdf>
5. <http://home.iitk.ac.in/~shalab/anova/chapter6-anova-bibd.pdf>

Rationale for Nature of the course

Experimental design can be used at the point of greatest leverage to reduce design costs by speeding up the design process, reducing late engineering design changes, and reducing product material and labor complexity. Designed Experiments are also powerful tools to achieve manufacturing cost savings by minimizing process variation and reducing rework, scrap, and the need for inspection.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

- Seminar
- Assignment preparation
- Group discussion
- Quiz

Pedagogy

Lecture, Seminar, Quiz, Problem Solving, Tutorial, Group Discussion, PPT.

Lecture Schedule

Unit	Topics	Hours	Mode
I	Introduction - Terminology in Experimental Designs – Principles of an Experimental Design – Replication – Randomization and Local Control – Size of the Plot.	6	Lecture, Quiz.
	Assumption of ANOVA Test – One Way Classification – ANOVA for fixed effect model – Variance of the Estimated parameters.	6	
	ANOVA for random effect model for one way classified data - Derivations and Problems.	6	
II	Two way Classification – ANOVA for fixed effect model – Variance of the Estimated parameters.	6	Lecture, Quiz.
	ANOVA for random effect model for two way classified data with one observation per cell.	6	
	Completely Randomised Design(C.R.D) – Statistical Analysis of C.R.D - Derivations and problems.	6	
III	Randomised Block Design(R.B.D) – Statistical Analysis of R.B.D – Efficiency of R.B.D relative to C.R.D – Estimation of missing value in R.B.D.	6	Presentation, Lecture, Quiz.
	Latin Square Design (L.S.D) – Statistical Analysis of $m \times m$ L.S.D for one Observation per Experimental Unit.	6	
	Least Square Estimates of Parameters – Expectation of sum of squares.	6	
IV	Factorial Experiments – 2^2 -Factorial Design – Statistical analysis of 2^2 design – Yates' method of computing Factorial Effect Totals.	6	Presentation, Lecture, Quiz.
	2^3 - Factorial Experiment – Statistical analysis of 2^3 -Design.	6	
	Confounding in factorial designs - Confounding in 2^3 Experiment – Partial confounding.	6	
V	Balanced Incomplete Block Designs(B.I.B.D) – Parameters of B.I.B.D – Incidence Matrix.	6	Assignments and Seminar.
	Symmetric (B.I.B.D) – Resolvable Design – Affine Resolvable Design.	6	
	Intra block Analysis of BIBD – Comparison of Two Treatments.	6	

COURSE OUTCOMES

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

CLO	Course Learning Outcomes	Knowledge Level
CLO 1	Describe how to design experiments, carry them out, and analyze the data they yield.	Up to K2
CLO 2	Investigate the logic of hypothesis testing, including analysis of variance and the detailed analysis of experimental data.	Up to K3
CLO3	Perform analysis of covariance in CRD and RBD and perform missing plot and analysis in RBD and LSD.	Up to K3
CLO 4	Apply principle of total and partial confounding in factorial experiments.	Up to K3
CLO 5	Analyze Balanced Incomplete Block Designs(B.I.B.D) and construct incomplete block designs.	Up to K4

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

Mapping of Course Outcomes (COs) with Program Outcomes (PO) & Program Specified Outcomes (PSOs)

CLO/ PO-PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CLO1	3	3	-	-	2	2	2	1	2	3	3	3	-
CLO2	3	3	-	-	2	2	2	1	2	3	3	3	-
CLO3	3	2	-	-	2	1	1	1	2	3	3	2	-
CLO4	2	2	-	-	1	1	1	1	2	3	2	3	-
CLO5	2	2	-	-	1	1	1	1	2	3	2	2	-

3-Advance Application

2- Intermediate Level

1- Basic Level

The Components of Assessment shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K4
2	CLO5	Seminar	5	K3
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2

SUMMATIVE ASSESSMENT - BLUE PRINT

S. No.	CLOs	K – Level	Section A		Section B		SectionC (Either/or Choice)	SectionD (Open Choice)
			MCQs		Short Answers			
			No. of questions	K - Level	No. of questions	K - Level		
1	CLO 1	Up to K2	2	K1 & K2	1	K1	2(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 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 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	41.67%
K2	5	6	10	10	31	25.84	
K3	-	-	20	30	50	41.67	41.67%
K4	-		10	10	20	16.67	16.66%
Total marks	10	10	50	50	120	100	100%

Course Designer: Dr. B.SEETHALAKSHMI, Assistant Professor, Department of Mathematics & Statistics

DEPARTMENT OF STATISTICS				CLASS: III B.Sc., STATISTICS				
Semester	Course Type	Course Code	Course Title	Credits	Hrs	CIA	Ext	Total
V	Core	20U5SMC10	Real Analysis	5	6	25	75	100

NATURE OF THE COURSE			
Knowledge and skill	✓	Employability oriented	
Skill oriented	✓	Entrepreneurship oriented	

Course Objectives:

On completion of this course, the learner will

- Have the good knowledge of the fundamental mathematical concepts in analysis.
- Understand the basic concepts of set theory and real number system, Open and closed sets, limit of a function.
- Determine the sequence whether it is convergent or divergent by using the appropriate tests.
- Determine if an infinite series is convergent or divergent by selecting the appropriate tests such as comparison test, D'Alembert's ratio test, Cauchy's root test, Leibnitz test etc.
- Be familiar with the concepts of continuity, derivative, Properties of derivatives and its theorems.
- Understand the concept of Riemann Integral, Sufficient condition for Riemann integrability and its theorems.

Unit	Description	Hours	K-level	CLO
I	Set Theory: Sets - Operations on sets –Real numbers – Bounded and unbounded sets : supremum, infimum – Completeness in the set of real numbers –Open sets – Limit point of a set – Closed sets-Countable and Uncountable sets.	18	Up to K2	CLO1
II	Sequences: Definition of Sequence –Limit points of a sequence – Limits : Inferior and superior -Convergent and Divergent sequences – Cauchy sequences- Monotonic sequences.	18	Up to K3	CLO2
III	Series: Introduction – Infinite Series – Positive term series – Comparison tests for positive term series – Cauchy’s root test - D’Alembert’s ratio test – Alternating series : Leibnitz test – absolute convergence : conditional convergence.	18	Up to K3	CLO3
IV	Differentiation: Function of a single variable : Limit and continuity – The Derivative – Increasing and decreasing functions – Rolle’s Theorem – Lagrange’s mean value theorem – Taylor’s theorem.	18	Up to K3	CLO4
V	Integration: Concept of Riemann Integral – Definition and existence of Riemann integral– Darboux theorem – Condition of integrability -Fundamental theorem of calculus – First mean value theorem.	18	Up to K4	CLO5

Book for study:

Malik, S.C., and Arora, S, (2009), Mathematical Analysis, Second Edition, New Age International, New Delhi.

Chapters:

Unit – I: Chapter 1 (Sec 1 (1.1 – 1.12), Sec 3, Sec 4 (4.1)),
Chapter 2 (Sec 1, 2, 3, 4)

Unit – II: Chapter 3 (Sec 1, 2, 3, 4, 5, 6, 9)

Unit – III: Chapter 4 (Sec 1, 2, 3, 4, 5, 10(10.1, 10.2))

Unit – IV: Chapter 5 (Sec 1(1.1,1.2)), chapter 6 (Sec 1, 3, 5, 6, 7, 8 (8.1))

Unit – V: Chapter 9 (Sec 1, 3, 4, 9, 10)

Books for References:

1. Arora, S. (1988) Real Analysis. SatyaPrakashanMandir, New Delhi.
2. Shanthi Narayan. (2003) Elements of Real Analysis, S. Chand & Co, New Delhi
3. Somasundaram, D. and Choudhary, B. (2002) A First Course in Mathematical Analysis, Narosa, Chennai
4. Walter Rudin, (2016), Principles of Mathematical Analysis, Fourteen reprints McGraw-Hill, New Delhi.

Web Resources:

1. <https://mathcs.org/analysis/reals/logic/notation.html>
2. <https://study.com/learn/lesson/open-set-vs-closed-examples-overview.html>
3. https://en.wikibooks.org/wiki/Real_Analysis/Sequences
4. <https://mathcs.org/analysis/reals/numser/series.html>
5. https://mathcs.org/analysis/reals/numser/t_comp.html
6. <https://www.geneseo.edu/~aguilar/public/notes/Real-Analysis-HTML/ch6-differentiation.html>
7. <https://www.geneseo.edu/~aguilar/public/notes/Real-Analysis-HTML/ch7-riemann-integration.html>

Rationale for nature of the course

In mathematics, real analysis is the branch of mathematical analysis that studies the behavior of real numbers, sequences and series of real numbers, and functions. Fundamental properties of the real numbers that lead to the formal development of real analysis and understand limits and their used in differentiation and integration. Aimed at exposing a number systems that under in the development of real analysis and understanding of various physical phenomena.

Activities having direct bearing on Skill Development /Employability/Entrepreneurship

- Seminars
- Assignments
- Group Discussion
- Quiz.

Pedagogy:

Lecture, Power point Presentation, Group Discussion, Quiz, Seminar, Problem Solving, Tutorial and LMS (CANVAS, FLICKERS).

Unit	Description	Hours	Mode
I	Sets - Operations on sets –Real numbers –Bounded and unbounded sets : supremum, infimum	6	Lecture, Quiz
	Completeness in the set of real numbers –Open sets – Limit point of a set.	6	Problem Solving, Quiz
	Closed sets-Countable and Uncountable sets.	6	Problem Solving, Quiz
II	Definition of Sequence –Limit points of a sequence – Limits : Inferior and superior.	6	Lecture, Presentation, Quiz
	Convergent and Divergent sequences.	6	Problem Solving, Quiz
	Cauchy sequences- Monotonic sequences.	6	Problem Solving, Quiz
III	Introduction – Infinite Series – Positive term series – Comparison tests for positive term series.	6	Lecture, Problem Solving, Quiz
	Cauchy's root test - D'Alembert's ratio test – Alternating series : Leibnitz test.	6	Lecture, Presentation, Quiz
	absolute convergence : conditional convergence.Series of real numbers. Convergence and divergence-series with nonnegative terms.	6	Lecture, Presentation, Quiz
IV	Function of a single variable : Limit and continuity – The Derivative – Increasing and decreasing functions.	6	Lecture, Problem Solving, Quiz
	Rolle's Theorem – Lagrange's mean value theorem.	6	Lecture, Presentation, Quiz
	Taylor's theorem.Differentiation: Limit of a function of a single variable.	6	Problem Solving, Quiz
V	Concept of Riemann Integral – Definition and existence of Riemann integral.	6	Lecture, Problem Solving, Quiz
	Darboux theorem – Condition of integrability.	6	Lecture, Presentation, Assignment, Quiz
	Fundamental theorem of calculus – First mean value theorem.	6	Lecture, Assignment, Quiz
Total Hours		90	

LECTURE SCHEDULE

Course Learning Outcome

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

CLO	Description	K - level
CLO 1	Understanding the basic concepts of operations on sets and set of real numbers, Upper and lower bounds and real number system, open and closed sets, limit functions.	Upto K2
CLO 2	Use the concept of sequences, bounded, monotonic sequence, convergent, divergent and Cauchy's sequence.	Upto K3
CLO 3	Identify the basic ideas of the Inequalities and Recognize when the series converges and diverges, Alternating series and Absolute convergence series.	Upto K3
CLO 4	Identify the concept of Continuity properties of a continuous function in a closed interval and Derivatives	Upto K3
CLO 5	Analyzing the Concept of Riemann Integral and Sufficient condition for Riemann integrability.	Upto K4

Mapping with course learning Outcomes (CLOs) with (POs) and (PSOs)

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

3- Advanced Applications

2- Intermediate Level

1- Basic Level

The Components of Assessment shall be

S. No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K4
2	CLO5	Seminar	5	K3
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2

Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K. Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of questions	K. Level	No. of questions	K. level			
1	CLO 1	Up to K2	2	(K1&K2)	1	K1	2 (K1& K1)	1 (K2)	
2	CLO 2	Up to K3	2	(K1&K2)	1	K2	2 (K3 & K3)	1 (K3)	
3	CLO 3	Up to K3	2	(K1&K2)	1	K1	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	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

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	41.66%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	41.67%
K4	-	-	10	10	20	16.67	16.67%
Total marks	10	10	50	50	120	100	100%

Course Designer

Prof. S.MEENAKSHI, Assistant Professor, Department of Mathematics & Statistics.

DEPARTMENT OF ECONOMICS				CLASS: III B.Sc., Statistics				
Semester	Course Type	Course Code	Course Title	Credits	Hours	CIA	Ext	Total
V	Elective	20U5SME1(A)	Econometrics	5	6	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives

- To know the basic econometric concepts.
- To acquire knowledge about the OLS estimator.

Unit	Course Content	Hours	K-Level	CLO
I	Unit-I Fundamentals of Econometrics Econometrics: Meaning and Definition, Scope of Econometrics – Relationship between Econometrics, Mathematical Economics and Statistics – Goals of Econometrics – Division of Econometrics – Limitations.	15	2	1
II	Unit-II Econometric models Methodology of Econometrics: Specification of the Model – Collection of Data and Estimation of the Model – Evaluation of the Coefficients of the Model – Forecasting Power of the Model – Theoretical and Applied Econometrics.	15	3	2
III	Unit-III Estimations Methods Least Square Estimation – Statistical Properties of Least Square Estimators – Importance of BLU Properties – Variance of the Random Variable (U_i) – The Sampling Distribution of the Least Squares Estimates – Least Squares and Maximum Likelihood Methods. The Standard-Error Test of the Estimators β_0 and β_1 .	15	3	3
IV	Unit-IV Simple Linear Regression Model Introduction – Stochastic and Non-stochastic Relations – Reasons for the Inclusion of Random Variable – Assumptions of Linear Stochastic Regression Model – The Distribution of the Dependent Variable Y.	15	4	4

V	Unit-V Multiple Linear Regression Model Model with Two Explanatory Variables – Statistical Properties of the Estimates – Test of Significance of the Parameters – Goodness of Fit (R^2) – General Linear Regression Model.	15	4	5

Books for Study

1. Shyamala, S., Navdeep Kaur and Arul Pragasam, T. (2013). A Text Book on Econometrics – Theory and Applications. Jalandhar: Vishal Publishing Co.
2. Gujarathi, Damodar. M. (2022). Basic Econometrics. McGraw-hill.
3. Madnani, G.M.K. (2015). Introduction to Econometrics: Principles and Applications. Oxford & IBH Publishing Co. Pvt. Ltd.,

Books for Reference

1. Koutsoyannis, A. (1977), Theory of Econometrics, McMillan.
2. Hill, R. C., Griffiths, W. E., & Lim, G. C. (2018). Principles of econometrics. John Wiley & Sons.
3. Chow. G.C., Econometrics, McGraw Hill, New York.
4. Apte .P.G, 2009, Text Book of Econometrics, Tata McGraw Hill.
5. Goldberger A.S, Introductory Econometrics, Harvard University.

Web Resources

1. http://zalamasyah.staff.unja.ac.id/wp-content/uploads/sites/286/2019/11/7-Principles-of-Econometrics-4th-Ed.-R.Carter-Hill-et.al_-1.pdf
2. <https://doonuniversity.ac.in/admin/assets/uploads/docs/econometrics%20513.pdf>
3. http://www.uop.edu.pk/ocontents/gujarati_book.pdf

Rationale for Nature of the Course

Economists analyze statistical data to help companies, organizations or policymakers make important decisions based on predicted economic trends. People who work in econometrics, a specialized field of economics, study data and develop theories that have practical applications for understanding economic concepts, such as scarcity or incentives.

Activities having direct bearing on Skill Development / Employability / Entrepreneurship

- Estimation of unknown variables from known variables.
- Construction of SLR and MLR models.

Pedagogy

Chalk and Talk, Peer Teaching and Learning, ICT enabled teaching aids.

Lesson Plan

Units	Description	Hours	Mode
I	Econometrics: Meaning and Definition, Scope of Econometrics Relationship between Econometrics, Mathematical Economics and Statistics Goals of Econometrics, Division of Econometrics, Limitations.	5 5 5	Chalk and Talk, PPT
II	Methodology of Econometrics: Specification of the Model Collection of Data and Estimation of the Model, Evaluation of the Coefficients of the Model and Forecasting Power of the Model Theoretical and Applied Econometrics.	4 7 4	Chalk and Talk, PPT
III	Least Square Estimation: Statistical Properties of Least Square Estimators, Importance of BLUE Properties, Variance of the Random Variable (U_i) The Sampling Distribution of the Least Squares Estimates – Least Squares and Maximum Likelihood Methods. The Standard-Error Test of the Estimators β_0 and β_1 .	7 8	Chalk and Talk, PPT
IV	Introduction: Stochastic and Non-stochastic Relations Reasons for the Inclusion of Random Variable Assumptions of Linear Stochastic Regression Model The Distribution of the Dependent Variable Y.	4 3 4 4	Chalk and Talk
V	Model with Two Explanatory Variables Statistical Properties of the Estimates Test of Significance of the Parameters Goodness of Fit (R^2), General Linear Regression Model.	4 3 4 4	Chalk & Talk and Assignment

COs	Course Learning Outcomes	Knowledge Level
CLO1	Understand the Scope of Econometrics	Up to K2
CLO2	Analyse the Methodology of Econometrics	Up to K3
CLO3	Identify the Statistical Properties of Least Square Estimators	Up to K3
CLO4	Differentiate the Stochastic and Non-stochastic Relations	Up to K4
CLO5	Examine the Goodness of Fit	Up to K4

Mapping of Course Learning Outcomes (CLOs) with Program Outcomes (PO) & Program Specified Outcomes (PSOs)

	PO					PSO							
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CLO1	3	3	2	2	1	3	3	3	2	3	3	-	-
CLO2	3	2	3	1	1	3	2	-	3	2	2	1	-
CLO3	3	3	2	3	-	3	3	3	2	3	1	1	-
CLO4	3	3	3	2	1	3	2	3	2	3	2	1	-
CLO5	3	3	3	2	1	3	2	2	-	2	1	1	-

Advanced Application - 3 Intermediate Level -2 Basic Level -1

The Components of Assessment shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K1,K2

Articulation Mapping – K Levels with Courses Outcomes (COs)

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 (K3&K3)	1(K4)
5	CLO 5	Up to K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

Distribution of Section-Wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Section D (No 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	-	-	30	20	50	41.67	42
K4	-	-	-	20	20	16.67	16
Total Marks	10	10	50	50	120	100.00	100

Course Designers: Dr. C. Nithiyanantham & Dr. V. Venkadeshwaran, Department of Economics

DEPARTMENT OF STATISTICS				CLASS: III B.Sc., STATISTICS				
Semester	CourseType	Course Code	Course Title	Credits	Hrs	CIA	Ext	Total
V	Elective I	20U5SME1 (B)	Reliability Theory and Survival Analysis	5	6	40	60	100

NATURE OF THE COURSE

Knowledge and Skill	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives:

1. Understand the concepts of reliability, coherent systems hazard function and its applications
2. Understand the concepts of censoring life distributions and ageing classes
3. Estimate non parametric survival function of the data

Units	Descriptions	Hrs	K - Levels	CLO
I	Concept of reliability, components and systems, coherent systems, reliability of coherent systems.	18	Up to K2	1
II	Estimation of parameters, IFR and DFR distributions. Reliability of system with independent components. Basic idea of maintainability.	18	Up to K3	2
III	System reliability: series, parallel, parallel-series and series-parallel configurations. k out of n systems.	18	Up to K3	3
IV	.Survival Analysis: Concepts of time, Order and random Censoring, likelihood in these cases. Life distributions- Exponential, Gamma, Weibull, Lognormal.	18	Up to K4	4
V	Life tables, Failure rate, mean residual life and their elementary properties. Ageing classes and their properties, Bathtub Failure rate. Estimation of survival function-Kaplan-Meier Estimator	18	Up to K3	5
Total Hours		90		

Book for Study:

1. Miller, R G. (1981) Survival Analysis, Wiley, New York.
2. Barlow R.E and Proscan, F. (1985). Statistical Theory of Reliability and Life testing Models, Marcel Dekker, New York.
3. Bain, L.J and Englehard, M. (1991). Statistical Analysis of Reliability and life Testing models, Marcel Dekker.

Book for reference:

1. Cox, D R. and Oakes, D. (1984). Analysis of Survival Data, Chapman & Hall, New York.
2. Gross, A.J. and Clark, V.A. (1975). Survival distribution: Reliability applications in the Biomedical Sciences, Wiley, New Delhi.
3. Kalbfleisch, J D. and Prentice, R.L.(1980). The Statistical Analysis of Failure Time Data, wiley, New York.
4. Lawless, J.F. (1982). Statistical Models and Methods of Life Time Data, Wiley, New York.
5. Sinha, S.K. (1979), Reliability and Life Testing, Wiley Eastern, New Delhi.

Web Resources

1. https://youtu.be/_c-iZ2BAXPw
2. <https://youtu.be/zX5DbO0bVrI>
3. <https://youtu.be/xpacBhN8U9w>
4. <https://youtu.be/xnAuIbiLS8Y>
5. <https://youtu.be/sK1cCjkmCCw>
6. <https://youtu.be/vX3l36ptrTU>
7. <https://youtu.be/It2USQrYsuA>
8. https://youtu.be/6A4_suM-ecg

Rationale for nature of the course:

1. To learn the reliability theory and analysis of survival data.
2. To distinguish censored and uncensored data
3. To visualize and communicate time-to-event data, to fit and interpret failure time model.

Activities having direct bearing on Skill Development / Employability /Entrepreneurship

Exercises, Seminars, Assignments Problem solving using calculator and Quiz.

Pedagogy:

Lecture, Problem solving, Tutorial.

LECTURE SCHEDULE

UNIT	Description	Hours	Total Hours	Mode
I	Concept of reliability	5	18	Chalk and Talk / Presentation
	components systems	5		Chalk and Talk / Presentation /Group Discussion
	coherent systems	4		Chalk and Talk / Presentation / Group Discussion
	reliability of coherent systems	4		Chalk and Talk / Presentation / Group Discussion
II	Estimation of parameters	3	18	Chalk and Talk / Presentation
	IFR distributions	3		Chalk and Talk / Presentation
	DFR distributions	3		Chalk and Talk / Presentation
	Reliability of system with independent components	3		Chalk and Talk / Tutorial / Quiz
	Basic idea of maintainability.	3		Chalk and Talk / Group Discussion
III	Intruduction of System reliability,	4	18	Chalk and Talk / Presentation
	series and parallel concepts	5		Chalk and Talk
	parallel-series	3		Chalk and Talk
	series-parallel configurations	3		Chalk and Talk
	k out of n systems	3		
IV	Survival Analysis: Introduction	3	18	Chalk and Talk
	Concepts of time, Order	3		Chalk and Talk
	random Censoring	3		Chalk and Talk / Tutorial
	Life distributions-Exponential	3		
	Gamma distribution	3		Chalk and Talk
	Weibull, Lognormal	3		Chalk and Talk / Tutorial

V	Life tables, Failure rate	3	18	Chalk and Talk / Seminar / Assignment
	mean residual life and their elementary properties.	3		Chalk and Talk / Seminar / Assignment
	Ageing classes and their properties,	3		Chalk and Talk / Seminar / Assignment
	Bathtub Failure rate.	3		Chalk and Talk / Seminar / Assignment
	Estimation of survival function	3		Chalk and Talk / Seminar / Assignment
	Kaplan-Meier Estimator	3		Chalk and Talk / Seminar / Assignment

Course Learning Outcome

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

CLO1	Understand the Concept of reliability, the component and coherent system	Up to K2
CLO2	Determine Estimate of parameters, increasing failure rate and decreasing failure rate distributions.	Up to K3
CLO3	Understand the concept of System reliability, series structure, parallel structure and parallel-series structure.	Up to K3
CLO4	Analyzing concept of the various Life distributions and problem solving.	Up to K4
CLO5	Estimation of survival function-Kaplan-Meier Estimator	Up to K3

Mapping of Course Learning Outcomes (CLOs) with Program Outcomes (PO) & Program Specified Outcomes (PSOs)

	PO					PSO							
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CLO1	3	-	1	-	-	-	1	-	-	3	2	-	-
CLO2	-	3	2	-	1	3	3	2	-	3	1	1	-
CLO3	3	2	2	-	1	2	-	3	-	3	1	1	-
CLO4	3	2	1	-	-	1	3	-	-	2	2	1	-
CLO5	3	2	1	-	-	1	3	-	-	2	2	1	-

Advanced Application - 3 Intermediate Level -2 Basic Level -1

The Components of Assessment Shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K1,K2

SUMMATIVE EXAMINATION – BLUE PRINT

S.No	CLOs	K-level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO 1	Up to K2	2	K1 & K2	1	K1	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	K2	2(K2 & K2)	1(K3)	
4	CLO 4	Up to K4	2	K1 & K2	1	K1	2(K3& K3)	1(K4)	
5	CLO 5	Up to K3	2	K1 & K2	1	K2	2(K2 & K2)	1(K3)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

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 inference 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 withoutchoice	Consolidated
K1	5	4	-	-	9	7.5	50.00%
K2	5	6	30	10	51	42.50	
K3	-	-	20	30	50	41.67	41.67%
K4	-	-	-	10	10	8.33	8.33%
Total marks	10	10	50	50	120	100	100%

Course Designer: Dr. R. PREMA SUMATHI, Asst. Professor, Dept. of Mathematics & Statistics

DEPARTMENT OF STATISTICS				CLASS: III B.Sc, STATISTICS				
Semester	Course Type	Course Code	Course Title	Credits	Hrs	CIA	Ext	Total
V	IDC	20U5SIDC	Economic Statistics	4	4	25	75	100

NATURE OF THE COURSE

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives:

1. To understand the concepts of interpretation of data and statistical fallacies.
2. To make the best decision by comparing all the possible alternatives.
3. To introduce fundamental concepts of Economics.
4. To Teach the Students about the Concept and Determination of Demand and Supply

Units	Descriptions	K – Levels	CLO
I	Interpretation of Data and Statistical Fallacies: Introduction – Meaning and need – Factors leading to mis-interpretation of data or statistical fallacies – Bias – Inconsistencies in Definitions – Faulty Generations – Inappropriate comparisons – Wrong Interpretation of statistical Measures – Technical Error – Problems.	Up to K2	1
II	Statistical Decision Theory: Introduction – Definitions – Ingredients of Decision problem – Acts – State of Nature or Events – payoff table – opportunity loss – Decision making Environment, under certainty and uncertainty – Optimal Decision – Maximax, Maximin and Minimax criterion – Problems.	Up to K2	2
III	Statistical Decision Theory (continued): Laplace criterion of Equal likelihoods – Hurwicz criterion of Realism – Expected Monetary Value (EMV) – Expected Opportunity Loss (EOL) – Expected Value of perfect information (EVPI) – Decision Tree – Problems.	Up to K2	3
IV	Introduction to Economics Meaning – Definitions (Wealth, Welfare, Scarcity, and Growth) – Scope of Economics – The Subject Matter of Economics – Basic Concepts of Economics: Goods: Classification, Price – Value – Wants: Characteristics – Utility: Types.	Up to K2	4

V	Demand and Supply Meaning of Demand – Law of Demand – Determinants of Demand – Exceptional Demand Curve – Meaning of Supply – Law of Supply –Determinants of the Supply – Commodity – Exceptions to the Law of Supply – Consumer’s Equilibrium.	Up to K2	5

Book for Study:

1. S. C Gupta and Indra Gupta, Business Statistics, Himalaya Publishing House
2. Maria John Kennady, M. (2012). Micro Economics. Himalaya Publishing House. Pvt. Ltd., Mumbai.
3. Bose. D and Marimuthu A. (2015). An Introduction to Micro Economics. Himalaya Publishing House Pvt. Ltd., Mumbai.

Chapters:

Unit I : Chapters 17(17.1 – 17.3 (17.3.1 – 17.3.5, 17.3.7))

Unit II : Chapters 18(18.1, 18.2(18.2.1 – 18.2.7), 18.3 (18.3.1 – 18.3.3))

Unit III : Chapter 18(18.3(18.3.4 – 18.3.8), 18.4)

Book for References:

1. D.C. Sancheti and V.K. Kapoor, Statistics (Theory, Methods & Applications), Thoroughly revised seventh edition, Reprint 2019, Sultan Chand and Sons, New Delhi.
2. S. C Gupta and V.K. Kappor (Reprint 2019), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
3. Jhingan, M.L. “**Advanced Economic Theory**” (2013) Vrinda Publication (P) Ltd., Delhi.
4. Ahuja, H.L., “**Principles of “Micro Economics**” (2012) S.Chand & Company Ltd., New Delhi.

Web Resources

1. <https://www.youtube.com/watch?v=BVE9e18zVVU>
2. <https://www.youtube.com/watch?v=HSc31v67590>
3. <https://www.youtube.com/watch?v=TUht9K5VXGs>
4. <https://d3bxy9euw4e147.cloudfront.net/oscms-rodcm/media/documents/Microeconomics2e-OP.pdf>
5. [https://edisciplinas.usp.br/pluginfile.php/4292722/mod_resource/content/1/%288th%20Edition%29%](https://edisciplinas.usp.br/pluginfile.php/4292722/mod_resource/content/1/%288th%20Edition%29%20)

Rationale for nature of the course

Interpretation of Data and Statistical Decision Theory helps in solving problems in different environments the needs decisions. This module aims to introduce students to use techniques for effective decision-making model formulation and applications that are used in solving business decision problem.

Economics is a branch of economics concerned with issues related to basic concepts, definitions, demand and supply its determinations. Knowledge of economics enables the policy makers to take decision on how to acquire resources for the economic activities, and how best to use the scarce resources for the production of goods and services

Activities having direct bearing on Skill Development / Employability / Entrepreneurship

Exercises, Seminars, Assignments Problem solving using calculator and Quiz.

Entrepreneurship

- Demand and Supply Analysis of Consumable Products
- Types of Goods and its preference

Pedagogy:

Lecture, Problem solving, Tutorial, Peer Teaching, OOC and ICT enabled teaching aids

Course Outcome

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

CLO1	Understand the basic concepts of interpretation of data and statistical fallacies.	Up to K2
CLO2	Understanding the theory of statistical decision.	Up to K2
CLO3	Learn about Optimal decision and Decision Tree.	Up to K2
CLO4	Students gathered Knowledge in Fundamental concepts of Economics	Up to K2
CLO5	Determination of Demand and Supply	Up to K2

K1- Remembering and recalling facts with specific answers

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

Mapping of Course Outcomes (CLOs) with Program Outcomes & Program Specified Outcomes (PSOs)

CLOs/ Os &PSOs	PO 1	PO 2	PO 3	PO 4	PO 5		PS O1	PS O2	PS O3	PSO 4	PS O5	PS O6	PS O7	PS O8
CLO1	3	3	2	3	2		3	2	3	2	3	3	2	2
CLO2	3	3	2	3	2		3	3	3	3	3	3	3	2
CLO3	3	3	2	3	3		3	3	3	3	1	3	3	1
CLO4	3	3	3	2	2		3	3	3	3	2	3	3	3
CLO5	3	3	2	2	3		3	3	3	-	2	3	3	3

- Basic level

2. Intermediate level

3. Advance level

LESSON PLAN

Units	Description	Hours	Pedagogy
I	Introduction – Meaning and need – Factors leading to mis-interpretation of data or statistical fallacies.	6	Lecture
	Bias – Inconsistencies in Definitions – Faulty Generations – Inappropriate comparisons – Wrong Interpretation of statistical Measures – Technical Error – Problems.	6	Lecture, Assignment
II	Introduction – Definitions –Ingredients of Decision problem – Acts – State of Nature or Events – payoff table	6	Lecture, problem solving, Quiz
	opportunity loss – Decision making Environment, under certainty and uncertainty – Optimal Decision – Maximax, Maximin and Minimax criterion – Problems.	6	Lecture, Seminar and Presentation
III	Laplace criterion of Equal likelihoods – Hurwicz criterion of Realism	4	Lecture
	Expected Monetary Value (EMV) – Expected Opportunity Loss (EOL)	4	Lecture& Presentation
	Expected Value of perfect information (EVPI) – Decision Tree – Problems.	4	Lecture & Assignment
IV	Meaning, Definitions (Wealth, Welfare, Scarcity, and Growth)	5	Lecture and Presentation
	Scope of Economics, The Subject Matter of Economics	3	Lecture
	Basic Concepts of Economics: Goods: Classification, Price Value, Wants: Characteristics, Utility: Types.	4	Lecture
V	Meaning of Demand, Law of Demand, Determinants of Demand, Exceptional Demand Curve.	5	Lecture and Presentation
	Meaning of Supply, Law of Supply, and Determinants of the Supply, Commodity, and Exceptions to the Law of Supply.	5	Lecture and Presentation
	Consumer's Equilibrium.	2	Lecture and Presentation
	Total Hours	60	

SUMMATIVE EXAMINATION – BLUE PRINT

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

K1 - Remembering and recalling facts with specific answers

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

Distribution of Section-wise Marks with K levels*

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/ OR)	Total marks	% of marks without choice	Consolidated
K1	10	-	-	10	7.69	8
K2	-	70	50	120	92.31	92
Total marks	10	70	50	130	100	100%

Course Designer:

Prof. G. K. LAKSHMI, Assistant Professor, Department of Mathematics & Statistics

DEPARTMENT OF STATISTICS				CLASS: III B.Sc., STATISTICS				
Semester	CourseType	Course Code	Course Title	Credits	Hrs	CIA	Ext	Total
VI	SBE –IV	20U6SSP2	Statistical Practical - II	2	2	40	60	100

NATURE OF THE COURSE

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives:

1. To understand the concepts of simple and stratified random sampling.
2. To provide strong foundation in the concepts of estimation theory.
3. To expose the essential ideas about designing and interpreting statistical field experiments.

Units	Descriptions	K - Levels	CLO
I	Simple random sampling: (without replacement and with replacement). Estimation of $\bar{y}, V(\bar{y}), SE(\bar{y})$ - Stratified random sampling: Estimation of $\bar{y}_{st}, V(\bar{y}_{st})$ – Systematic sampling: Estimation of $\bar{y}_{sy}, V(\bar{y}_{sy})$.	Up to K2	1
II	Construction of confidence intervals for mean(s), variance(s), and proportion(s) based on Normal, t, Chi-square and F distributions.	Up to K3	2
III	Non-parametric tests: Sign test, Wilcoxon's Signed rank test, Median test, Runs test, Mann-whitney test and Kruskal-wallis test.	Up to K3	3
IV	Control charts: $\bar{X}$ and R, p, np and c charts – Determination of OC curve for single sampling plan – Determination of ASN, ASI and OC curves for Double sampling plans.	Up to K4	4
V	Analysis of CRD, RCBD, and LSD – Missing plot technique in RCBD and LSD (with one and two missing observations) – Analysis of $2^2, 2^3, 3^2$ factorial experiments, confounding in 2^3 factorial designs.	Up to K3	5

Book for Study:

1. S. Sampath, Sampling Theory & Methods, 2ndEdition, Narosa Publishing House
2. S. C Gupta and V.K. Kappor (2002), Fundamentals of Mathematical Statistics, Sultan chand and sons, New Delhi.

Book for References:

1. D.C. Sancheti and V.K. Kapoor, Statistics (Theory, Methods & applications), Thoroughly revised seventh edition, Reprint 2019, Sultan Chand and Sons, New Delhi.
2. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, Revised edition (2014).

Web Resources

1. <https://www.questionpro.com/blog/sample>
2. <https://www.youtube.com/watch?v=9j7u6dfvFrs>
3. <https://youtu.be/p-gvwkHePaU>
4. <https://www.youtube.com/watch?v=zEvfkSuPqWk>

Rationale for nature of the course:

Knowledge, thinking analytically and applying basic techniques of sampling to interpret data identify various types of estimators and designed Experiments are also powerful tools to achieve manufacturing cost savings by minimizing process variation and reducing rework, scrap, and the need for inspection.

Activities having direct bearing on Skill Development / Employability / Entrepreneurship

Exercises, Seminars, Assignments Problem solving using calculator and Quiz.

Pedagogy:

Lecture, Problem solving, Tutorial.

Course Outcome

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

CLO1	Understand the basic concepts of Sampling Methods	Up to K2
CLO2	Construct Confidence interval and acquire the knowledge of interval estimation and non - parametric test.	Up to K3
CLO3	Understand and analyse the various method of Non-parametric tests.	Up to K3
CLO4	How to design variables control charts, how to set up and use x-bar and R control charts, Determine the average run length for variables control charts.	Up to K4
CLO5	Apply principle of total and partial confounding in factorial experiments.	Up to K3

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

Mapping of Course Learning Outcomes (CLOs) with Program Outcomes (POs) and ProgramSpecified Outcomes (PSOs)

	PO					PSO							
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CLO1	3	3	3	2	2	3	3	3	3	3	2	3	1
CLO2	3	2	-	-	2	1	1	1	2	3	3	2	1
CLO3	3	3	2	1	1	2	2	3	3	1	3	3	1
CLO4	3	2	3	2	2	3	2	2	3	2	2	2	1
CLO5	3	2	3	2	1	3	2	2	3	2	2	2	1

Course Designer: Prof. G. K. LAKSHMI, Assistant Professor, Department of Mathematics and Statistics.

DEPARTMENT OF STATISTICS				CLASS: III B.Sc., Statistics				
Semester	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core	20U6SMC11	Statistical Quality Control	5	6	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

COURSE OBJECTIVES

- To help students understand the concepts underlying statistical quality control and to develop their ability to apply those concepts to the design and management of quality control processes in industries.
- To understand the differences between attributes and variables.
- To introduce the students the basics of Statistical Quality Control and to enable them describe quality characteristics and relationships.

Unit	Description	Hours	K-level	CLO(s)
I	Control charts for variables: Need for Statistical Quality Control techniques in Industry – Causes of quality variation – Uses of Shewart Control charts – specifications, tolerance limits – 3σ limits – warning limits – Application of Theory of runs in quality control. Variable Control charts – $\bar{X}$, R and σ - charts – Basis of sub grouping – Interpretation of $\bar{X}$ and R charts.	20	K3	1
II	Control charts for attributes: p, np, c and u charts. Construction of charts – choice between p and np charts.	18	K2	2
III	Acceptance Sampling: Sampling inspection – inspection by attributes and variables - concepts of Producer's risk, Consumer's risk. AQL, LTPD, AOQ, AOQL, ATI and ASN. Rectifying inspection plans.	20	K3	3
IV	Acceptance sampling for attributes: Single sampling plan – Operating procedure, OC function and OC curve. Double sampling plans- Operating procedure, OC function, AOQ, ATI and ASN curves.	16	K4	4
V	Acceptance sampling for variables: Known- σ and unknown- σ sampling plans (one sided specification only). Determination of n and k for one sided specification of OC curve.	16	K3	5

Books for study:

1. Kapoor, V.K. and Gupta, S.P. (2007) Fundamentals of Applied Statistics, Sultan Chand & Sons. UNIT I, II (Chapter: 1(1.1-1.9))
2. Mahajan, M. (2002). Statistical Quality Control, (Third Edition), Dhanpat Rai and Co., Delhi. UNIT III, IV, V (Chapter: 10, 12)

Books for Reference:

1. Gupta, R.C. (1974) Statistical Quality Control, Khanna Publishing Co, New Delhi.
2. Montgomery, D.C. (2009). Introduction to Statistical Quality Control, Sixth Edition, Wiley India, New Delhi.

Web Resources

- Shewart control chart - <https://youtu.be/VOPP5Oqm-9A>
- Control chart example - <https://youtu.be/p-gvwkHePaU>
- OC function and OC curve - <https://youtu.be/J17SUDcrphw>

Rationale for Nature of the course

Statistical quality control, **the use of statistical methods in the monitoring and maintaining of the quality of products and services**. One method, referred to as acceptance sampling, can be used when a decision must be made to accept or reject a group of parts or items based on the quality found in a sample.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

- Seminar
- Assignment preparation
- Group discussion
- Quiz

Pedagogy

Chalk and Talk, PPT, Seminar, Interaction, Problem solving.

Lecture Schedule

Unit	Topics	Hours	Mode
I	Control charts for variables: Need for Statistical Quality Control techniques in Industry – Causes of quality variation.	7	Presentation, Chalk and Talk.
	Uses of Shewart Control charts – specifications, tolerance limits – 3σ limits – warning limits.	7	
	Application of Theory of runs in quality control. Variable Control charts – $\bar{X}$, R and σ - charts – Basis of sub grouping – Interpretation of $\bar{X}$ and R charts.	6	
II	Control charts for attributes: p, np, c and u charts.	6	Presentation, Chalk and Talk and Assignments
	Construction of charts.	6	
	choice between p and np charts.	6	
III	Acceptance Sampling: Sampling inspection.	3	Presentation, Chalk and Talk, Assignments
	inspection by attributes and variables.	7	
	concepts of Producer's risk, Consumer's risk.	3	
	AQL, LTPD, AOQ, AOQL, ATI and ASN. Rectifying inspection plans.	7	
IV	Acceptance sampling for attributes: Single sampling plan.	6	Presentation, Chalk and Talk, Assignments
	Operating procedure, OC function and OC curve.	5	
	Double sampling plans- Operating procedure, OC function, AOQ, ATI and ASN curves.	5	
V	Acceptance sampling for variables: Known- σ and unknown- σ sampling plans (one sided specification only).	8	Assignments and Seminar
	Determination of n and k for one sided specification of OC curve.	8	

COURSE OUTCOMES

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

CLO	Course Learning Outcomes	Knowledge Level
CLO 1	How to design variables control charts, how to set up and use x-bar and R control charts, Determine the average run length for variables control charts.	Up to K3
CLO 2	Understand the statistical basis of the attributes control chart, how to design attributes control chart, how to set up and use the p-chart for fraction non- conforming, how to set up and use the np-control chart for the number of nonconforming items, Know how to set up and use the c-control chart for defects, how to set up and use the u- control chart for defects per unit	Up to K2
CLO 3	Describe acceptance sampling plans, producer's risk, consumer's risk, and lot tolerance percentage defective.	Up to K3
CLO 4	Describe single sampling plan and a double sampling plan. Interpret and use OC curves in determining acceptable quality level.	Up to K4
CLO 5	Variables, of course, are quality characteristics that are measured on a numerical scale.	Up to K3

Mapping of Course Outcomes (COs) with Program Outcomes (PO) & Program Specified Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	3	3	2	1	1	2	2	3	3	1	3	3
CLO2	3	3	1	1	1	2	2	3	3	1	3	3
CLO3	3	3	-	1	1	2	3	2	3	1	3	3
CLO4	2	2	-	1	1	2	3	2	3	1	2	3
CLO5	2	2	2	1	1	2	3	2	3	1	2	3

3- Advance Application

2- Intermediate Level

1- Basic Level

The Components of Assessment shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K1

SUMMATIVE ASSESSMENT - BLUE PRINT

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 K3	2	K1 & K2	1	K1	2(K2 & K2)	1(K3)
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 K3	2	K1 & K2	1	K2	2(K3 & K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 - Remembering and recalling facts with specific answers.

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

K3 - Application oriented - Solving Problems.

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

Distribution of section wise marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	5	4	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	30	50	41.67	41.67%
K4	-		10	10	20	16.67	16.66%
Total marks	10	10	50	50	120	100	100%

Course Designer:

Dr. M. REVATHI, Assistant Professor, Department of Mathematics and Statistics

DEPARTMENT OF STATISTICS				CLASS: III B.Sc., Statistics				
Semester	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core	20U6SMC12	Stochastic Processes	5	6	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

COURSE OBJECTIVES

1. To expose the students to the basics of stochastic process and to clarify Markov chain, Poisson Process and birth and death process.
2. To determine limit probabilities in Markov chains after an infinitely long period
3. To derive differential equations for time continuous Markov Processes with a discrete state space.
4. To solve differential equations for distributions and expectations in time continuous processes and to determine corresponding limit distributions.

Unit	Description	Hours	K-level	CLO(s)
I	Stochastic Process: Basic Concepts ,Introduction of Stochastic Process, Specification of Stochastic Process according to time parameter space and state space, Stationary Process and examples of Stochastic Processes, Martingales and elementary problems.	20	K3	1
II	Markov Chains: Definition and Examples of Markov Chain, Higher Transition Probabilities and simple problems.	18	K2	2
III	Markov Chains: Classification of States and Chains, Determination of Higher Transition Probabilities, Graph Theoretic Approach.	20	K3	3
IV	Markov Processes with Discrete State Space: Poisson Process, Poisson Process and Related Distributions, Generalization of Poisson Process.	16	K4	4
V	Birth and Death Process: Birth and Death Process, Markov Processes with Discrete State Space(Continuous Time Markov Chains),Randomization (Uniformization) ,Derived Markov Chain, Erlang Process.	16	K3	5

Books for Study:

J. Medhi, Stochastic Process, New Age International (P) Limited Publishers, Second edition

Unit-I-Chapter2-sec(2.1,2.2,2.3,2.4)

Unit-II-Chapter3-sec(3.1,3.2)

Unit-III-Chapter 3-sec(3.4,3.5, 3.7)

Unit-IV- Chapter4-sec(4.1,4.2,4.3)

Unit-V-Chapter 4-sec(4.4,4.5,4.6,4.7)

Books for Reference:

- Ross,S.M(1983),Stochastic Processes,Wiley,NewYork.
- Bhat,U.N (1972) ,Elements of Applied Stochastic Processes,Wiley,NewYork

Web Resources:

- <https://www.stat.auckland.ac.nz/~fewster/325/notes/ch1annotated.pdf>
- <https://www.randomservices.org/random/markov/index..>
- <https://towardsdatascience.com/introduction-to-markov-chains>

Rationale for Nature of the course

Stochastic Process is the process of some values changing randomly over time. At its simplest form, it involves a variable changing at a random rate through time. . There are various types of Stochastic processes .Some well known types are random walks,Markov Chains are used in computer science and other fields.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

- Seminar
- Assignment preparation
- Group discussion
- Quiz

Pedagogy

Chalk and Talk, PPT, Seminar, Interaction, Problem solving.

Lecture Schedule

Unit	Topics	Hours	Mode
I	Introduction of Stochastic Processes and Types	7	Presentation, Chalk and Talk.
	Specification of Stochastic Process	7	
	Stationary Process of Stochastic Process and elementary problems	6	
II	Definition of Markov Chains	6	Presentation, Chalk and Talk and Assignments
	Higher Transition Probabilities	6	
	Problems on Markov Chains	6	
III	Classification of States and Chains	3	Presentation, Chalk and Talk, Assignments
	Determination of Higher Transition Probabilities	7	
	Problems on Higher Transition Probabilities	3	
	Graph Theoretic Approach	7	
IV	Poisson Process	6	Presentation, Chalk and Talk, Assignments
	Related Distributions.	5	
	Generalisation of Poisson Process.	5	
V	Birth and Death Process	8	Assignments and Seminar
	Derived Markov Chain, Erlang Process	8	

COURSE OUTCOMES

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

CLO	Course Learning Outcomes	Knowledge Level
CLO 1	Explain about the basic concepts of Stochastic Process	Up to K3
CLO 2	Find the Higher Transition Probabilities.	Up to K2
CLO 3	Obtain the classification of states in Markov Chains	Up to K3
CLO 4	Derive differential equations for time continuous Markov Processes with a discrete state space.	Up to K4
CLO 5	Infer the concepts of Markov Chains in different fields of applications.	Up to K3

**Mapping of Course Outcomes (COs) with Program Outcomes (PO) &
Program Specified Outcomes (PSOs)**

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	3	-	-	-	2	3	2	3	1	3	3	3
CLO2	3	-	-	-	2	3	2	3	1	3	3	3
CLO3	3	-	-	-	2	3	1	3	1	3	3	2
CLO4	3	-	-	-	1	3	1	3	1	3	2	3
CLO5	3	-	-	-	1	3	1	3	1	3	2	2

3- Advance Application

2- Intermediate Level

1- Basic Level

The Components of Assessment Shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K1

SUMMATIVE ASSESSMENT - BLUE PRINT

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 K3	2	K1 & K2	1	K1	2(K2 & K2)	1(K3)
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 K3	2	K1 & K2	1	K2	2(K3 & K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 - Remembering and recalling facts with specific answers.

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

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

Distribution of section wise marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	5	4	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	30	50	41.67	41.67%
K4	-		10	10	20	16.67	16.66%
Total marks	10	10	50	50	120	100	100%

Course Designer: Prof. Krishna Jayanthi . S, Assistant Professor., Department of Mathematics and Statistics

DEPARTMENT OF STATISTICS				CLASS: III B.Sc., Statistics				
Semester	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Core	20U6SMC13	Applied Statistics	5	6	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

COURSE OBJECTIVES

- To help students understand the concepts underlying statistical quality control and to develop their ability to apply those concepts to the design and management of quality control processes in industries.
- To understand the differences between attributes and variables.
- To introduce the students the basics of Statistical Quality Control and to enable them describe quality characteristics and relationships.

Unit	Description	Hours	K-level	CLO(s)
I	Analysis of Time Series: Introduction, Components of Time Series: Trend –Periodic Changes- Irregular(or Random) Component, Analysis of Time Series: Mathematical Models for Time Series – Uses of Time Series, Measurement of Trend: Graphic Method- Method of Semi- averages – Method of curve Fitting by Principle of Least Squares- Growth curves and Their Fitting – Moving Average Method – Approximation to Moving Averages.	20	K3	1
II	Measurement of Seasonal Variations: Method of Simple Averages – Ratio to Trend Method - Ratio to Moving Average Method – Link Relative Method – Deseasonalisation of Data, Measurement of Cyclic Variations, Auto – Regression Series: First Order Auto- regression Series – Second Order Auto- regression Series – General Auto – regression, Auto – Correlation and Correlogram: Correlogram of Moving Average – Correlogram of Harmonic Series - Correlogram of Auto – regressive series, Random Component in a Time Series – Variate Difference Method.	18	K2	2
III	Index Numbers: Introduction, Basic problems involved in the construction of Index Numbers: Simple Aggregate Method – Weighted Aggregate Method – Average of Price Relatives – Chain Base Method, The Criteria of a Good Index Number: Unit Test – Time Reversal Test – Factor Reversal Test – Circular Test	20	K3	3

IV	Classification of Index Numbers: Economic Adviser's Wholesale Price Index Number – Cost of Living (Consumer Price) Index Number – Consumer Price Indices- Indian Scenario, Base Shifting, Splicing and Deflating of Index Numbers, Index of Industrial Production – Indian Scenario, Index of Agricultural Production, Uses of Index Numbers, Limitations of Index Numbers	16	K4	4
V	Demand Analysis : Introduction, Demand and Supply – laws of demand and supply, Price Elasticity of Demand - Price Elasticity of Supply, Partial and Cross Elasticities of Demand, Types of Data Required for Estimating Elasticities: Leontief's Method – Pigou's Method(From Time Series Data) - Pigou's Method(From Family Budget Data), Engel's law and Engel Curves.	16	K3	5

Books for study:

Kapoor, V.K. and Gupta, S.P. (2007) Fundamentals of Applied Statistics, Sultan Chand & Sons.

Chapters: 2, 3, 4(4.1 – 4.6)

Books for Reference:

1. Arumugam, S.(2018) Statistics Quality Control, New Gamma Publishing House.
2. Pillai, R.S.N and Bagavathi Statistics Theory and Practice, Sultan Chand & Sons.

Web Resources:

Analysis of Time series - <https://youtu.be/GVirvz8usyY>

Index numbers - <https://youtu.be/cv5iPhRmSAG>

Demand Analysis - https://youtu.be/cbeB9HI8_Ws

Rationale for Nature of the course

Applied Statistics includes planning for the collection of data, managing data, analyzing, interpreting and drawing conclusions from data and identifying problems, solutions and opportunities using analysis. This major builds **critical thinking and problem solving skills in data analysis and empirical research.**

Activities having direct bearing on Skill development / Employability / Entrepreneurship

- Seminar
- Assignment preparation
- Group discussion
- Quiz

Pedagogy

Chalk and Talk, PPT, Seminar, Interaction, Problem solving.

Lecture Schedule

Unit	Topics	Hours	Mode
I	Analysis of Time Series: Introduction, Components of Time Series: Trend –Periodic Changes- Irregular(or Random) Component.	7	Presentation, Chalk and Talk.
	Analysis of Time Series: Mathematical Models for Time Series – Uses of Time Series.	6	
	Measurement of Trend: Graphic Method- Method of Semi- averages – Method of curve Fitting by Principle of Least Squares- Growth curves and Their Fitting – Moving Average Method – Approximation to Moving Averages.	7	
II	Measurement of Seasonal Variations: Method of Simple Averages – Ratio to Trend Method - Ratio to Moving Average Method – Link Relative Method – Deseasonalisation of Data, Measurement of Cyclic Variations, Auto.	6	Presentation, Chalk and Talk and Assignments
	Regression Series: First Order Auto- regression Series – Second Order Auto- regression Series – General Auto –regression.	6	
	Auto Correlation and Correlogram: Correlogram of Moving Average – Correlogram of Harmonic Series - Correlogram of Auto – regressive series, Random Component in a Time Series – Variate Difference Method.	6	
III	Index Numbers: Introduction, Basic problems involved in the construction of Index Numbers: Simple Aggregate Method .	6	Presentation, Chalk and Talk, Assignments
	Weighted Aggregate Method – Average of Price Relatives – Chain Base Method.	7	
	The Criteria of a Good Index Number: Unit Test – Time Reversal Test – Factor Reversal Test – Circular Test	7	
IV	Classification of Index Numbers: Economic Adviser's Wholesale Price Index Number – Cost of Living (Consumer Price).	6	Presentation, Chalk and Talk, Assignments
	Index Number – Consumer Price Indices- Indian Scenario, Base Shifting, Splicing and Deflating of Index Numbers.	5	
	Index of Industrial Production – Indian Scenario, Index of Agricultural Production, Uses of Index Numbers, Limitations of Index Numbers.	5	
V	Demand Analysis : Introduction, Demand and Supply – laws of demand and supply, Price Elasticity of Demand - Price Elasticity of Supply, Partial and Cross Elasticities of Demand.	8	Assignments and Seminar
	Types of Data Required for Estimating Elasticities: Leontief's Method – Pigou's Method(From Time Series Data) - Pigou's Method(From Family Budget Data), Engel's law and Engel Curves.	8	

COURSE OUTCOMES

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

CLO	Course Learning Outcomes	Knowledge Level
CLO 1	Define time series components. Explain time series with different structures. Explain trend, seasonality, cyclical irregularity . Explain stochastic components. Describe and use difference and lag operators	Up to K3
CLO 2	Run and interpret time series models and regression models for time series	Up to K2
CLO 3	Understand the concept and purpose of index Numbers. Calculate the indices to measure price and quantity changes over period of time. Understand different tests an ideal index Number satisfies. Understand consumer price index Numbers.	Up to K3
CLO 4	The index is used by government agencies and departments such as the Finance Ministry and RBI for policy making. To understand the concept of estimating the Gross Value Added of the manufacturing sector quarterly.	Up to K4
CLO 5	To understand the factors affecting the demand for a product or service in a market. Companies use this information to formulate strategies on pricing marketing communications, sales forecasting etc.	Up to K3

Mapping of Course Outcomes (COs) with Program Outcomes (PO) & Program Specified Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	3	3	-	-	2	2	2	1	2	3	3	3
CLO2	3	3	-	-	2	2	2	1	2	3	3	3
CLO3	3	2	-	-	2	1	1	1	2	3	3	2
CLO4	2	2	-	-	1	1	1	1	2	3	2	3
CLO5	2	2	-	-	1	1	1	1	2	3	2	2

3- Advance Application

2- Intermediate Level

1- Basic Level

The Components of Assessment shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K1

SUMMATIVE ASSESSMENT - BLUE PRINT

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 K3	2	K1 & K2	1	K1	2(K2 & K2)	1(K3)
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 K3	2	K1 & K2	1	K2	2(K3 & K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 - Remembering and recalling facts with specific answers.

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

K3 - Application oriented - Solving Problems.

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

Distribution of section wise marks with K levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	5	4	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	30	50	41.67	41.67%
K4	-		10	10	20	16.67	16.66%
Total marks	10	10	50	50	120	100	100%

Course Designer:

Dr.S.VALLIRANI, Assistant Professor, Department of Mathematics and Statistics

DEPARTMENT OF STATISTICS				Class: III B.Sc., Statistics				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective - III	20U6SME2(A)	INTRODUCTION TO R PROGRAMMING	4	4	25	75	100

NATURE OF THE COURSE

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives

- To make students exercise the fundamentals of statistical analysis in R environment.
- To analysis data for the purpose of exploration using descriptive statistics.
- To understand probability and sampling distributions and learn the creative application of linear regression.

Units	Descriptions	K - Levels	CLO
I	Basics: First steps – An overgrown calculator – Assignments – Vectorized arithmetic – standard procedures – Graphics – R language essentials – Expressions and objects – Functions and arguments – Vectors – Quoting and escape sequences – Missing values – Functions that create vectors – Matrices and arrays – Factors – Lists – Data frames – Indexing – conditional selection – Indexing of data frames – Grouped data and data frames – Implicit loops – Sorting.	Up to K2	1
II	The R environment: Session management – The workspace – Textual output – Scripting – Getting help – Packages – Built in data – attach and detach – Subset, transform, and within – The graphic subsystem – Plot layout - Building a plot from pieces – Using par – Combining plots – R programming – Flow control – Classes and generic functions.	Up to K3	2
III	Probability, Distributions, Descriptive statistics and graphics: Random sampling – Probability calculations and Combinatorics - discrete and continuous distribution – The built-in distributions in R – densities – Cumulative distribution functions – Quantiles – Random numbers – Graphical display of distributions and tables – Graphics for graphical data .	Up to K4	3
IV	One and Two sample tests: One-sample t test – Wilcoxon sigend-rank test – Two- sample t test – Comparison of variances – Two-sample wilcoxon test – The paired t test – The matched-pairs wilcoxon test.	Up to K4	4

V	Regression and correlation: Simple linear regression – Residuals and fitted values – Correlation – Pearson correlation – Spearman's ρ – Plotting multivariate data – Model specification and output - The poisson distribution – Survival analysis with constant hazard – Fitting poisson models.	Up to K4	5

Book for Study:

Peter Dalgaard, Introductory Statistics with R, Second Edition.

Chapters:

Unit I - Chapter 1(1.1(1.1.1-1.1.5), 1.2(1.2.1 – 1.2.16))

Unit II - Chapter 2(2.1(2.1.1-2.1.8), 2.2(2.2.1-2.2.4), 2.3(2.3.1, 2.3.2))

Unit III - Chapter 3(3.1-3.5(3.5.1-3.5.4)), 4(4.2, 4.4, 4.6)

Unit IV - Chapter 5(5.1 – 5.7), 6(6.1 – 6.4(6.4.1, 6.4.2))

Unit V - Chapter 11(11.1, 11.2), 15(15.1(15.1.1, 15.1.2), 15.2.

Book for References:

- Quick, J.M. (2010) Statistical Analysis with R, Packt Publishing LTd.,UK.
- Robert I. Kabacoff, R in Action Data Analysis and Graphic with R, Manning Publications, 2011.
- Brian Everitt and Torsten Hothorn. A Handbook of Statistical Analysis Using R, 2nd Edition Chapman and Hall/CRC, 2009.

Web Resources

1. <https://www.youtube.com/watch?v=7cGwYMhPDUY>
2. <https://www.youtube.com/watch?v=cDPFWbjg8Tc>
3. <https://www.youtube.com/watch?v=Rxe086csxTU>
4. <https://www.youtube.com/watch?v=5f7S1Jx6WyE>
5. <https://www.youtube.com/watch?v=o4f9XLkUuO0>

Rationale for nature of the course:

Introduction to 'R' Programming course covers the basics of this open source language, including vectors, factors, lists, and data frames. useful coding skills and be ready to start your own data analysis in R. It's in high demand for Data Scientists, Analysts, and Statisticians alike and is capable of handling AI, machine learning, financial analysis, and much more.

Activities having direct bearing on Skill Development / Employability / Entrepreneurship

- Seminars
- Assignments
- Group Discussion
- Quiz

Pedagogy:

Lecture, Problem solving, Tutorial.

Lecture Schedule

Units	Description	Hours	Total Hours	Pedagogy
I	First steps – An overgrown calculator – Assignments – Vectorized arithmetic – standard procedures	3	12	Lecture
	Graphics – R language essentials – Expressions and objects – Functions and arguments – Vectors	2		Lecture
	Quoting and escape sequences – Missing values – Functions that create vectors	2		Lecture & Presentation
	Matrices and arrays – Factors –Lists – Data frames – Indexing – conditional selection	2		Lecture
	Indexing of data frames – Grouped data and data frames – Implicit loops – Sorting.	3		Lecture
II	Session management – The workspace – Textual output – Scripting – Getting help	3	12	Lecture
	Packages – Built in data – attach and detach	2		Lecture
	Subset, transform, and within – The graphic subsystem – Plot layout	2		Lecture
	Building a plot from pieces – Using par – Combining plots	2		Lecture & Group Discussion
	R programming – Flow control – Classes and generic functions.	3		Lecture & Presentation
III	Random sampling – Probability calculations and Combinatorics	2	12	Lecture
	discrete and continuous distribution – The built-in distributions in R	3		Lecture& Presentation
	densities – Cumulative distribution functions	3		Lecture
	Quantiles – Random numbers	2		Lecture
	Graphical display of distributions and tables – Graphics for graphical data.	2		Lecture & Seminar
IV	One-sample t test	3	12	Lecture
	Wilcoxon sigend-rank test	2		Lecture
	Two- sample t test – Comparison of variances	2		Lecture
	Two-sample wilcoxon test	2		Lecture
	The paired t test – The matched-pairs wilcoxon test	3		Lecture & Group Discussion

V	Simple linear regression – Residuals and fitted values	2	12	Lecture
	Correlation – Pearson correlation – Spearman's ρ	3		Lecture & Seminar
	Plotting multivariate data – Model specification and output	2		Lecture
	The poisson distribution – Survival analysis with constant hazard	2		Lecture & Presentation
	Fitting poisson models	3		Lecture & Group Discussion
Total			60	

Course Learning Outcome

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

CLO1	Install code and Use R programming Language in R studio IDE to perform basic tasks on vectors, matrices and data frames.	Up to K2
CLO2	Describe key terminology, concepts and techniques employed in statistical analysis.	Up to K3
CLO3	Define, calculate, implement probability and probability distribution to solve a wide variety of problems.	Up to K4
CLO4	Conduct and interpret a variety of hypothesis tests to aid decision making.	Up to K4
CLO5	Understand, analyse, interpret correlation and regression to analyse the underlying relationships between different variables.	Up to K4

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

Mapping of Course Outcomes (COs) with Program Outcomes (PO) & Program Specified Outcomes (PSOs)

CLO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO 1	3	2	2	1	-	1	1
CLO 2	3	2	2	2	1	2	2
CLO 3	3	2	2	2	1	2	2
CLO 4	3	2	2	2	1	2	2
CLO 5	3	3	2	3	1	3	3

3 - Advanced Application 2 - Intermediate Level 1- Basic Level

The Components of Assessment shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K1

SUMMATIVE ASSESSMENT - BLUE PRINT

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 question	K - Level		
1	CLO 1	Up to K2	2	K1 & K2	1	K1	2(K2 & K2)	1(K2)
2	CLO 2	Up to K3	2	K1 & K2	1	K1	2(K2 & K2)	1(K3)
3	CLO 3	Up to K4	2	K1 & K2	1	K2	2(K3 & K3)	1(K4)
4	CLO 4	Up to K4	2	K1 & K2	1	K2	2(K4 & K4)	1(K3)
5	CLO 5	Up to 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

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	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	10	30	25	25%
K4	-		10	30	40	33.33	33.33%
Total marks	10	10	50	50	120	100	100%

Course designer:

Dr. R. CHITRA, Assistant Professor, Coordinator, Department of Mathematics and Statistics.

Prof. G.K. LAKSHMI, Assistant Professor, Department of Mathematics and Statistics.

DEPARTMENT OF STATISTICS				Class: III B.Sc., Statistics				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective - III	20U6SME2(B)	INTRODUCTION TO PYTHON PROGRAMMING	4	4	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives

The objective of the course is

- To impart the knowledge on basic components of computer programming using the Python language.
- To compute basic Mathematical and Statistical models through python packages.
- To emphasize features unique to Python such as tuples, array slices and output formatting.
- To make them understand the concept of python programming and apply it in simple statistical tasks.

Unit	Description	Hours	K-Level	CLO
I	Introduction to Python – Features of Python – Flavors of Python – Installing Python for Windows – Installing Packages – Writing and executing a Python Program – Getting help in Python – Comments in Python – Data types in Python – Built-in datatypes – Determining the Datatype of a Variable — Constants, Identifier and Reserved words – Naming conventions in Python. Text Book 1: Chapters 1, 2, 3	12	Up to K2	CLO1
II	Operators in Python – Operator Precedence and Associativity – Mathematical Functions – Input and Output statements – Control Statements – if, if...else and if...elif...else statements – Loops: While – for – Infinite – Nested - The else Suite – break – continue – pass – assert – return statements Text Book 1: Chapters 4, 5, 6	12	Up to K3	CLO2

III	Array – Advantages of Arrays – Creating an Array – Processing the Arrays – Types of Arrays – Creating Arrays in numpy – Mathematical Operations on Arrays – Attributes of an Array – Working with Multidimensional Arrays – Matrices in numpy – Operations on Matrices in Python. Text Book 1: Chapter 7	12	Up to K4	CLO3
IV	Pandas: Data structures for Statistics – Data Handling – Grouping – Statsmodels: Tools for Statistical Modeling – Seaborn: Data Visualization – Datatypes: Categorical, Numerical – Plotting in Python – Functional and Object-Oriented Approaches to Plotting – Interactive Plots – Displaying Statistical Datasets – Univariate Data – Bivariate and Multivariate Plots. Text Book 2: Chapter 2(2.5,2.6,2.7), Chapter 4	12	Up to K4	CLO4
V	Tests of Means of Numerical data – Distribution of a Sample Mean – Comparison of Multiple Groups – Tests on Categorical Data: One Proportion, Frequency Tables – Linear Regression Models: Linear Correlation – Correlation coefficient – Rank Correlation Text Book 2: Chapter 8(8.2,8.3), Chapter 9(9.1, 9.2.1,9.2.2), Chapter 11(11.1.1, 11.1.2)	12	Up to K4	CLO5

Books for Study:

1. Nageswara Rao R, Core Python Programming, Second Edition 2018, Dreamtech Press, New Delhi.
2. Haslwanter T, An Introduction to Statistics with Python with Application in the Life Sciences, 2016, Springer, Switzerland.

Books for Reference:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", First Edition 2012, O'Reilly.
2. Wesley J. Chun, Core Python programming, Second Edition 2010, Pearson Publications.
3. Mark Lutz, Programming Python, Fourth Edition 2010, O'Reilly Media.
4. Mark Summerfield, Programming in Python 3, 2009, Pearson Addison-Wesley Professional.

Web Resources:

- <https://nptel.ac.in/courses/106/106/106106182/>
- <https://www.python.org/about/gettingstarted/>
- <https://www.programiz.com/python-programming>
- <https://www.tutorialspoint.com/python/index.html>
- <https://www.w3schools.com/python/>
- <https://www.math.purdue.edu/~bradfor3/ProgrammingFundamentals/Python/>

Rationale for the nature of the course

Python is an object-oriented, high-level programming language with dynamic semantics. Python Programming is a general-purpose skill used in almost all fields, including Data Science, Scientific and Mathematical computing, Web development, Finance and trading, System automation and administration, computer graphics, Mapping and geography (GIS Software), etc. This course imparts programming skill to the students. This course is both skill oriented and employability oriented because of the benefits of learning statistical tools in Python.

Activities having direct bearing on Skill Development /Employability/Entrepreneurship

- Seminars
- Assignments
- Group Discussion
- Quiz.

Pedagogy:

Chalk and Talk, Seminar, Tutorial, Group Discussion, ICT Tools, PPT, Assignment, Quiz

Lecture Schedule

Unit	Topics	Hours	Mode
I	Introduction to Python – Features of Python – Flavors of Python	2	Presentation, Chalk and Talk.
	Installing Python for Windows – Installing Packages – Writing and executing a Python Program – Getting help in Python.	3	
	Comments in Python – Data types in Python – Built-in datatypes – Determining the Datatype of a Variable	4	
	Constants, Identifier and Reserved words – Naming conventions in Python.	3	
II	Operators in Python – Operator Precedence and Associativity - Mathematical Functions – Input and Output statements Control Statements	4	Presentation, Chalk and Talk and Assignments
	– if, if...else and if...elif...else statements	3	
	Loops: While – for – Infinite – Nested	3	
	The else Suite – break – continue – pass – assert – return statements	2	
III	Array – Advantages of Arrays – Creating an Array – Processing the Arrays – Types of Arrays – Creating Arrays in numpy	5	Presentation, Chalk and Talk, Assignments
	Mathematical Operations on Arrays – Attributes of an Array – Working with Multidimensional Arrays.	3	
	Matrices in numpy – Operations on Matrices in Python	4	
IV	Pandas: Data structures for Statistics – Data Handling – Grouping – Statsmodels: Tools for Statistical Modeling – Seaborn: Data Visualization	5	Presentation, Chalk and Talk, Assignments
	Datatypes: Categorical, Numerical – Plotting in Python – Functional and Object-Oriented Approaches to Plotting	4	
	Interactive Plots – Displaying Statistical Datasets – Univariate Data – Bivariate and Multivariate Plots.	3	
V	Tests of Means of Numerical data – Distribution of a Sample Mean – Comparison of Multiple Groups	5	Assignments and Seminar
	Tests on Categorical Data: One Proportion, Frequency Tables	4	
	Linear Regression Models: Linear Correlation – Correlation coefficient – Rank Correlation	3	

COURSE LEARNING OUTCOMES

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

CLO	Course Outcome	Knowledge level
CLO1	Explain basic principles of Python Programming Language	Up to K2
CLO2	Apply operators, mathematical functions in Python and Construct control statements in the Python programs	Up to K3
CLO3	Categorize types of Arrays and its advantages and apply NumPy in arrays and matrices	Up to K4
CLO4	Analyze the data via different kinds of plots by importing the suitable python packages	Up to K4
CLO5	Test the hypothesis for the given data using suitable python packages	Up to K4

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

Mapping of Course Outcomes (COs) with Program Outcomes (PO) & Program Specified Outcomes (PSOs)

CLO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO 1	3	2	2	1	-	1	1
CLO 2	3	2	2	2	1	2	2
CLO 3	3	2	2	2	1	2	2
CLO 4	3	2	2	2	1	2	2
CLO 5	3	3	2	3	1	3	3

3 - Advanced Application 2 - Intermediate Level 1- Basic Level

The Components of Assessment shall be

S.No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K1

SUMMATIVE ASSESSMENT - BLUE PRINT

S. No.	CLOs	K – Level	Section A		Section B		Section C (Either/or Choice)	Section D(Open Choice)
			MCQs		Short Answers			
			No. of questions	K - Level	No. of questions	K - Level		
1	CLO 1	Up to K2	2	K1 & K2	1	K1	2(K2 & K2)	1(K2)
2	CLO 2	Up to K3	2	K1 & K2	1	K1	2(K2 & K2)	1(K3)
3	CLO 3	Up to K4	2	K1 & K2	1	K2	2(K3 & K3)	1(K4)
4	CLO 4	Up to K4	2	K1 & K2	1	K2	2(K4 & K4)	1(K3)
5	CLO 5	Up to 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

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	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	10	30	25	25%
K4	-		10	30	40	33.33	33.33%
Total marks	10	10	50	50	120	100	100%

Course designer:

Prof. S. MEENAKSHI SELVARAJ, Assistant Professor, Department of Mathematics and Statistics

DEPARTMENT OF STATISTICS				Class: III B.Sc., Statistics				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective Practical-I	20U6SMP2 (A)	PRACTICAL IN R	2	2	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives

The objective of the course is

1. To acquire programming skills in R.
2. To compute basic Mathematical and Statistical models through R packages.
3. To provide hands on learning experience to nurture their programming skill on R.
4. To demonstrate significant experience with the R program development environment.

S. No.	List of Experiments
1	Using R as a calculator.
2	Constructing frequency graphs.
3	Construction of plots.
4	Computation of Measures of central tendency.
5	Computation of Measures of dispersion.
6	Computation of Quartile deviation, Mean deviation and construction of Box plot.
7	Computation of coefficient of variation and coefficient of skewness and kurtosis.
8	Computation of correlation coefficient covariance, Karl's pearson and Spearman's rank correlation.
9	Graphical representation of Two normal or ordinary variable.
10	Fitting of simple and multiple linear regression.
11	Computing and plotting uniform, binomial and poisson distribution.
12	Computing and plotting normal and multinormal distribution.
13	Computing and plotting Exponential distribution.
14	Testing and hypothesis: One sample, two sample independent t-test and paired t-test

Books for Reference:

1. Quick, J.M. (2010) Statistical Analysis with R, Packt Publishing Ltd., UK.
2. Robert I. Kabacoff, R in Action Data Analysis and Graphics with R, Manning Publications, 2011.
3. Brian Everitt and Torsten Hothorn. A Handbook of Statistical Analysis Using R, 2nd Edition Chapman and Hall/CRC, 2009.
4. Peter Dalgaard, Introductory Statistics with R, Second Edition.

Web Resources:

- <https://www.youtube.com/watch?v=meubQMpubxE>
- <https://www.youtube.com/watch?v=RkbGMP41SiU>
- <https://www.youtube.com/watch?v=SjcUlHh3UJg>
- <https://www.youtube.com/watch?v=LV2cMjGPDxU>
- <https://www.youtube.com/watch?v=10jYstRPDAU>
- <https://www.youtube.com/watch?v=ACWuV16tdhY>
- https://www.youtube.com/watch?v=_GA6EMABh3s
- <https://www.youtube.com/watch?v=E-xpJWjLLtI>
- <https://www.youtube.com/watch?v=q1RD5ECsSB0>
- <https://www.youtube.com/watch?v=778WK1Pf8eI>
- <https://www.youtube.com/watch?v=hciJsCwPmVvk>
- <https://www.youtube.com/watch?v=HenFpbOz6E4>
- https://www.youtube.com/watch?v=scWZAcU8q_c

Rationale for the nature of the course

R program is an interpreter, object-oriented, high-level programming language with dynamic semantics. R Programming is a general-purpose skill used in almost all fields, including Data Science, Scientific and Mathematical computing, Web development, Finance and trading, System automation and administration, computer graphics, basic game development, security and penetration testing, Mapping and geography (GIS Software), etc. This course imparts programming skill to the students. This course is both skill oriented and employability oriented because of the benefits of learning R programme.

Activities having direct bearing on Skill Development /Employability/Entrepreneurship

- Seminars
- Assignments
- Group discussion
- Quiz.

Pedagogy:

Demonstration and Practical Session

COURSE LEARNING OUTCOMES

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

CLO	Description	K - Level
CLO1	Constructing frequency graphs and plots.	Up to K2
CLO2	Describe key terminology, concepts and techniques employed in statistical analysis.	Up to K3
CLO3	Define, calculate, implement probability and probability distribution to solve a wide variety of problems.	Up to K3
CLO4	Conduct and interpret a variety of hypothesis tests to aid decision making.	Up to K4
CLO5	Understand, analyse, interpret correlation and regression to analyse the underlying relationships between different variables.	Up to K4

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

Mapping with Courses Learning Outcomes (CLOs)

CLO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO 1	2	3	2	1	-	-	-
CLO 2	3	3	2	2	1	1	1
CLO 3	3	3	2	2	1	1	1
CLO 4	3	3	2	3	1	1	1
CLO 5	3	3	2	3	1	1	1

3 - Advanced Application

2 - Intermediate Level

1- Basic Level

Course designer:

Dr. R. CHITRA, Assistant Professor, Coordinator, Department of Mathematics and Statistics.

Prof. G.K. LAKSHMI, Assistant Professor, Department of Mathematics and Statistics.

DEPARTMENT OF STATISTICS				Class: III B.Sc., Statistics				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
VI	Major Elective Practical	20U6SMP2 (B)	PRACTICAL IN PYTHON	2	2	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives

The objective of the course is

- To acquire programming skills in core Python.
- To compute basic Mathematical and Statistical models through python packages.
- To provide hands on learning experience to nurture their programming skill on python.
- To demonstrate significant experience with the Python program development environment.

S. No.	List of Experiments	K-Level	CLO
1	A python program to convert numbers from octal, binary and hexadecimal systems into decimal number system	K2	CLO1
2	A python program to convert numbers from different number systems into decimal number system	K2	CLO1
3	A python program that displays stars in an equilateral triangular form using a single for loop	K2	CLO2
4	A python program to evaluate Exponential series	K3	CLO2
5	A python program to storing student's marks into an array and finding total marks and percentage of marks	K3	CLO3
6	A python program to sort the array elements using bubble sort technique.	K3	CLO3
7	A python program to perform some mathematical operations on a numpy array	K2	CLO3
8	A python program to plot mathematical expressions using matplotlib.	K3	CLO4
9	A python program to plot 2D data on 3D plot	K4	CLO4
10	A python program to plot a pie chart using matplotlib	K3	CLO4
11	A python program to display employee id numbers on X-axis and their salaries on Y-axis in the form of a bar graph for two departments of a company	K4	CLO4
12	A Python program for testing the mean of the single sample.	K4	CLO5
13	A python program for performing two sample t-test.	K4	CLO5
14	A python program to fit statistical model.	K4	CLO5

Books for Reference:

1. Nageswara Rao R, Core Python Programming, Second Edition 2018, Dreamtech Press, New Delhi.
2. Haslwanter T, An Introduction to Statistics with Python with Application in the Life Sciences, 2016, Springer, Switzerland
3. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", First Edition 2012, O'Reilly.
4. Wesley J. Chun, Core Python programming, Second Edition 2010, Pearson Publications.
5. Mark Lutz, Programming Python, Fourth Edition 2010, O'Reilly Media.
6. Mark Summerfield, Programming in Python 3, 2009, Pearson Addison-Wesley Professional.

Web Resources

- <https://nptel.ac.in/courses/106/106/106106182/>
- <https://www.python.org/about/gettingstarted/>
- <https://www.programiz.com/python-programming>
- <https://www.tutorialspoint.com/python/index.htm>
- <https://www.w3schools.com/python/>
- <https://www.math.purdue.edu/~bradfor3/ProgrammingFundamentals/Python/>
- <https://www.w3resource.com/python-exercises/>
- <https://www.practicepython.org/>
- <https://pynative.com/python/>
- <https://cs231n.github.io/python-numpy-tutorial/>

Rationale for the nature of the course

Python is an interpreter, object-oriented, high-level programming language with dynamic semantics. Python Programming is a general-purpose skill used in almost all fields, including Data Science, Scientific and Mathematical computing, Web development, Finance and trading, System automation and administration, computer graphics, basic game development, security and penetration testing, Mapping and geography (GIS Software), etc. This course imparts programming skill to the students. This course is both skill oriented and employability oriented because of the benefits of learning statistical tools in Python.

Activities having direct bearing on Skill Development /Employability/Entrepreneurship

- Seminars
- Assignments
- Group discussion
- Quiz.

Pedagogy:

Demonstration and Practical Session

COURSE LEARNING OUTCOMES

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

CLO	Description	K - Level
CLO1	Explain basic conversion of number systems in Python Programming Language	Up to K2
CLO2	Apply operators, mathematical functions in Python and Construct control statements in the Python programs	Up to K3
CLO3	Construct arrays and apply NumPy in arrays and matrices for programs	Up to K3
CLO4	Analyze the data via different kinds of plots by importing the suitable python packages	Up to K4
CLO5	Test the hypothesis for the given data using suitable python packages	Up to K4

K1 - Remembering and recalling facts with specific answers

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

K3 - Application oriented - Solving Problems

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

Mapping with Courses Learning Outcomes (CLOs)

CLO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO 1	2	3	2	1	-	-	-
CLO 2	3	3	2	2	1	1	1
CLO 3	3	3	2	2	1	1	1
CLO 4	3	3	2	3	1	1	1
CLO 5	3	3	2	3	1	1	1

3 - Advanced Application

2 - Intermediate Level

1- Basic Level

Course designer:

Prof. S.MEENAKSHI SELVARAJ, Assistant Professor, Department of Mathematics and Statistics.

DEPARTMENT OF ECONOMICS				CLASS: III B.Sc., Statistics				
Semester	Course Type	Course Code	Course Title	Credits	Hours	CIA	Ext	Total
VI	Core Elective	20U6SME3(A)	Demography	4	4	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓	Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives

- To know the concept of demography
- To examine the various methods of measuring fertility rate.
- To analyse the causes for decline in mortality rate
- To classify various theories of population
- To explain population growth

Unit	Course Content	Hours	K-Level	CLO
I	Unit- I : Introduction Meaning of Demography – Concepts – Nature and Scope – Importance – population studies and demography – Development of population studies in the world and India-Relationship of Demography with other disciplines.	15	2	1
II	Unit- II: Fertility Introduction – Fertility – Methods of Measuring Fertility: Crude Birth Rate, Corrected Birth Rate, General Fertility Rate – Age Specific Fertility – Total Fertility Rate – Gross Reproduction Rate – Net Reproduction Rate – Completed Fertility Rate – Standardised Fertility Rate – Cohort Fertility Rate – Factors Affecting Fertility: Biological, Physiological, Social and Economic Factors. .	15	3	2
III	Unit- III: Mortality Meaning – Methods of Measuring Mortality: Crude Death Rate, Age Specific Death Rate, Cause Specific Death Rate, Infant Mortality Rate, Standardized Death Rate, Death Rate by Cause – Factors Affecting Mortality – Causes of Decline in Mortality Rates in Developing Countries.	15	3	3
IV	Unit – IV: Theories of Population Malthusian Theory of Population – Optimum Theory of Population – Karl Marx’s Theory of Surplus Population – Leibenstein’s Motivational Theory of Population.	15	4	4

V	Unit – V: Population Growth and Economic Development Introduction – Effects of Population Growth on Economic Development – Factors Promoting Economic Development – Factors Retarding Economic Development – Effects of Population Growth on Indian Economy.	15	3	5

Books for Study

1. Asha A. Bhende.& Tara Kanikar, (2019). **“Principles of Population Studies”**. Mumbai: Himalaya Publishing House.
2. M.L.Jhingan, B.K.Bhatt, J.N.Desai, (2014). **“Demography”** 2nd Revised Edition, Delhi, Vrinda Publications (P) Ltd.

Books for Reference

1. Bogue, Donald J. (1969). **“Principles of Demography”**. New York: John Wiley and Sons.
2. Baskar D. Misra. (1980). **“An Introduction to the Study of Population”**. Madras: South Asian Publishers Pvt. Ltd.
3. Malthus, Ghosh. (2011). **“An Essay on the Principles of Population”**. New Delhi: Atlantic Publications.
4. Srinivastava.(2005). **“A Textbook of Demography”**. New Delhi: Vikas Publishing House.
5. Sharma, Rajendran K. (2020). **“Demography and Population Problems”**. New Delhi: Atlantic Publications.

Web Resources

1. <https://www.pdfdrive.com/demography-the-study-of-human-population-e187590068.html>
2. <https://www.pdfdrive.com/concepts-methods-and-practical-applications-in-applied-demography-an-introductory-textbook-e187392458.html>

Rationale for Nature of the Course

A study of Demography seeks to understand population dynamics by investigating three main demographic processes: birth, death, migration, and aging (including death).

Activities having direct bearing on Skill Development / Employability / Entrepreneurship

- Discussion about Demography
- Population Theories

Pedagogy

Chalk and Talk, Peer Teaching and Learning, ICT enabled teaching aids.

Lesson Plan

Units	Description	Hours	Mode
I	Meaning of Demography, Concepts, Nature and Scope and Importance population studies and demography, Development of population studies in the world and India Relationship of Demography with other disciplines.	5 5 5	Chalk and Talk, Presentation
II	Introduction: Fertility and Methods of Measuring Fertility: Crude Birth Rate, Corrected Birth Rate General Fertility Rate, Age Specific Fertility, Total Fertility Rate, Gross Reproduction Rate, Net Reproduction Rate, Completed Fertility Rate, Standardised Fertility Rate, Cohort Fertility Rate. Factors Affecting Fertility: Biological, Physiological, Social and Economic Factors. .	4 7 4	Chalk and Talk, Presentation
III	Meaning and Methods of Measuring Mortality: Crude Death Rate, Age Specific Death Rate Cause Specific Death Rate, Infant Mortality Rate, Standardized Death Rate, Death Rate by Cause Factors Affecting Mortality, Causes of Decline in Mortality Rates in Developing Countries.	6 5 4	Chalk and Talk, Presentation
IV	Malthusian Theory of Population Optimum Theory of Population Karl Marx's Theory of Surplus Population Leibenstein's Motivational Theory of Population.	4 3 4 4	Chalk and Talk
V	Introduction, Effects of Population Growth on Economic Development Factors Promoting Economic Development Factors Retarding Economic Development Effects of Population Growth on Indian Economy.	5 3 3 4	Chalk & Talk and Assignment

CO	Course Learning Outcomes	Knowledge Level
CLO1	Identify the concepts in demography studies	Up to K2
CLO2	Explain fertility rate	Up to K3
CLO3	Analyse mortality rate	Up to K3
CLO4	Various theories of population	Up to K4
CLO5	Examine the growth of population	Up to K4

Mapping with Course Learning Outcomes (CLOs) with (POs) and (PSOs)

	PO					PSO							
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CLO1	3	2	2	2	-	3	3	3	2	3	3	2	1
CLO2	3	1	3	2	1	3	3	2	-	3	2	2	1
CLO3	3	3	2	3	-	3	3	3	2	3	-	2	1
CLO4	3	3	3	2	1	3	2	3	2	3	2	2	1
CLO5	3	3	3	2	1	3	2	2	-	2	3	2	1

3- Advanced Applications

2- Intermediate Level

1- Basic Level

Articulation Mapping – K Levels with Courses Outcomes (COs)

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 (K3&K3)	1(K4)
5	CLO 5	Up to K4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

The Components of Assessment shall be

S. No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K4
2	CLO5	Seminar	5	K3
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2

Distribution of Section-Wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Section D (No 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	-	-	30	20	50	41.67	42
K4	-	-	-	20	20	16.67	16
Total Marks	10	10	50	50	120	100.00	100

Course Designers: Dr. S.Sureshkannan & Dr. M.Manjula, Assistant Professor, Department of Economics

DEPARTMENT OF STATISTICS				CLASS: III B.Sc., STATISTICS				
Semester	Course Type	Course Code	Course Title	Credits	Hrs	CIA	Ext	Total
VI	Core – Elective IV	20U6SME3(B)	Numerical Methods	4	4	25	75	100

NATURE OF THE COURSE

Knowledge and Skill	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

Course Objectives:

- To reveal understanding of common numerical methods and how they are used to obtain inexact solutions to otherwise difficult mathematical and statistical problems.
- To develop the analytical capability and to impart knowledge on statistical methods.
- To derive numerical methods for various mathematical and statistical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- To select the appropriate numerical technique to solve a given engineering problem.
- To realize the limitations and performance of different schemes in order to interpret the output generated from them.
- To increase the mathematical and statistical skills of the students in the areas of numerical methods.

Unit	Description	Hours	K-level	CLO
I	Solutions for Numerical Algebraic Equations: Bisection method – Iterative Method – False position method – Newton Raphson method – Horner’s method.	18	Up to K2	CLO1
II	Solutions for Simultaneous Algebraic Equations: Gauss Elimination method – Inversion of matrix using Gauss elimination – Method of triangularization method – Crout’s Method – Iterative methods – Gauss Jacobi method – Gauss Seidal method.	18	Up to K3	CLO2
III	Operators and Interpolation for equal intervals: Finite differences – Operators - E, Δ, δ and ∇ and their role in difference tables – Difference of a polynomial – Factorial polynomial – Interpolation for equal intervals – Gregory Newton’s forward and backward interpolation – Problems – Central difference formula – Gauss forward and backward interpolation – Problems.	18	Up to K3	CLO3

IV	Interpolation for unequal intervals: Divided differences – Lagrange’s interpolation formula – Newton’s forward difference formula to get the derivative – Newton’s backward formula to compute the derivative – Strling’s formula – Problems.	18	Up to K3	CLO4
V	Numerical solutions for Integration and Differentiation : Numerical Integration: Trapezoidal rule – Romberg’s method – Simpson’s one – third rule – Simpson’s three – eight rule – Weddle’s rule. Numerical Differentiation : Taylor series method – Euler method – Runge - kutta method – Problems.	18	Up to K4	CLO5

Book for study:

P. Kandasamy , K. Thilagavathy and K. Gunavathy – “Numerical Methods”, S.Chand& Company Ltd., Reprint 2019.

Chapters:

Unit – I: chapter 3 (3.1 – 3.5)

Unit – II: chapter 4 (4.1 – 4.4, 4.7 – 4.9)

Unit – III: chapter 5 (5.1 – 5.4), chapter 6 (6.1 – 6.3), chapter 7(7.1 – 7.4)

Unit – IV: chapter 8 (8.1 – 8.7), chapter 9 (9.1 – 9.4)

Unit – V: chapter 11 (11.5 – 11.7, 11.9 – 11.12)

Books for Reference:

1. S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, - “Numerical Methods”- 2002 scitech publications(India) Pvt.Ltd.
2. Balasubramaniam,Pand Venkatraman, M.K. (1972) Numerical Mathematics, Part I and II, Rochouse and Sons, New Delhi.
3. Saxena, H.C. (1972) Finite differences, S. Chand & Co, New Delhi.
4. Rajaraman, V.(1993) Computer Oriented Numerical Methods, PHI learning, New Delhi.
5. Sastry, S. S. (1993) Introductory Methods of Numerical Analysis, PHI learning, New Delhi.
6. Hutchison, I. H. (2015)A student guide to Numerical Methods, Cambridge University Press, Cambridge.

Web Resources:

1. <https://www.youtube.com/watch?v=mzQFGOvH-mk>
2. <https://atozmath.com/example/CONM/Bisection.aspx?q=fp&q1=E1>
3. <https://byjus.com/maths/gauss-elimination-method/#:~:text=In%20mathematics%2C%20the%20Gaussian%20elimination,rank%20of%20the%20given%20matrix>
4. <https://www.youtube.com/watch?v=gxy6VI1hEfs>
5. <https://www.geeksforgeeks.org/newtons-divided-difference-interpolation-formula/>

6. <https://atozmath.com/example/CONM/NumeInterPola.aspx?q=A&q1=E1>
7. <https://www.cuemath.com/lagrange-interpolation-formula/>
8. <https://atozmath.com/example/CONM/NumeInterPola.aspx?q=SM&q1=E1>
9. https://en.wikipedia.org/wiki/Taylor_series
10. <https://www.sciencedirect.com/topics/mathematics/runge-kutta-method#:~:text=Runge%E2%80%93Kutta%20method%20is%20an,high%20order%20derivatives%20of%20functions.>

Rationale for nature of the course:

Knowledge and skill

Numerical Methods is apprehensive with all aspects of the numerical solution of a problem, from the theoretical development and understanding of numerical methods to their practical implementation as reliable and efficient computer programs. Most numerical analysts specialize in small subfields, but they share some common concerns, perspectives, and mathematical methods of analysis.

Activities having direct bearing on Skill Development /Employability/Entrepreneurship

- Seminars
- Assignments
- Group Discussion
- Quiz.

Pedagogy:

Lecture, Power point Presentation, Group Discussion, Quiz, Seminar, Problem Solving, Tutorial and LMS (CANVAS, FLICKERS).

LECTURE SCHEDULE

Unit	Description	Hours	Mode
I	Introduce the concept of solution of numerical algebraic and transcendental equations-The bisection method – Iteration method – Problems.	6	Lecture, Quiz
	Criterion of order of convergence of Newton's method - Regula false method - Problems.	6	Problem Solving
	Horner's Method and some related problems.	6	Problem Solving
II	Finding the Solution of simultaneous linear algebraic equations-Gauss Elimination method and inversion matrix using Gauss elimination method and some related problems.	6	Lecture, Presentation
	Method of triangularation and some related problems	6	Problem Solving
	Gauss Jordan method- Gauss Jacobi - Gauss Seidal method and derive some related problems.	6	Problem Solving
III	Finite Differences definition-First and higher order differences - Forward and backward differences related problems- Properties of operator Differences of a polynomial.	6	Lecture, Problem Solving, Quiz
	Factorial polynomial - Error propagation Operator E and E-1 Relation among Δ , E , ∇ , δ , E - summation of series and some problems.	6	Lecture, Presentation
	Newton's forward - backward interpolation formula - Gauss forward - backward interpolation formula some related problems.	6	Lecture, Presentation
IV	Divided differences - Newton's divided difference formula - Lagrange's interpolation and related problems.	6	Lecture, Problem Solving
	Newton's forward difference formula to get the derivative – Newton's backward formula to compute the derivative and problems.	6	Lecture, Presentation
	Striling's formula and related Problems.	6	Problem Solving
V	Derivatives using Trapezoidal rule - Simpson's 1/3 and 3/8th rule - Weddle's rule and problems – Romberg's Integration.	6	Lecture, Problem Solving
	Introduction of Numerical solution of ODE-definition-Taylor's series method and related problems	6	Lecture, Presentation, Assignment
	Explain the concept of Euler's Modified method- Runge-Kutta method and some problems.	6	Lecture, Assignment
Total Hours		90	

Course Learning Outcome

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

CLO	Description	K - level
CLO1	Apply the basic concepts and techniques of solving algebraic and transcendental equations to find roots using bisection, linear interpolation, Newton's methods	Up to K2
CLO2	Demonstrate understanding and ability to solve the simultaneous linear equation using Gauss elimination, Jacobi and Gauss-Seidel iteration method	Up to K3
CLO3	Solve the numerical techniques of interpolation and error approximations in various intervals in real life situations	Up to K3
CLO4	Display considerate and ability to use Lagrangian formula, Gauss forward and backward interpolation formula for solving unequal interpolation problems.	Up to K3
CLO5	Express indulgent and ability to solve numerical differentiation and integration using Trapezoid rule, Simpson's rule, and Taylor and Euler series.	Up to K4

K1- Recall, K2 – Understanding, K3 – Applying, K4 – Analyzing and K5 - Evaluating

Mapping with Course Learning Outcomes (CLOs) with (POs) and (PSOs)

	PO					PSO							
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CLO1	3	3	3	2	2	3	2	2	3	3	2	2	1
CLO2	3	3	3	2	2	3	3	2	3	2	2	2	1
CLO3	3	3	3	2	1	3	3	2	3	2	2	2	1
CLO4	3	2	3	2	2	3	2	2	3	2	2	2	1
CLO5	3	2	3	2	1	3	2	2	3	2	2	2	1

3- Advanced Applications

2- Intermediate Level

1- Basic Level

The Components of Assessment shall be

S. No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K4
2	CLO5	Seminar	5	K3
3	CLO1, CLO2, CLO3, CLO4, CLO5	Quiz	5	K2

Learning Outcome Based Education (LOBE) & Assessment

Summative Examination – Blue Print

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

Units	CLOs	K. Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of questions	K. Level	No. of questions	K. level			
1	CLO 1	Up to K2	2	(K1&K2)	1	K1	2(K1& K1)	1(K2)	
2	CLO 2	Up to K3	2	(K1&K2)	1	K2	2(K3 & K3)	1(K3)	
3	CLO 3	Up to K3	2	(K1&K2)	1	K1	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	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

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	41.67%
K2	5	6	10	10	31	25.84	
K3	-	-	20	30	50	41.66	41.66%
K4	-	-	10	10	20	16.66	16.66%
Total marks	10	10	50	50	120	100	100%

Course Designer

Prof. N.SRIVIVEKA SARATHA, Assistant Professor, Department of Mathematics and Statistics



THE MADURA COLLEGE, MADURAI
DEPARTMENT OF STATISTICS

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)

PSO1 – Placement: To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

PSO 2 – Entrepreneur: To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

PSO3 – Research and Development: Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.

PSO4 – Contribution to Business World: To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO 5 – Contribution to the Society: To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Eligibility criteria for Admission

A candidate who has acquired B.Sc., degree in Statistics or B.Sc., degree in Mathematics shall permit to join the course.

Duration of the Course

The students shall undergo prescribed course of study for the period of two academic years under CBCS semester pattern with outcome based education.

Medium of Instruction: English

System: Choice Based Credit System with Outcome Based Model

Courses of Study with Credit Distribution

Credits	Sem I	Sem II	Sem III	Sem IV	Total
Part A	12	14	19	17	62
Part B					
(i) Discipline – Centric / Generic Skill	6	6	3	3	18
(ii) Skill Enhancement	2	2	2	2	10
(iii) Summer Internship / Industrial Training			2		
Part C				1	1
Total	20	22	26	23	91

Nature of the Course

Courses are classified according to the following nature

- Skill Oriented
- Employability Oriented
- Entrepreneurship Oriented

Teaching & Evaluation Pattern

- Outcome Based Education (OBE) & Assessment
- This curriculum is designed based on Tamilnadu State Council for Higher Education (TANSCH) State Integrated Board of Studies and UGC.
- Students understanding must be built on and assessed for wide range of learning activities, which includes different approaches and are classified along several bases, such as

Based on Purpose

- **Formative** (Internal tests, Assignment, Seminar, Quiz, ICT based Assignment etc.)
- **Summative** (Evaluation of students learning at the end of instructional unit)
- **Based on Domain knowledge: (Post Graduate Up to K4 Levels)**
- Assessment through K1, K2, K3, K4

Evaluation

Methods	Marks
Formative (CIA)	25
Summative (External)	75
Total	100

Formative Test (CIA-Continuous Internal Assessment): 25 Marks

- Centralised system of Internal Assessment Tests
- There will be a two internal assessment tests
- Duration of Internal assessment test will be 1 hour
- Students shall write retest on the genuine grounds if they are absent in either Test I or Test II with the approval of HoD and the Principal.

Question Paper Pattern for Formative Test

Section	Question pattern	Marks
A	Short answer (2 X 2 ½ marks)	5
B	Either / Or type (2 X 5 marks)	10
C	Open choice type (1 out of 2 X 10 marks)	10
Total		25

The blue print for the internal test will be as follows.

Pattern	No. of questions	Marks per question	Total marks
Part A (Short answer type - no choice)	2	2 ½	5
Part B (Paragraph answer type - Either-or)	2	5	10
Part C (Essay type - open choice – one question to be answered out of 2 questions asked)	1/2	10	10
Total marks		25	

- 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

- For the purpose of Formative assessment (CIA), the course teacher may decide the CLO for the two tests as per the following conditions.
 - i. Any two CLOs shall be considered for the first test.
 - ii. Two CLOs (other than those already considered for the first test) shall be considered for the second test.
 - iii. The remaining CLO may be considered for assignment

Question Paper Pattern for Summative Examination

Section	Question pattern	Marks
A	Multiple choice (10 X 1 marks)	10
B	Short answer (5 X 2 marks)	10
C	Either / Or type (5 X 5 marks)	25
D	Open choice type (3 out of 5 X 10 marks)	30
Total		75

In respect of external examinations passing minimum is 45% for PG Courses and in total, aggregate of 50%. The curriculum is revised to suit the changing trends by propagation of ideas ensuring professional growth through innovative method of teaching.

Evaluation Pattern for Practical Papers

I) Continuous Internal Assessment: 40 Marks

Internal Components	Marks
Internal test	30
Observation	10
Total	40

II). External Assessment: 60 Marks (50 marks – practical + 10 marks – viva)

Total marks (I + II): 100 Marks

DEPARTMENT OF STATISTICS
THE MADURA COLLEGE (AUTONOMOUS), MADURAI

M.Sc. Statistics curriculum structure

(Under OBE pattern for the students admitted during the academic year 2023 - 24 onwards)

M.Sc. First Year Semester I

List of Courses	Course Code	Credit	Hours
Core-I (Real Analysis & Linear Algebra)	23P1SCCT1	5	6 (5L + 1T)
Core-II (Sampling Methods)	23P1SCCT2	5	6 (5L + 1T)
Core-III (Distribution Theory)	23P1SCCT3	4	6 (5L + 1T)
Elective – I (Categorical Data Analysis or Population Studies)	23P1SECT1(A) 23P1SECT1(B)	3	5 (4L + 1T)
Elective – II (Bayesian Inference or Clinical Trails)	23P1SECT2(A) 23P1SECT2(B)	2	3 (3L)
Elective – III (Practical in R (Core II &III based) or Data analysis in MS Excel (Core II &III based))	23P1SECP1(A) 23P1SECP1(B)	1	2
Skill Enhancement Course -SEC 1 (Statistical Practical-I (Calculator based) – Core II &III)	23P1SSED1	2	2
Total		22	30

M.Sc. First Year Semester II

List of Courses	Course Code	Credit	Hours
Core-IV (Estimation Theory)	23P2SCCT4	5	6 (5L + 1T)
Core-V (Measure and Probability Theory)	23P2SCCT5	5	6 (5L + 1T)
Core-VI (Time Series Analysis)	23P2SCCT6	4	6 (5L + 1T)
Elective – IV (Actuarial Statistics or Simulation Analysis)	23P2SECT3(A) 23P2SECT3(B)	3	5 (4L + 1T)
Elective – V (Survival Analysis or Econometrics)	23P2SECT4(A) 23P2SECT4(B)	2	3 (3L)
Elective – VI Practical in R (Core IV &VI based) Or Data Analysis in SPSS (Core IV &VI based)	23P2SECP2(A) 23P2SECP2(B)	1	2
Skilled Enhancement Course (NME) – Statistical Survey	23P2SSEN1	2	2
Total		22	30

M.Sc. Statistics - I Year – First Semester

List of Courses	Course Code	Credit	Hours
Core-I (Real Analysis & Linear Algebra)	23P1SCCT1	5	6 (5L + 1T)
Core-II (Sampling Methods)	23P1SCCT2	5	6 (5L + 1T)
Core-III (Distribution Theory)	23P1SCCT3	4	6 (5L + 1T)
Elective – I (Categorical Data Analysis or Population Studies)	23P1SECT1(A) 23P1SECT1(B)	3	5 (4L + 1T)
Elective – II (Bayesian Inference or Clinical Trails)	23P1SECT2(A) 23P1SECT2(B)	2	3 (3L)
Elective – III (Practical in R (Core II &III based) or Data analysis in MS Excel (Core II &III based))	23P1SECP1(A) 23P1SECP1(B)	1	2
Skill Enhancement Course -SEC 1 (Statistical Practical-I (Calculator based) – Core II &III)	23P1SSED1	2	2
Total		22	30

Semester wise Mapping of Course with Programme Specific Outcomes (PSOs)

Course Type	CC1	CC2	CC3	Elective - I	Elective - I	Elective - II	Elective – II	Elective – III	Elective – III	Skill Enhancement Course -SEC 1
Course Title	Real Analysis and Linear Algebra	Sampling Methods	Distribution Theory	Categorical Data Analysis	Population Studies	Bayesian Inference	Clinical Trails	Practical in R (Core II &III based)	Data analysis in MS Excel (Core II &III based))	Statistical Practical-I (Calculator based) – Core II &III
PSO1	3	3	3	2	3	2	3	2	3	3
PSO2	2	3	3	2	3	2	3	3	2	2
PSO3	2	3	3	3	3	3	3	3	2	2
PSO4	3	2	2	2	3	2	3	3	3	3
PSO5	2	2	2	3	2	3	2	2	2	2

Title of the Course		Real Analysis & Linear Algebra						
TANSCHÉ Course type		CC1						
Course Category		Core						
Nature of Course		Skill Development						
Category	Course	Year	I	Credits	5	Course Code	23P1SCCT1	
		Semester	I					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		5		1				6
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Undergraduate level Vector Algebra and Matrix Theory						
Objectives of the Course		1. To provide recollection as well as building Mathematical foundation in Real Analysis and Matrix Theory 2. To understand concepts and definition of metric space and theorems related to it 3. To know integration and differentiation concepts and its application, to know real functions in one variable as well as several variables, understand it on numerical problems 4. To know Linear space and its basis. Rank of a matrix, characteristic roots and its multiplicity, Different types of inverses, numerical examples and real life application 5. To know Different types of matrices, orthogonality, canonical forms, decomposition of matrix, quadratic forms, numerical examples and real life applications						
Course Outline		UNIT-I : Metric Space – open, closed sets – Intervals (rectangles), Real valued Continuous functions- Discontinuities - compact sets, Bolzano – Weirstrass theorem, Heine – Borel theorem.						
		Unit II: Derivatives - maxima and minima - Riemann integral & Riemann – Stieltjes integral with respect an increasing integrator – properties of R.S. integral. Functions of several variables, constrained and unconstrained maxima – minima of functions, partial and total derivatives						

	Unit III: Basic properties of matrices (orthogonal, idempotent, Kronecker product, projection operators etc); Linear dependence, independence and rank of a matrix; characteristic roots and polynomial, multiplicity of characteristic roots; Cayley Hamilton theorem; inverse of a matrix and determinants;
	Unit IV: Reduction of matrices, Echelon form, Hermite canonical form, diagonal reduction, rank factorization, triangular reduction Jordan form; Symmetric matrices and its properties; Decomposition like, singular value decomposition, spectral decomposition, Cholesky decomposition etc.
	Unit V: Matrix differentiation; Generalized inverse and its properties, Moore-Penrose inverse; Application of g-inverse; Quadratic forms, classification, definiteness, index and signature, extremum; transformation and reduction of quadratic form; applications of quadratic forms.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	This course will enable the students to comprehend the theoretical and applied concepts of Real analysis and Linear Algebra which enables to apply for the statistical concepts.
Text Book(s)	1. Rudin, Walter (1976) : Principles of Mathematical Analysis, McGraw Hill. 2. Apostol, T.M. (1985) : Mathematical Analysis, Narosa, Indian Ed. 3. Graybill, F.A. (1983) : Matrices with application in Statistics, 2nd ed. Wadsworth. 4. Rao, C.R. & Bhimasankaran, P.(1992) : Linear algebra, Tata McGraw Hill Pub. Co. Ltd. 5. Searle, S.R. (1982) : Matrix Algebra useful for Statistics, John Wiley and Sons, Inc.
Reference Book(s)	1. Royden, H.L.(1995) : Real analysis, 3ed., Prentice Hall of India. 2. Rangachari, M.S.(1996) : Real Analysis, Part 1, New Century Book House. Ash, 3. R.B. (1972): Real analysis and probability, Academic press. 4. Biswas, S. (1984): Topics in Algebra of Matrices, Academic Publications. 5. David, A.Harville(1997) : Matrix algebra from a statistician's perspective, Springer. 6. Hoffman, K. and Kunze, R. (1971) : Linear Algebra, 2nd ed. Prentice Hall, Inc.

Websites and e-Learning resources	1. Euclidean space and metric space: https://www.math.uci.edu/~gpatrick/source/205b06/chapviii.pdf 2. Taylors theorem https://www.youtube.com/watch?v=LEspaisjDFE 3. Riemann-Stieltjes integral https://www.youtube.com/watch?v=TpKIeWgcmC8 4. Vector space https://www.youtube.com/watch?v=1XIT3Y2oyAU 5. Linear transformation and matrix https://amsi.org.au/ESA_Senior_Years/SeniorTopic8/8a/8a_2content_3.html 6. Linear algebra https://www.commonlounge.com/discussion/efdfcf2937b94fbeb7a3e1a309381d85

COURSE OUTCOMES:

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

	Course Outcome	K-level
CO1	Get a Mathematical foundation in Real analysis and Matrix Theory to understand univariate and multivariate concepts in Statistical Theory	K2
CO2	Get a clear understanding R.S. integral, partial differentiation in several variable functions, get theoretical knowledge by understanding the need and application of theorems like Bolzano – Weirstrass theorem, Heine– Borel theorem	K3
CO3	Understand concepts in matrix theory -rank and factorization, inverse of matrix, g-inverses and its applications, characteristic roots and its multiplicity, canonical forms and decomposition of matrix, orthogonality, quadratic forms and its index, solving linear system	K3
CO4	Able to get solve numerical problems and evaluate and interpret outcome	K4
CO5	analyze real life problems and explore research problems	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	2	3	3	3	3	3	3
CLO2	3	3	3	3	2	3	3	3	3	3	3
CLO3	3	3	3	2	3	3	3	3	3	3	3
CLO4	2	3	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	2	3	3	3	3	3	3

Assessment Schema**Components of CIA**

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

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 (K3&K3)	1 (K3)
3	CLO 3	Up to K3	2	K2 & K3	1	K2	2 (K2&K2)	1 (K3)
4	CLO 4	Up to K4	2	K3 & K4	1	K2	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

Distribution of Marks with K Level for Summative Examination

K - Level	Section A (MCQ)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Chioce)	Total Marks	% of (Marks without Choice)	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30.00	30%
K4	2	-	20	20	42	35.00	35%
K5	-	-		-			
Total	10	10	50	50	120	100	100

Course Designer:

Dr. M. Venkateswaran

Title of the Course		Sampling Methods					
TANSCHÉ Course type		CC2					
Course Category		Core					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23P1SCCT2
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		5	1	-		6	
Marks		CIA	Semester			Total	
		25	75			100	
Pre-requisite(s)		Undergraduate Statistical Inference					
Objectives of the Course		- To cover sampling design and analysis methods - To explain and compare various sampling procedures. - To understand the concepts of bias and sampling variability and strategies for reducing the bias and sampling variability.					
Course Outline		Unit I: Preliminaries – Simple Random Sampling - PPS selection methods					
		Unit II: Midzuno sampling method – PPSWR and PPSWOR sampling methods – Ordered and Unordered estimators					
		Unit III: Stratified Sampling – Allocation Problems – Systematic Sampling Methods – Balanced, Modified and Centered systematic sampling methods – Yates corrected estimator.					
		Unit IV: Ratio Estimation – Unbiased Ratio Type estimators – Regression Estimation - Double Sampling for Ratio and Regression Estimation					
		Unit V: Multistage Sampling - Randomized Response Methods – Call Back Techniques					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / applied survey techniques adopted in Economics and Statistics department of Tamil Nadu State Government. (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Justification for nature of course		Statistical Techniques provide scientific approaches to develop the domain of human knowledge largely through empirical studies.					
Text Book(s)		- S.Sampath (2005) : Sampling Theory and Methods, Narosha Publishing House. - W.G. Cochran (1965) : Sampling Techniques, Wiley and Sons					

Reference Book(s)	1. M.N.Murthy(1967) : Sampling Theory and Methods: Statistical Publishing Society, Calcutta 2. Parimal Mukhopadhyay (2005) : Theory and Methods of Survey Sampling , Prentice Hall of India 3. P.V.Sukhatme, B.V.Sukhatme, S.Sukhatme and C.Asok (1984) L Theory of Same Surveys with Applications, IASRI, New Delhi 4. Singh, D and Choudhary, F.S. (1977) Theory and Analysis of Sample Survey Designs.Wiley Eastern, New Delhi.
Websites and e-Learning resources	1. https://egyankosh.ac.in/bitstream/123456789/73586/3/Unit-7.pdf 2. http://home.iitk.ac.in/~shalab/course1.htm 3. https://ia801409.us.archive.org/35/items/Cochran1977SamplingTechniques_201703/Cochran_1977_Sampling%20Techniques.pdf 4. http://www.mim.ac.mw/books/S.%20Sampath%20Sampling%20theory%20and%20methods%202001.pdf 5. http://150.107.117.36/NPTEL_DISK4/NPTEL_Content/Web_courses/Phase2_web/111104073/Module7/Lecture24.pdf 6. https://nptel.ac.in/content/storage2/courses/111104073/Module7/Lecture23.pdf 7. https://egyankosh.ac.in/bitstream/123456789/73586/3/Unit-7.pdf 8. https://egyankosh.ac.in/bitstream/123456789/73586/3/Unit-7.pdf 9. http://home.iitk.ac.in/~shalab/course1.htm

COURSE OUTCOMES:

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

CLO's	Course Learning Outcomes	K-Level
CLO-1	To apply basics and advanced levels of sampling methods for different types of data	Upto K3
CLO-2	To draw a conclusion about the best sampling procedure.	Upto K3
CLO-3	To use practical applications of ratio and regression method of estimations.	Upto K4
CLO-4	To analyze data from multi-stage sampling methods.	Upto K4
CLO-5	To estimate the hidden responses using randomized response techniques.	Upto K2

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	3	3	3	3	3	3	3	3	3
CLO2	2	3	3	2	2	2	3	3	3	3	3
CLO3	3	2	3	3	3	2	3	3	3	3	3
CLO4	3	3	3	3	2	2	3	3	3	3	3
CLO5	3	2	3	2	2	2	3	3	3	3	3

Assessment Schema : Components of CIA

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model Display	5

Blueprint for Semester Examination

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	Upto K3	2	K2 & K3	1	K2	2(K2 & K3)	1(K3)
2	CLO 2	Upto K3	2	K2 & K3	1	K2	2(K2 & K3)	1(K3)
3	CLO 3	Upto K4	2	K3 & K4	1	K1	2(K4 & K4)	1(K4)
4	CLO 4	Upto K4	2	K3 & K4	1	K3	2(K4 & K4)	1(K4)
5	CLO 5	Upto K2	2	K1 & K1	1	K1	2(K1 & K1)	1(K2)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section wise marks with K levels for summative Examination

K Levels	Section A MCQs	Section B (Short Answers)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
K5	-	-	-	-	-	-	-
Total marks	10	10	50	50	120	100	100%

Course Designer:

Dr. P. Vetri Selvi

Title of the Course		Distribution Theory					
TANSCHÉ Course type		CC3					
Course Category		Core					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23P1SCCT3
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		-		6
Marks		CIA	Semester				Total
		25	75				100
Pre-requisite(s)		Undergraduate Statistical Inference					
Objectives of the Course		- To provide theoretical knowledge on the concept of functions of random variables and its usage. - To educate the knowledge on the both discrete and continuous distributions. - To acquire the knowledge on deriving its characteristics of distributions.					
Course Outline		Unit I: Brief review of distribution theory, functions of random variables and their distributions using Jacobian of transformation, Laplace and Cauchy distribution, lognormal distribution, gamma, logarithmic series.					
		Unit II: Bivariate Normal distribution – Moment generating function –marginal and conditional distributions. Moments – Distribution of correlation coefficient when population correlation coefficient is equal to zero – Distribution of Regression coefficients.					
		Unit III: Sampling distributions, truncated normal distribution ,non-central chi-square distribution, t and F distributions and their properties, distributions of quadratic forms under normality and related distribution theory – Cochran’s and James theory.					
		Unit IV: Order statistics their distributions and properties, Joint and marginal distributions of order statistics, extreme value and their asymptotic distributions, approximating distributions of sample moment, delta method.					
		Unit V: Kolmogorov Smirnov distributions, life distributions, exponential, Weibull and extreme value distributions Mills ratio, distributions classified by hazard rate.					
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired		Knowledge, Problem Solving, Analytical ability, Professional Competency,					

from this course	Professional Communication and Transferrable Skill
Justification for nature of course	Statistical Techniques provide scientific approaches to develop the domain of human knowledge largely through empirical studies.
Text Book(s)	1. Gibbons (1971) : Non-parametric inference, Tata McGraw Hill. 2. Rohatgi, V.K. and Md. Whsanesh Saleh, A.K.(2002): An introduction to probability & Statistics, John Wiley and Sons
Reference Book(s)	1. Rao, C.R. (1973) : Linear statistical inference and its applications, 2ed, Wiley Eastern. 2. Mood,A.M. & Graybill, F.A. and Boes, D.C. : Introduction to the theory of statistics, McGraw Hill. Johnson,S. & Kotz,(1972): Distributions in Statistics, Vol. I, II & III, Houghton & Mifflin. 3. Dudewicz, E.J., Mishra, S.N.(1988) : Modern mathematical statistics, John Wiley. Searle, S.R.(1971) : Linear models, John Wiley
Websites and e-Learning resources	1. https://www.researchgate.net/publication/344320988_An_Introduction_to_Probability_and_Statistics 2. https://www.usb.ac.ir/FileStaff/7344_2018-12-2-10-44-10.pdf 3. https://sistemas.fciencias.unam.mx/~misraim/Mood.pdf 4. https://www.stat.rice.edu/~dobelman/textfiles/DistributionsHandbook.pdf 5. https://www.probabilitycourse.com/chapter5/5_3_2_bivariate_normal_dist.php 6. https://www2.stat.duke.edu/courses/Spring12/sta104.1/Lectures/Lec22.pdf 7. https://www.probabilitycourse.com/chapter5/5_3_3_solved_probs.php 8. http://athenasc.com/Bivariate-Normal.pdf 9. https://pages.stat.wisc.edu/~shao/stat609/stat609-13.pdf 10. http://amath2.nchu.edu.tw/honda/605Lecture/Lecture%2005_addendum_Chisquare,t%20and%20F%20distributions.PDF 11. https://www.maths.dur.ac.uk/stats/courses/Proba34/1617Probability34H.pdf 12. https://www2.stat.duke.edu/courses/Spring12/sta104.1/Lectures/Lec15.pdf 13. https://www.tutorialspoint.com/statistics/kolmogorov_smirnov_test.htm 14. https://www.weibull.com/hotwire/issue128/relbasics128.htm

COURSE OUTCOMES:

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

CLO's	Course Learning Outcomes	K-Level
CLO-1	To understand the knowledge on importance of the random variables and its role in the distribution theory.	Upto K2
CLO-2	To explain the moments for the data come from the univariate and bivariate distributions.	Upto K3
CLO-3	To interpret the properties of special univariate continuous distributions, truncated normal distribution and few non-central distributions.	Upto K4
CLO-4	To analyze data from multi-stage sampling method To interpret the distributions of order statistics with regard to Median, Sample Range and Joint distribution of order two.	Upto K3
CLO-5	To identify the data distribution based on One sample and two samples using KS tests.	Upto 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	2	3	3	3	3	3
CLO2	2	3	3	2	2	2	3	3	3	3	3
CLO3	3	3	3	3	3	2	3	3	3	3	3
CLO4	2	3	3	3	3	3	3	3	3	3	3
CLO5	3	2	3	3	3	2	3	3	3	3	3

Assessment Schema**Components of CIA**

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model Display	5

Blueprint for Semester Examination

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 & 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	K3 & K4	1	K3	2(K4 & K4)	1(K4)
4	CLO 4	Up to K3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)
5	CLO 5	Up to K4	2	K3 & K4	1	K2	2(K4 & K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of section wise marks with K levels for Summative Examination

K Levels	Section A MCQs	Section B (Short Answers)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	
K4	2	-	20	20	42	35	35%
K5	-	-	-	-	-	-	-
Total marks	10	10	50	50	120	100	100%

Course Designer:

Dr. P. Vetri Selvi

Title of the Course		Categorical Data Analysis						
TANSCHÉ Course type		EC1						
Course Category		Elective (Discipline Specific)						
Nature of Course		Skill Development and Employability						
Category	Core	Year	I	Credits	3	Course Code	23P1SECT1(A)	
		Semester	I					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		4		1		-		5
Marks		CIA			Semester		Total	
		25			75		100	
Pre-requisite(s)		Basic knowledge in mathematics, probability theory and R programming.						
Objectives of the Course		1. To equip the students with knowledge of various data models 2. To create and apply modelling on various data sets.						
Course Outline		Unit I: Categorical response data – Probability distribution for categorical data (Binomial and Multinomial distribution) – Statistical inference for a proportion and discrete data.						
		Unit II: Introduction to contingency tables: 2×2 and $r \times c$ tables – measures of association and nonparametric methods. Tests for independence and homogeneity of proportions - Fishers exact test - Odds ratio and Logit, other measures of association - Introduction to 3-way tables – full independence and conditional independence - collapsing and Simpsons paradox.						
		Unit III: Generalized linear models: Components – Generalized linear models for binary data – counts and rates – Statistical inference and model checking.						
		Unit IV: Logistic regression: model – statistical inference – logistic regression with categorical predictors. Multiple logistic regression – Summarizing effects in logistic regression – Summarizing predictive power.						
		Unit V: Log linear models: Log linear model for counts and contingency tables – Statistical inference – log linear and logistic model connection. Models for matched pairs: Comparing dependent proportions for binary matched pairs – Quasi – independence model – Kappa summary – Baralely – Terry model for paired preferences.						
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)						

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Knowledge on analysing skill on discrete data will be gained.
Text Book(s)	1. Agresti, Alan. (1996) An Introduction to Categorical Data Analysis, Wiley, New York. 2. Bergsma, W. Croon, M.A. and Hagenaars, J.A. (2009) Marginal Models: For Dependent, Clustered, and Longitudinal Categorical Data. Springer, New York. 3. Bishop, Y.M. Fienberg, S.E. and Holland, P.W. (1975) Discrete Multivariate Analysis: Theory and Practice, MIT Press, Cambridge.
Reference Book(s)	1. Edwards, D. (2000). Introduction to Graphical Modeling, 2/e, Springer, New York. 2. Fienberg, S.E. (1980). The Analysis of Cross-Classified Categorical Data. MIT Press, Cambridge. 3. Wasserman, L. (2004) All of Statistics: A Concise Course in Statistical Inference. Springer, New York. 4. Whittaker, J. (1990) Graphical Models in Applied Multivariate Statistics, Wiley, New York.
Websites and e-Learning resources	1. Logit Model https://www.youtube.com/watch?v=70JBhL05TAA 2. Logistic regression https://www.youtube.com/watch?v=NmjT1_nClzg 3. Multinomial, ordinal data and logistic regression https://www.youtube.com/watch?v=rrB6szcQiUY

COURSE OUTCOMES:

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

CLO's	Course Learning Outcomes	K-level
CLO1	Understand the distribution and apply on ordinal data sets with advanced models	Upto K2
CLO2	Develop various suitable contingency tables for categorical data.	Upto K3
CLO3	Design the generalized linear models for different categorical data.	Upto K4
CLO4	Understanding, applying and inference the concept of logistic model.	Upto K4
CLO5	Application for log linear models and matched paired category data.	Upto 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	3	3	3	3	3	3	2	3
CLO2	3	2	3	3	3	3	3	2	3	3	3
CLO3	3	3	2	3	2	3	3	3	2	3	3
CLO4	3	3	3	2	2	2	2	3	3	3	3
CLO5	3	3	3	2	2	3	3	3	3	3	2

Assessment Schema**Components of CIA**

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

SL. No	CLOs	K-level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO 1	Up to K 2	2	K1 & K1	1	K1	2(K1& K1)	1(K2)	
2	CLO 2	Up to K 3	2	K2& K3	1	K1	2(K2 & K2)	1(K3)	
3	CLO 3	Up to K 3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)	
4	CLO 4	Up to K 4	2	K3 & K4	1	K2	2(K4& K4)	1(K4)	
5	CLO 5	Up to K 4	2	K3& K4	1	K3	2(K4& K4)	1(K4)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

Distribution of Marks with K Level for Summative Examination

K - Level	Section A (MCQ)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Chioce)	Total Marks	% of (Marks without Choice)	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30.00	30%
K4	2	-	20	20	42	35.00	35%
K5	-	-		-			
Total	10	10	50	50	120	100	100

Course Designer:
Dr. R. Madhanagopal

Title of the Course		Population Studies						
TANSCHÉ Course type		EC1						
Course Category		Elective (Discipline Specific)						
Nature of Course		Skill Development and Employability						
Category	Elective	Year	I	Credits	3	Course Code	23P1SECT1 (B)	
		Semester	I					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		4		1		-		5
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Basic level mathematics						
Objectives of the Course		• To understand the concept of population growth and its consequences. • To know from where one can collect the data related to population. • To know the structure and characteristics of population. • To explain, reasoning and compare the population growths.						
Course Outline		Unit I: Population studies: Nature and Scope – population studies and demography – Development of population studies – Development since second world war – II. Development of population studies in India: Pre – independence and post independent period – Interrelation between population studies and other disciplines.						
		Unit II: Source of population data: Population census – Vital statistics or registration of vital events – Civil registration in India – Sample surveys – Dual report system – population register – international publications. Population theories: Theory of Malthus – Marxist and socialist view – Growth theories.						
		Unit III: Population structure and characteristics – Sex and Age structure – Marital status - Literacy and education attainment.						
		Unit IV: Mortality: Rates and ratios of vital events – Crude death rate – Specified death rate – Age – specific death rate – Infant mortality rate – Standardised death rate. Fertility: Crude birth rate – General fertility rate – Specific fertility rate – Age-specific fertility rate – Total fertility rate. Measure of population growth: Crude rate of natural increase and Pearle’s vital index – Gross and Net reproduction rate.						
		Unit V: Migration: Concept – Immigration and emigration, in and out migration – Internal migrations – methods of measuring internal migration – Internal migration in India – International migration – Population polices: Indian population policy.						

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Students will gain skill on basic of population structure and data collection, computations of mortality and fertility.
Text Book(s)	1. Asha A. Bhende and Tara Kanitkar (1994) Principles of population studies, Himalayan publication house, India. 2. Gupta S.C and Kapoor V.K (2009) Fundamentals of Applied Statistics, Sultan Chand and sons.
Reference Book(s)	1. Krishnamurthy Srinivasan (2017) Population concerns in India shifting trends, policies and programs, SAGE publication, New Delhi. 2. Dudley L. Poston (2019) Handbook of population, part of book series “Handbooks of sociology and social research”, Second edition, Springer. 3. Hans Raj (2007) Fundamentals of demography: Populations Studies special reference with India, Surjeet publications, India.
Websites and e-Learning resources	Population studies https://www.youtube.com/watch?v=pgmRT8VBwRA&list=PLFW6lRTa1g80WOAEi_LA2IKZu-eUlzEQq https://www.youtube.com/watch?v=0PbQ5f0dexQ&list=PLFW6lRTa1g80WOAEi_LA2IKZu-eUlzEQq&index=2 Source of data https://www.youtube.com/watch?v=ZJphOd5V3oU Population size, Distribution and growth https://www.youtube.com/watch?v=8d8h1m3Zn4I Demographic transition Theory https://www.youtube.com/watch?v=Pui3XjIC2II

COURSE OUTCOMES:

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

CLO's	Course Learning Outcomes	K-level
CLO1	Know how the population studies have developed and its outlines.	Upto K2
CLO2	Collect the data related to population from various sources.	Upto K3
CLO3	Understand and explain the characteristics and structure of the population	Upto K4
CLO4	Know to calculate and compare the mortality and fertility rates.	Upto K4
CLO5	Know how mitigation influences population and its policies.	Upto K3

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	2	2	2	3	3	3	3	2	3
CLO2	3	2	2	2	2	3	3	2	3	3	3
CLO3	3	3	3	3	3	3	3	3	3	2	3
CLO4	3	3	3	3	3	3	2	3	3	3	3
CLO5	3	3	3	3	3	3	3	3	3	3	2

Assessment Schema

Components of CIA

Component	Weight / Mark
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

SL. No	CLOs	K-level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO 1	Up to K 2	2	K1 & K1	1	K1	2(K1& K1)	1(K2)	
2	CLO 2	Up to K 3	2	K2& K3	1	K1	2(K2 & K2)	1(K3)	
3	CLO 3	Up to K 3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)	
4	CLO 4	Up to K 4	2	K3 & K4	1	K2	2(K4& K4)	1(K4)	
5	CLO 5	Up to K 4	2	K3& K4	1	K3	2(K4& K4)	1(K4)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

Distribution of Marks with K Level for Summative Examination

K - Level	Section A (MCQ)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Chioce)	Total Marks	% of (Marks without Choice)	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30.00	30%
K4	2	-	20	20	42	35.00	35%
K5	-	-		-			
Total	10	10	50	50	120	100	100

Course Designer:
Dr. R. Madhanagopal

Title of the Course		Bayesian Inference					
TANSCHÉ Course type		EC2					
Course Category		Elective II (Discipline Specific)					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23P1SECT2(A)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		3	-		-		3
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Probability Theory					
Objectives of the Course		- To make the students to understand the basic concepts of the Bayesian Methods. - To study the natural and principled way of prior information. - To educate various estimation methods like point estimation, Interval estimation with Bayes estimators.					
Course Outline		Unit I: Statistical decision theory – loss functions – 0-1, absolute error, squared error– risk function – minimax solution – prior distribution –Bayes risk.					
		Unit II: Subjective probability – its interpretation and evaluation - Subjective determinationof prior distributions-Improper prior, non-informative prior, invariant prior, Jeffreys non informative prior and natural conjugate prior					
		Unit III:Point estimation – Bayes estimators under various loss functions– generalizationto convex loss functions - Evaluation of the estimate in terms of posterior risk.					
		Unit IV: Interval estimation–credible interval, highest posterior density region –Comparison of interpretation of the confidence co-efficient of an interval by Bayesian.					
		UNIT V: Bayesian testing of statistical hypotheses – specification of the appropriate form of the prior distribution for Bayesian hypothesis testing problem–prior odds, posterior odds.					
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge and Professional Competency					

Justification for nature of course	The course provides knowledge to identify various types of Bayesian methods and their properties. The student estimates the result using various methodology.
Text Book(s)	1. Bansal, A.K.(2007) Bayesian Parametric Inference, Narosa, NewDelhi. 2. Berger, J.O. (1985) Statistical Decision Theory and Bayesian Analysis, 2/e, Springer, NewYork. 3. Bernardo, J.M. and Smith, A.F.M. (2000) Bayesian Theory, Wiley, New York.
Reference Book(s)	Bayesian Data Analysis, 3/e, CRC press, London 1. Ghosh,J.K.Delampady,M.andSamanta,T.(2010)AnIntroductiontoBayesianAnalysis: TheoryandMethods, Springer,NewYork. 2. Lee, P.M. (2012) Bayesian Statistics – An Introduction, 4/e,Wiley, London. Leonard, T. and J.S.J. Hsu. (1999) Bayesian Methods: An Analysis for Statisticians and Interdisciplinary Researchers, Cambridge University Press, London. 3. Robert,C.P. (1994) The Bayesian Choice: A Decision Theoretic Motivation, 2/e, Springer, NewYork.
Websites and e-Learning resources	1. Applied Bayesian for Analytics https://onlinecourses.swayam2.ac.in/imb21_mg33/preview 2. Subjective probability https://youtu.be/GC-l345c1FY 3. Point and interval estimation https://youtu.be/rM-QfUFadUU 4. Prior and Posterior distributions https://youtu.be/R9NQY2Hyl14

Course Learning Outcome (For Mapping with Pos and PSOs)

At the end of the Course, Students will be able to

CLO's	Course Learning Outcomes	Knowledge Level
CO1	Acquire the knowledge of statistical decision theory.	Upto K2
CO2	Understand and evaluate the concepts of prior distribution.	Upto K4
CO3	Knowledge about point estimation and the generalization to convex loss functions	Upto K3
CO4	Know how to construct the confidence co-efficient of an interval by Bayesian.	Upto K4
CO5	Apply the concept of Bayesian hypothesis testing problem	Upto K3

MAPPING CLOs WITH PSOs

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	2	1	1	3	1	1	3	3	3	3	3
CLO2	2	3	1	2	1	2	3	3	3	3	3
CLO3	1	2	2	3	1	2	3	3	3	3	3
CLO4	1	1	2	2	3	1	3	3	3	3	3
CLO5	2	2	2	1	1	3	3	3	3	3	3

Assessment Schema

Components of CIA

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Summative Examination– Blue Print

Unit	CLOs	KLevel	Section A		Section B		Section C(Either/or Choice)	Section D(Open Choice)
			MCQs		Short Answers			
			No.of questions	K Level	No.of questions	K level		
1	CLO1	Up toK2	2	K1&K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up toK4	2	K3&K4	1	K2	2(K4&K4)	1(K4)
3	CLO3	Up toK3	2	K2&K3	1	K1	2(K2&K2)	1(K3)
4	CLO4	Up toK4	2	K3&K4	1	K3	2(K4&K4)	1(K4)
5	CLO5	Up toK3	2	K2&K3	1	K2	2(K3&K3)	1(K3)
No.of Questions to be asked			10		5		10	5
No.of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

Distribution of section wise mark with K levels for Summative Examination

K-Levels	Section AMCQs	Section B(Short Answers)	Section C(Either/or)	Section D(Open choice)	Total marks	%of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total marks	10	10	50	50	120	100	100%

Course Designer:
Dr. A. Saberunnisa

Title of the Course		Clinical trials					
TANSCHÉ Course type		EC2					
Course Category		Elective II (Discipline Specific)					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23P1SECT2(B)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		3	-		-		3
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Bio-Statistics					
Objectives of the Course		- To make the students to understand the basic concepts of the clinical trials. - To study the experimental design in clinical trial. - To educate meta analysis and its methods.					
Course Outline		Unit I: Clinical trials –Introduction- defining clinical trials - Practicalities of Usage- Non experimental designs.					
		Unit II: Random Error and Bias- the effects of Random and systematic Error are distinct- Hypothesis tests versus Significance Tests- Two types of random error- The properties of confidence intervals.					
		Unit III: Clinical Bias- random error and bias, Bias from numerous sources, controlling structural bias.					
		Unit IV: Experiment design in clinical trials-Trials as simple experiment designs-goals of experiment design.					
		Unit V: Meta- Analyses- Introduction, cumulative Meta-Analysis, Limitations of Meta-Analysis.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge and Professional Competency					
Justification for nature of course		The course provides knowledge of Clinical trials and its application. It is used in researches to determine new form of treatment and behavioural intervention.					

Text Book(s)	1. Steven Piantadosi.(2017) Clinical Trials, A Methodological Perspective, Third edition by John Wiley & Sons, Inc.
Reference Book(s)	1. Lawrence M.Friedman, Curt D. Furberg, and David L.DeMets (2015) Fundamentals of Clinical Trials, Fifth Edition by Springer. 2. David Machin, Simon Day and Sylvan Green(2004) Textbook of Clinical Trials, second edition by John Wiley & Sons., Ltd. 3. Weichung Joe Shih, Joseph Aisner (2015) Statistical Design and Analysis of Clinical Trials: Principles and methods, by Taylor and Francis Group 4. Stephen B Hulley MD, Steven R Cummings , Warren S Browner, Deborah G Grady , Thomas B Newman(2013), Designing Clinical Research, fourth edition by Lippincott Williams & Wilkins, Wolters Kluwer. 5. David L. De Mets (Editor), Thomas D. Cook (2007), Introduction to Statistical Methods for Clinical Trials, first edition by Taylor and Francis Group.
Websites and e-Learning resources	1. Clinical Trials and Study Designing: https://youtu.be/q0cfYz2rg-4 2. Experimental studies, Designing the clinical trials, various phases https://youtu.be/j06IC68RpPU 3. Meta Analysis https://youtu.be/Omnq13QZ-3c

Course Learning Outcome (For Mapping with Pos and PSOs)

At the end of the Course, Students will be able to

CLO's	Course Learning Outcomes	Knowledge Level
CO1	Acquire the knowledge of clinical trials.	Upto K2
CO2	To identify the concepts of random error and bias.	Upto K4
CO3	Knowledge about clinical bias from numerous sources	Upto K3
CO4	Know how to design the experiments in clinical trials	Upto K4
CO5	Apply the concept of Meta analysis to strengthen the evidence on disease.	Upto K3

MAPPING CLOs WITH PSOs

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	2	1	1	1	3	3	3	3	3
CLO2	2	2	2	3	2	1	3	3	3	3	3
CLO3	3	2	2	2	1	1	3	3	3	3	3
CLO4	2	1	1	3	1	2	3	3	3	3	3
CLO5	1	1	1	3	2	2	3	3	3	3	3

Assessment Schema

Components of CIA

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Summative Examination– Blue Print

Unit	CLOs	KLevel	Section A		Section B		Section C(Either/ or Choice)	Section D(Open Choice)
			MCQs		Short Answers			
			No.of questions	K Level	No.of questions	K level		
1	CLO1	Up to K2	2	K1&K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K4	2	K3&K4	1	K2	2(K4&K4)	1(K4)
3	CLO3	Up to K3	2	K2&K3	1	K1	2(K2&K2)	1(K3)
4	CLO4	Up to K4	2	K3&K4	1	K3	2(K4&K4)	1(K4)
5	CLO5	Up to K3	2	K2&K3	1	K2	2(K3&K3)	1(K3)
No.of Questions to be asked			10		5		10	5
No.of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

Distribution of section wise marks with K levels for Summative Examination

K Levels	Section AMCQs	Section B(Short Answers)	Section C(Either/or)	Section D(Open choice)	Total marks	%of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total marks	10	10	50	50	120	100	100%

Course Designer:
Dr. A. Saberunnisa

Title of the Course		Practical in R (Core II & III based)						
TANSICHE Course type		EC3						
Course Category		Elective						
Nature of Course		Skill Development / Employability / Entrepreneurship						
Category	Core	Year	I	Credits	1	Course Code	23P1SECP1(A)	
		Semester	I					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
						2		2
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Basic R Programming, Theory on Sampling and Distribution						
Objectives of the Course		- Fitting of various distributions with random number generation using R programming. - Sampling distributions and its estimators using R programming.						
Course Outline		List of Practicals using R programming: 1. Fitting of various distributions with random number generation 2. Sample selection using random number 3. Simple random sampling 4. Stratified random sampling – PPSWR 5. Stratified random sampling – PPSWOR 6. Linear Systematic random sampling 7. Circular systematic random sampling 8. Ratio method of estimation 9. Regression method of estimation 10.Circular sampling for equal sizes 11.Horvitz – Thomson estimator; Des- Raj estimator and Murthy estimator						
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved						
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill						

Justification for nature of course	This course will enable the students to study on the various sampling techniques in collecting the data and able to fit the suitable distribution using R programming
Websites and e-Learning resources	1. https://homerhanumat.github.io/elemStats/sampling-and-surveys.html 2. https://rstudio.github.io/r-manuals/r-intro/Probability-distributions.html 3. https://bookdown.org/siju_swamy/Stat_Lab/descriptive-statistics-probability-using-r.html

COURSE OUTCOMES:

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

	Course Outcome
CO1	Understand the basic concepts of sampling theory and learn how to represent a sample from a population.
CO2	Use R to implement different sampling techniques and analyze the results of a sampling study.
CO3	Apply sampling techniques like ratio estimation and regression estimation to real-world problems
CO4	Understand the basic concepts of probability and distribution theory and learn how to use R to simulate
CO5	Analyze different probability distributions and apply distribution theory to real-world problems.

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	2	3	3	3	3	3	3
CLO2	3	3	3	3	2	3	3	3	3	3	3
CLO3	3	3	3	2	3	3	3	3	3	3	3
CLO4	2	3	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	2	3	3	3	3	3	3

Course Designer:

Dr. P. Vetri Selvi

Title of the Course		Data Analysis in MS Excel (Core II & III based)					
TANSCHE Course type		EC3					
Course Category		Elective					
Nature of Course		Skill Development / Employability / Entrepreneurship					
Category	Core	Year	I	Credits	1	Course Code	23P1SECP1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
					2		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic MS Excel knowledge, Theory on Sampling and Distribution					
Objectives of the Course		- Fitting of various distributions with random number generation using MS Excel. - Sampling distributions and its estimators using MS Excel.					
Course Outline		List of Practicals using MS Excel: - Fitting of various distributions with random number generation - Sample selection using random number - Simple random sampling - Stratified random sampling – PPSWR - Stratified random sampling – PPSWOR - Linear Systematic random sampling - Circular systematic random sampling - Ratio method of estimation - Regression method of estimation - Circular sampling for equal sizes - Horvitz – Thomson estimator; Des- Raj estimator and Murthy estimator					
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Justification for nature of course	This course will enable the students to study on the various sampling techniques in collecting the data and able to fit the suitable distribution using MS Excel.
Websites and e-Learning resources	1. https://www.youtube.com/watch?v=LpUM0jQSba4 2. https://www.youtube.com/watch?v=jfuuavyG9KA

COURSE OUTCOMES:

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

	Course Outcome
CO1	Understand the basic concepts of sampling theory and learn how to select a representative sample from a population.
CO2	Use Excel to implement different sampling techniques and analyze the results of a sampling study.
CO3	Apply sampling techniques like ratio estimation and regression estimation to real-world problems
CO4	Understand the basic concepts of probability and distribution theory and learn how to use Excel to simulate
CO5	Analyze different probability distributions and apply distribution theory to real-world problems.

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	2	3	3	3	3	3	3
CLO2	3	3	3	3	2	3	3	3	3	3	3
CLO3	3	3	3	2	3	3	3	3	3	3	3
CLO4	2	3	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	2	3	3	3	3	3	3

Course Designer:

Dr. P. Vetri Selvi

Title of the Course		Statistical Practical-I (Calculator Based) - Core II &III					
TANSCHE Course type		SEC1					
Course Category		Skill Enhancement Course					
Nature of Course		Employability / Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23P1SSED1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
					2		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Distribution Theory and Sampling techniques					
Objectives of the Course		- Fitting of various distributions with random number generation using calculator based. - Sampling distributions and its estimators using calculator based.					
Course Outline		List of Practicals using Calculator based: 1. Fitting of various distributions with random number generation 2. Sample selection using random number 3. Simple random sampling 4. Stratified random sampling – PPSWR 5. Stratified random sampling – PPSWOR 6. Linear Systematic random sampling 7. Circular systematic random sampling 8. Ratio method of estimation 9. Regression method of estimation 10.Circular sampling for equal sizes 11.Horvitz – Thomson estimator; Des- Raj estimator and Murthy estimator					
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Justification for nature of course		This course will enable the students to study on the various sampling techniques in collecting the data and able to fit the suitable distribution using calculator based					

COURSE OUTCOMES:

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

	Course Outcome
CO1	Understand the basic concepts of sampling theory and learn how to select a representative sample from a population.
CO2	To implement different sampling techniques and analyze the results of a sampling study.
CO3	Apply sampling techniques like ratio estimation and regression estimation to real-world problems
CO4	Understand the basic concepts of probability and distribution theory to simulate
CO5	Analyze different probability distributions and apply distribution theory to real-world problems.

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	2	3	3	3	3	3	3
CLO2	3	3	3	3	2	3	3	3	3	3	3
CLO3	3	3	3	2	3	3	3	3	3	3	3
CLO4	2	3	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	2	3	3	3	3	3	3

Course Designer:

Dr. P. Vetri Selvi

M.Sc. First Year Semester II

List of Courses	Course Code	Credit	Hours
Core-IV (Estimation Theory)	23P2SCCT4	5	6 (5L + 1T)
Core-V (Measure and Probability Theory)	23P2SCCT5	5	6 (5L + 1T)
Core-VI (Time Series Analysis)	23P2SCCT6	4	6 (5L + 1T)
Elective – IV (Actuarial Statistics or Simulation Analysis)	23P2SECT3	3	5 (4L + 1T)
Elective – V (Survival Analysis or Econometrics)	23P2SECT4	2	3 (3L)
Elective – VI Practical in R (Core IV &VI based) Or Data Analysis in SPSS (Core IV &VI based)	23P2SECP2	1	2
Skill Enhancement Course (NME) – Statistical Survey	23P2SSEN1	2	2
Total		22	30

Semester wise Mapping of Course with Programme Specific Outcomes (PSOs)

Course Type	CC4	CC5	CC6	Elective - IV	Elective - IV	Elective - V	Elective - V	Elective - VI	Elective - VI	Skill Enhancement Course (NME)
Course Title	Estimation Theory	Measure and Probability Theory	Time Series Analysis	Actuarial Statistics	Simulation Analysis	Survival Analysis	Econometrics	Practical on R (Core IV &VI based)	Statistical Data Analysis on	Statistical Survey
PSO1	3	3	3	2	3	2	3	3	3	3
PSO2	2	3	3	2	3	2	3	3	2	2
PSO3	2	3	3	3	3	3	3	3	3	2
PSO4	3	2	2	2	3	2	3	3	3	3
PSO5	2	2	2	3	2	3	2	3	3	2

Title of the Course		Estimation Theory						
TANSCHÉ Course type		CC4						
Course Category		Core						
Nature of Course		Employability / Skill Development						
Category	Core	Year	I	Credits	5	Course Code	23P2SCCT4	
		Semester	II					
Instructional Hours per week	Lecture		Tutorial		Practical		Total	
	5		1		-		6	
Marks	CIA			Semester			Total	
	25			75			100	
Pre-requisite(s)		Probability Theory						
Objectives of the Course		- To make the students to understand the basic concepts of the statistical estimation theory. - To study the properties of ideal estimators like unbiasedness, consistency, sufficiency, completeness. - To educate various estimation methods like method of moments, method of maximum likelihood, interval estimate, and Bayes estimate.						
Course Outline		Unit I: Sufficient statistics, Neyman, Fisher Factorisation theorem, the existence and construction of minimal sufficient statistics, Minimal sufficient statistics and exponential family, sufficiency and completeness, sufficiency and invariance.						
		Unit II: Unbiased estimation: Minimum variance unbiased estimation, locally minimum variance unbiased estimators, Rao Blackwell–theorem. Completeness-Lehmann Scheffe theorems, Necessary and sufficient condition for unbiased estimators						
		Unit III: Cramer- Rao lower bound, Bhattacharya system of lower bounds in the 1-parameter regular case. Chapman –Robbins inequality.						
		Unit IV: Maximum likelihood estimation, computational routines, strong consistency of maximum likelihood estimators, Asymptotic Efficiency of maximum likelihood estimators, Best Asymptotically Normal estimators, Method of moments.						
		UNIT V: Bayes’ and minimax estimation: The structure of Bayes’ rules, Bayes’ estimators for quadratic and convex loss functions, minimax estimation, interval estimation.						

Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	The course provides knowledge to identify various types of estimators and their properties. The student estimates the result using various methodology in estimators.
Text Book(s)	1. Rajagopalan. M and Dhanavanthan P, (2012), and Statistical Inference, PHI Learning Pvt. Ltd., New Delhi 2. V.K.Rohatgi et al (2002): An introduction to probability and statistics, John Wiley. 3. Lehmann, E.L. (1983): Theory of point estimation, John Wiley.
Reference Book(s)	1. Zacks, S. (1971): The theory of statistical inference, John Wiley. 2. Rao, C.R. (1973): Linear statistical inference and its applications, Wiley Eastern 2nd ed. 3. Ferguson, T.S. (1967): Mathematical statistics, A decision theoretic approach, Academic Press, New York and London. 4. Lindley, D.V. (1965): Introduction to probability and statistics, Part 2, Inference, Cambridge University Press.
Websites and e-Learning resources	1. Point Estimation http://web.mit.edu/14.381/www/Estimation.pdf 2. Unbiased estimator https://www.math.arizona.edu/~jwatkins/N_unbiased.pdf 3. Properties of Point Estimators and Methods of Estimation http://www.utstat.toronto.edu/~olgac/sta255_2013/notes/sta255_Lecture9.pdf 4. Interval estimation http://www.yorku.ca/ptryfos/ch5000.pdf 5. Prior and posterior distributions https://www.probabilitycourse.com/chapter9/9_1_1_prior_and_posterior.php

Course Learning Outcome (for Mapping with POs and PSOs)

At the end of the Course, Students will be able to

CLO's	Course Learning Outcomes	Knowledge Level
CO1	To understand the consistency, sufficiency and unbiasedness.	Upto K2
CO2	To understand the concepts and drive the uniformly minimum variance unbiased estimators.	Upto K3
CO3	To derive the inequality including CR inequality, KCR inequality and Bhattacharya inequality.	Upto K3
CO4	To estimate the parameter using method of moments, method of MLE, Interval estimation and shortest with confidence intervals.	Upto K4
CO5	To learn the concepts and to apply simple numerical illustration for Loss function, Risk function and Bayes estimate.	Upto K4

MAPPING CLOs WITH PSOs

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	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	2	3	3	3	3	3	3
CLO3	3	3	3	2	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3	3	3
CLO5	3	2	3	3	3	3	3	3	3	3	3

Assessment Schema

Components of CIA

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

S. No.	CLOs	K Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of questions	K Level	No. of Questions	K level		
1	CLO1	Upto K2	2	K1&K1	1	K1	2(K1 &K1)	1(K2)
2	CLO2	Upto K3	2	K2&K3	1	K1	2(K2 &K2)	1(K3)
3	CLO3	Upto K3	2	K2&K3	1	K2	2(K3 &K3)	1(K3)
4	CLO4	Upto K4	2	K3&K4	1	K2	2(K4 &K4)	1(K4)
5	CLO5	Upto K4	2	K3&K4	1	K3	2(K4 &K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of section wise marks with K levels for Summative Examination

K Levels	Section A MCQs	Section B (Short Answers)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total marks	10	10	50	50	120	100	100%

Course Designer:
Dr. A. Saberunnisa

Title of the Course		Measure and Probability theory					
TANSCHÉ Course type		CC5					
Course Category		Core					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23P2SCCT5
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		-		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Undergraduate level Mathematics.					
Objectives of the Course		• This paper provides mathematical background for the knowledge of Probability Theory extended from measure theoretical approach. • The students will be able to understand the basic concepts of the distribution function and random variables that help in understanding for estimation and testing problems in Statistical Inference. • The fundamentals of this course will pave the way for further research.					
Course Outline		Unit I: Measure Theory - Limits of sequence of sets, classes of sets – Field, Sigma Field and Monotone class, Measure and Measure Space – Measurable function					
		Unit II: Lebesgue – Stieltjes measure, Measure integral and its properties, Dominated convergence theorem – Radon–Nikodymn theorem, almost everywhere convergence, convergence in measure and convergence in mean.					
		Unit III: Events, sample space, different approaches to probability, random variables and random vector, Distribution functions of random variables and random vector, Expectation and moments, basic, Markov, Chebyshev’s, Holder’s, Minkowski’s and Jensen’s inequalities.					
		Unit IV: Independence of sequence of events and random variables, conditional probability, conditional expectation, Characteristic functions and their properties, inversion formula, convergence of random variables, convergence in probability, almost surely, in the r-th mean and in distribution, their relationships, convergence of moments, Helly-Bray theorem, continuity theorem and convolution of distributions.					

	Unit V: Central limit theorem, statement of CLT, Lindeberg, Levy and Liapounov forms with proof and Lindeberg Feller's form examples. Khintchine weak law of large numbers, Kolmogorov inequality, strong law of large numbers
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Students will gain the skills related to identifying the concept, problems and solve them.
Text Book(s)	1. Bhat, B.R. (1985): Modern probability theory, 2nd ed. Wiley Eastern. 2. Chow, Y.S. and Teicher, H. (1979): Probability theory, Springer Verlag. Chung, K.L. et al: A course in probability theory, Academic press.
Reference Book(s)	1. Parthasarthy, K.R. (1977): Introduction to probability and measure, MacMillan Co., 2. Breiman, L. (1968): Probability, Addison Wesley. 3. Munroe, M.E. (1971): Measure and integration, 2nd ed. Addison Wesley. 4. Halmos, P.R. (1974): Measure theory, East-West. 5. De Barr, G. (1987): Measure theory and integration, Wiley Eastern.
Websites and e-Learning resources	1. Measure & Probability: https://nptel.ac.in/courses/111/101/111101100/# 2. Law of Large Numbers: https://www.youtube.com/watch?v=VpuN8vCQ--M 3. Central Limit Theorem: https://www.youtube.com/watch?v=JNm3M9cqWyc 4. https://www.youtube.com/watch?v=YAIJCEDH2uY 5. Inequalities in Probability: https://www.youtube.com/watch?v=nrDkb2MAwSA https://www.youtube.com/watch?v=DWsDqKIW7Z4

COURSE OUTCOMES:

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

CLO's	Course Learning outcomes	K-level
CO1	Resolve problems that occur in the sequences of sets and classes of sets.	Upto K2
CO2	Provide critical thinking in Integrals and their application to Probability Theory.	Upto K3
CO3	Evaluate, integrate, and apply appropriate tools in Probability and Conditional Probability.	Upto K3
CO4	Demonstrate the ability to apply basic methods in analyzing the convergence in Probability and rth mean and in Distribution and Characteristics functions.	Upto K4
CO5	Demonstrate critical thinking skills, such as problem solving using weak and strong law of large numbers and different forms of Central Limit Theorems.	Upto 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	3	3	3	3	3	3	3	3
CLO2	3	2	3	3	3	3	3	3	2	3	2
CLO3	3	3	2	3	2	3	3	3	3	3	3
CLO4	3	3	3	2	2	2	3	3	3	2	3
CLO5	3	3	3	2	2	3	3	3	3	3	3

Assessment Schema**Components of CIA**

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

SL. No	CLOs	K-level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO 1	Up to K 2	2	K1 & K1	1	K1	2(K1& K1)	1(K2)	
2	CLO 2	Up to K 3	2	K2& K3	1	K1	2(K2 & K2)	1(K3)	
3	CLO 3	Up to K 3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)	
4	CLO 4	Up to K 4	2	K3 & K4	1	K2	2(K4& K4)	1(K4)	
5	CLO 5	Up to K 4	2	K3& K4	1	K3	2(K4& K4)	1(K4)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

Distribution of Marks with K Level for Summative Examination

K - Level	Section A (MCQ)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Chioce)	Total Marks	% of (Marks without Choice)	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30.00	30%
K4	2	-	20	20	42	35.00	35%
K5	-	-		-			
Total	10	10	50	50	120	100	100

Course Designer:
Dr. R. Madhanagopal

Title of the Course		Time Series Analysis							
TANSCHE Course type		CC6							
Course Category		Core							
Nature of Course		Employability / Skill Development							
Category	Core	Year	I	Credits	4	Course Code	23P2SCCT6		
		Semester	II						
Instructional Hours per week		Lecture	Tutorial	Practical	Total				
		5	1	--	6				
Marks		CIA		Semester		Total			
		25		75		100			
Pre-requisite(s)		UG level time series modelling							
Objectives of the Course		1. Understanding of various components of time series and forecasting univariate time series 2. Apply different methods for fitting time series models 3. Understanding various important concepts in forecasting and smoothing methods 4. Understanding stationary and non-stationary nature of time series data							
Course Outline		Unit I: Time Series – Introduction – components of time series – stationary and non-stationary time series - differencing method to convert non stationary series – concept of co integration.							
		Unit II: Standard statistical measures for Time Series analysis: Absolute measures – Mean absolute error, Mean error, Mean square error. Relative measures – Percentage error, Mean percentage error, Mean absolute percentage error.							
		Unit III: Smoothing methods – Single exponential smoothing. Double exponential smoothing (Holt method). Triple exponential smoothing (Holt-Winter’s method).							
		Unit IV: Decomposition method: Additive and Multiplicative decomposition – Forecast and Confidence Intervals – Kruskal-Wallis test for seasonality - Moving average Forecasting – Spencer’s and Henderson’s moving averages (without derivation). Stationary and Non-stationary Time series- Auto correlation function (ACF) and Partial Auto correlation function (PACF)- Portmanteau tests: Ljung–Box test and Box–Pierce test							

	Unit V: ARIMA models: Random model ARIMA (0,0,0), Non-Stationary Random model, ARIMA (0,1,0), Stationary Auto Regressive model of order one-ARIMA (1,0,0). Stationary Moving average model of order one-ARIMA (0,0,1).-A Simple Mixed model ARIMA (1,0,1), ARIMA (1,1,1).-Seasonal Time series ARIMA(p,d,q) (P, D,Q) with ARIMA (0,1,1)(0,1,1), ARCH and GARCH models: Description and properties of these models (Without proof).
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	1. The course provides the knowledge on the forecasting techniques with suitable ARIMA models by analysing the old data. 2. The course identifies the best model in forecast the data.
Text Book(s)	1. Montgomery, D. C., Peck, E. and Vining, G. G. (2003): Introduction to Linear regression analysis, third edition, John Wiley and Sons, Inc. 2. Draper, N.R. and Smith, H. (2000) : Applied Regression Analysis, 2nd edition, John Wiley & Sons. 3. Spyros Makridakis, Steven C. Wheelwright and Victor E. McGee (2012), Forecasting Methods and Applications – Second Edition, John Wiley & Sons. 4. T.M.J.A.Coaray(2008): Applied Time Series Analysis and Forecasting, NAROS A publishing house Pvt.Ltd
Reference Book(s)	1. Chatterjee S. and Betram Price (1977): Regression Analysis by Examples, John Wiley & Sons. 2. George E.P. Box and Gwilym M. Jenkins (1976): Time Series Analysis – Forecasting and Control, Holdne – Day Inc. 3. Johnston J. (1984) : Econometric Methods, (3rd Edition), McGraw Hill International Book Company, New Delhi. 4. Singh, Parashar and Singh (1997): Econometrics and Mathematical Economics (1st Edition), S. Chand & Co, New Delhi.
Websites and e-Learning resources	http://mathforum.org , http://ocw.mit.edu/ocwweb/Mathematics , http://www.opensource.org www.mathpages.com

COURSE OUTCOMES:

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

CLO's	Course Outcomes	K-level
CO1	Identifying the stationary of the time series.	Up to K2
CO2	Describing the concept of standard statistical measures for time series.	Up to K3
CO3	Modelling time series using exponential methods.	Up to K3
CO4	Structuring the time series data based on seasonal and non- seasonal nature.	Up to K4
CO5	Fitting ARIMA model and evaluating goodness of fit	Up to 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	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	3	2	3	3	3	2	3
CLO4	3	3	2	3	3	3	3	3	2	3	3
CLO5	3	3	3	3	3	3	3	3	3	3	3

Assessment Schema**Components of CIA**

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

SL.No	CLOs	K-level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1 & K1	1	K1	2(K1& K1)	1(K2)	
2	CLO 2	Up to K 3	2	K2& K3	1	K1	2(K2 & K2)	1(K3)	
3	CLO 3	Up to K 3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)	
4	CLO 4	Up to K 4	2	K3 & K4	1	K2	2(K4& K4)	1(K4)	
5	CLO 5	Up to K 4	2	K3& K4	1	K3	2(K4& K4)	1(K4)	
No. of Questions to be asked			10		5		10	5	30
No. of Questions to be answered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each Section			10		10		25	30	75

Distribution of Section wise marks with K levels for summative Examination

K - Level	Section A (MCQ)	Section B (Short Answer Questions)	Section C (Either / Or Choice)	Section D (Open Chioce)	Total Marks	% of (Marks without Choice)	Consolidated
K1	2	4	10	-	16	13.33	33.33
K2	2	2	10	10	24	20.00	
K3	4	4	10	20	38	31.67	31.67
K4	2	-	20	20	42	35	35
K5	-	-		-			
Total	10	10	50	50	120	100	100

Course Designer:

Dr. M. Rabert

Title of the Course		Actuarial Statistics						
TANSCHÉ Course type		Elective IV						
Course Category		Elective (Discipline Specific)						
Nature of Course		Employability / Entrepreneurship/ Skill Development						
Category	Core	Year		I	Credits	3	Course Code	23P2SECT3(A)
		Semester		II				
Instructional Hours per week		Lecture	Tutorial		Practical			Total
		4	1		--			5
Marks		CIA		Semester				Total
		25		75				100
Pre-requisite(s)		UG level Vital Statistics with mathematical Knowledge.						
Objectives of the Course		Provides fundamental in mathematical and statistical methods. The knowledge of actuarial methods to summarize data.						
Course Outline		Unit I: Life tables, and its relation with survival function - life table assumptions and uses, analytical laws of mortality - Gompertz and Makeham’s laws of mortality –ultimate and aggregate mortality tables.						
		Unit II: Abridged life tables – construction of abridged life tables – methods by Read and Merrell, Greville’s, Kings method. Utility Theory.						
		Unit III: Models for individual claims and their sums – multiple life function – joint life status and last survival status.						
		Unit IV: Policy Values: Nature of reserve - prospective and retrospective reserves - modified reserves - Surrender values and paid up policies - Industrial assurance - Children's deferred assurances						
		Unit V: Pension Funds: Capital sums on retirement and death- widow's pensions - Sickness benefits - Benefits dependent on marriage						
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)						
Skills acquired from this course		Knowledge Problem Solving, Analytical ability Professional Competency, Professional Communication and Transferrable Skill						
Justification for nature of course		This course enables to prepare mortality tables and actuarial methods for summarizing the financial data towards insurance.						

Text Book(s)	1. S.C.Gupta and V.K.Kapoor(2007) Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi 2. Mathematical Basis of Life Assurance (IC-81) (2000), Published by insurance institute of India, Bombay. 3. O.P Gupta, S.S.Chaudhary and M.A.Ansari- Applied Statistics, Kedar Nath Ram Nath, Meerut. 4. Parimal Mukhopadhyay(2011) –Applied Statistics, Books and Allied (P) Ltd, Kolkata.
Reference Book(s)	1. Barcley G.W. (1970) Techniques of Population Analysis, Wiley, New York. 2. Borowiak, D.S. and Shapiro, A.F. (2013) Financial and Actuarial Statistics: An Introduction, CRC Press, London. 3. Donald, D.W.A. (1970) Compound Interest and Annuities-certain, For The Institute of Actuaries and the Faculty of Actuaries at the University Press. 4. Spurgeon, E.T. (2011) Life Contingencies, Cambridge University P press, Cambridge. 5. Hooker,P.F. Longley, L.H Cook (1957) Life and other contingencies, Cambridge. 6. Alistair Neill(1977) Life contingencies, Heinemann Professional Publishing, Portsmouth. 7. Hossack,I.B. Pollard, J.H. and Zehnworth, B.(1999) Introductory statistics with applications in general insurance, Cambridge University Press, Cambridge.
Websites and e-Learning resources	1. Measure of Mortality: Life tables https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032240235577Anupama_Singh_Mortality_and_its_measures.pdf 2. Gompertz and Makeham’s laws of mortality https://en.wikipedia.org/wiki/Gompertz%E2%80%93Makeham_law_of_mortality https://web.stanford.edu/~jhj1/teachingdocs/Jones-mortmodel2005.pdf 3. Abridged life tables – construction of abridged life tables https://www.cdc.gov/nchs/data/series/sr_02/sr02_004.pdf https://www.statsdirect.com/help/survival_analysis/abridged_life_table.htm 4. Policy Values https://www.math.umd.edu/~slud/s470/BookChaps/01Book.pdf 5. https://www.actuariayfinanzas.net/images/sampledData/FundamentalsofActuarialMathematics_S.DavidPromislow2015.pdf

COURSE OUTCOMES:

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

CLO's	Course Outcomes	K-level
CO1	Acquire the knowledge of different mortality life tables	Up to k2
CO2	Know how to construct life tables and understand different types of insurances.	Up to k4
CO3	Knowledge about models for individual claims and their sums	Up to k3
CO4	Calculate quantities such as premiums, surrender values paid up policies, industrial assurance ,childrens deferred assurances using actuarial techniques.	Up to k4
CO5	Describe, explain and apply the fundamental theories of actuarial science as they apply in pension funds.	Up to k3

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	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	2	3	3
CLO4	3	3	3	2	3	3	3	3	3	2	3
CLO5	3	3	2	3	3	2	3	3	2	3	3

Assessment Schema
Components of CIA

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

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

Distribution of section wise marks with K levels for Summative Examination

K Levels	Section A MCQs	Section B (Short Answers)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total marks	10	10	50	50	120	100	100%

Course Designer:
Dr. M. Rabert

Title of the Course		Simulation Analysis						
TANSCHE Course type		Elective IV						
Course Category		Elective (Discipline Specific)						
Nature of Course		Employability / Skill Development						
Category	Core	Year	I	Credits	3	Course Code	23P2SECT3(B)	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		4		1		--		5
Marks		CIA			Semester		Total	
		25			75		100	
Pre-requisite(s)		UG computer knowledge level						
Objectives of the Course		Provides a grounding statistical models in simulation and programming methods. its equips. With knowledge of simulation methods to summarize data.						
Course Outline		Unit I: Introduction to Simulation: Advantages and Disadvantages of Simulation - Areas of Application - System Environment - Components of a system - Types of models - Discrete-event system simulation -Steps in a Simulation Study; Simulation examples						
		Unit II: Statistical Models in Simulation: Useful Statistical model - Discrete Distribution - Continuous Distribution - Poisson Process - Empirical Distribution. Simulation of Manufacturing and Material Handling System: Modeling of manufacturing system - Models of martial Handling system - Goals and performance Measure .						
		Unit III: Simulation of Queuing system: Queuing system Characteristics - Queueing Notation - Transient and Steady-State Behaviour of Queues - Steady-state Behaviour of Infinite-Population Markovian Models - Properties of Random Numbers -Techniques for generating Random Variate Generation: Inverse Transformation Technique - Uniform Distribution, Exponential Distribution, Triangular Distribution, Empirical Continuous Distribution.						

	Unit IV: Input Data Analysis: Data Collection - Identifying the Distribution with Data - Parameter Estimation - Goodness-of fit Tests- Chi-square Test- Kolmogorov - Smirnov Test - Selecting Input models without Data - Multivariate and Time Series - Input Models. Verification and Validation of Simulation Models: Model Building - Verification and Validation.
	Unit V: Output Data Analysis: Stochastic Nature of Output Data - Types of Simulation with respect their Estimation - Output Analysis for Terminating Simulation - Output Analysis for Steady - State Simulations. Comparison and Evaluation of Alternative System Designs: Comparison of Two system Design.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	This course enhances the knowledge on simulation data using various statistical methods.
Text Book(s)	Deo, N. (1983) System Simulation with Digital Computer. Prentice Hall of India, New Delhi
Reference Book(s)	1. Gardon, G. (1992) System Simulation, Prentice Hall of India, New Delhi. 2. Banks, J. Carson II, J.S. and Nelson, B.L. (1995) Discrete - Event System Simulation Prentice Hall, New Delhi. 3. Law, A.M. (2007) Simulation Modeling and Analysis, McGraw Hill, New York.
Websites and e-Learning resources	1. https://youtu.be/oZkNjGgaNVY 2. https://youtu.be/gyMcHmlezu4 3. https://youtu.be/0YFdS_-5Ft0 4. https://youtu.be/6FShQ4ez728 5. https://youtu.be/MjztG9U0YKc 6. https://youtu.be/YdbxIDvid1I 7. https://youtu.be/DNQNFlyFsgY 8. https://youtu.be/tLWNeUn1Vv8

COURSE OUTCOMES:

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

CLO's	Course Outcomes	K-level
CO1	Acquire the knowledge of different Programming Languages for simulation	Up to k2
CO2	Know how to construct statistical models in simulation different types of simulations	Up to k4
CO3	Knowledge about model for queueing systems.	Up to k3
CO4	Calculate input data analysis using by different statistical methods.	Up to k4
CO5	Calculate input data analysis using by different statistical methods.	Up to k3

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	3	2	3	3	3	3	3	3
CLO2	3	3	3	2	3	3	3	3	3	2	3
CLO3	3	3	3	3	2	3	3	3	3	2	3
CLO4	3	3	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	2	3	3	3	2	3	3	2

Assessment Schema**Components of CIA**

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

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

Distribution of section wise marks with K levels for Summative Examination

K Levels	Section A MCQs	Section B (Short Answers)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total marks	10	10	50	50	120	100	100%

Course Designer:

Dr. M. Rabert

Title of the Course		Survival Analysis						
TANSCHÉ Course type		Elective-V						
Course Category		Elective (Discipline Specific)						
Nature of Course		Skill Development / Employability						
Category	Core	Year	I	Credits	2	Course Code	23P2SECT4(A)	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		3		-		-		3
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Basic Statistical distributions and estimation theory						
Objectives of the Course		1. To estimate and interpret survival and/or hazard functions from survival data 2. To compare survival and/or hazard functions. 3. To assess the relationship of explanatory variables to survival time						
Course Outline		Unit-I: Concepts of time, Order and random Censoring, likelihood in these cases. Life distributions Exponential, Gamma, Weibull , Lognormal , Pareto , Linear Failure rate. Parametric inference (Point estimation, scores, MLE)						
		Unit-II: Life tables, failure rate, mean residual life and their elementary properties. Concept of Ageing, Types of Ageing classes and their properties and relationship between them Bathtub Failure rate, Concept of Inverse Hazard rate.						
		Unit-III: Estimation of survival function Actuarial Estimator, Kaplan- Meier Estimator, Estimation under the assumption of IFR / DFR . Tests of exponentiality against non- parametric classesTotal time on test, Despande test.						
		Unit-IV: Two sample problem- Gehan test, Log rank test. Mantel Haenszel test, Tarone Ware tests. Introduction to Semi- parametric regression for failure rate, Cox’s proportional hazards(PH) model with one and several covariates and estimation problems in Cox’s PH Model. Rank test for the regression coefficients.						
		Unit-V: Introduction to Competing risks analysis and estimation problems in competing risk model for parametric and non- parametric semi parametric set up. Ideas of Multiple decrement life table and its applications.						
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved						

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Justification for nature of course	Survival analysis is a powerful tool that can be used to answer a variety of questions about the time to an event and relatively complex statistical technique. Survival analysis is used in a variety of fields like banking (loan), pharmaceutical (effectiveness of drug) and so on.
Text Book(s)	1. Miller, R.G. (1981) : Survival analysis (John Wiley). 2. Cox, D.R. and Oakes, D. (1984): Analysis of Survival Data, Chapman and Hall, NewYork. 3. Elisha T Lee, John Wenyu Wang and Timothy Wenyu Patt(2003): Statistical Methods for Survival data Analysis, 3/e, Wiley Inter Science.
Reference Book(s)	1. Gross, A.J. and Clark, V.A. (1975) : Survival distribution : Reliability applications in the Biomedical Sciences, John Wiley and Sons. 2. Elandt Johnson, R.E. Johnson N.L.: Survival Models and Data Analysis, John Wiley and sons. 3. Kalbfleisch J.D. and Prentice R.L. (1980), The Statistical Analysis of Failure Time Data, JohnWiley. 4. Klelin P. John and Moeschberger (2003): Survival Analysis: Techniques for Censored and Truncated Data, 2/e, Springer. 5. Lawless J.F. (1982) Statistical Models and Methods of Life Time Data; John Wiley & Sons.
Websites and e-Learning resources	1. Survival Analysis: https://youtu.be/nGANjEVsw2o 2. Actuarial estimator calculation in practical: https://youtu.be/U_2wjOEK9vs 3. Competing risk analysis: https://youtu.be/3BmCqNMOXZo

COURSE OUTCOMES:

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

	Course Outcome	K-level
CO1	Understand the fundamental concepts of survival analysis	Upto K2
CO2	Learn various parametric and non-parametric survival models	Upto K3
CO3	Master data preprocessing techniques for survival analysis	Upto K4
CO4	Develop skills in model assessment and interpretation	Upto K3
CO5	Apply survival analysis in real-world scenarios	Upto 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	3	3	3	2	3	3	2	2
CLO2	3	3	2	3	3	2	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3	3	2
CLO4	3	3	3	2	2	3	3	3	2	2	3
CLO5	3	3	3	3	3	2	3	3	2	2	3

Assessment Schema**Components of CIA**

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

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 & 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	K3 & K4	1	K3	2(K4 & K4)	1(K4)
4	CLO 4	Up to K3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)
5	CLO 5	Up to K4	2	K3 & K4	1	K2	2(K4 & K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of section wise marks with K levels for Summative Examination

K Levels	Section A MCQs	Section B (Short Answers)	Section C (Either/ or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
K5	-	-	-	-	-	-	-
Total marks	10	10	50	50	120	100	100%

Course Designer:
Dr. M. Venkateswaran

Title of the Course		Econometrics						
TANSCHÉ Course type		Elective-V						
Course Category		Elective (Discipline Specific)						
Nature of Course		Skill Development / Employability						
Category	Core	Year	I	Credits	2	Course Code	23P2SECT4(B)	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		3		-		-		3
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Regression and fitting of various models						
Objectives of the Course		1. To forecast business cycles in the capitalist economy 2. To study the effect of certain economic decisions with various statistical techniques 3. To give empirical context to a prior reasoning in economics						
Course Outline		Unit-I: Nature and scope of Econometrics - Theory and analysis of consumer demand specification - Estimation of demand function- Price and income elasticity of demand - Price elasticity’s of supply						
		Unit-II: Ordinary least square model and generalized least squares model: Introduction - estimation and prediction - Problem of multi collinearity and heteroscedasticity – Causes, consequences and solutions of and estimation.						
		Unit-III: Autocorrelation: Causes, consequences and testing for auto-correlated disturbances - Autoregressive series of order 1 (AR(1)) - Lagged variables and distributed log methods						
		Unit-IV: Simultaneous equations model- Concept, structure and types - Identification Problem with restrictions on variance and covariance - Methods of estimation- Indirect least square method, two-stage least squares method of estimation						
		Unit-V: Full information estimators - Full Information Maximum Likelihood (FIML) - Three stage least squares estimators (3-SLS) and its Properties						
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved						
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill						

Justification for nature of course	This course prepares the student in business view of economics and forecasting techniques with various statistical assumptions in the real time scenario.
Text Book(s)	1. Agarwal H.S, Introduction to Econometrics, Lakshmi Narain Agarwal Educational Publishers, Agra (1976). 2. Gujarati, D. N., Dawn C Porter and SangeethaKunasekar, (2016), Basic Econometrics, Fifth Edition, McGraw Hill Publisher, New York. 3. Johnston, J., and J. DiNardo,.(1997). Econometric Methods, McGraw-Hill.
Reference Book(s)	1. Castle, J. and Shephard, N. (2009) The Methodology and Practice of Econometrics. Oxford University Press, London. 2. Goldberger, A.S. (1964) Econometrics theory, Wiley, New York. 3. Kelejion, H. H. and Oates, W.E. (1988) Introduction to Econometrics, Principles and Applications. Harper and Row, New York. 4. Maddala, G.S. and KajalLagari. (2009) Introduction to Econometrics, Wiley, New York. 5. Madnani, G.M.K. (2008) Introduction to Econometrics: Principles and Applications. Oxford and IBH, New Delhi. 6. Wooldridge, J. (2012) Introduction Econometrics: A Modern Approach. Cengage Learning, New Delhi. 7. Khotsoyiannis, A. (1977). Theory of Econometrics. Second Edition, Macmillan.
Websites and e-Learning resources	1. NPTEL Course on Introduction to Econometrics https://nptel.ac.in/courses/130/106/130106001/ 2. Generalized Linear Model https://www.youtube.com/watch?v=GJMWX56P-3o 3. Multi collinearity https://www.youtube.com/watch?v=Cba9LJ9IS8s 4. Auto Correlation https://www.youtube.com/watch?v=UFvDSX3jsYg 5. Simultaneous equation https://www.youtube.com/watch?v=xfWTeeVt2Tg 6. Maximum Likelihood function https://www.youtube.com/watch?v=XepXtl9YKwc

COURSE OUTCOMES:

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

	Course Outcome	K-level
CO1	Understand the concepts of Economics towards business parameters	Upto K2
CO2	Understand and apply the generalized linear model by eliminating the errors faced in modelling	Upto K3
CO3	Create a model for forecasting in short term and long term by studying the issues in the model	Upto K4
CO4	Apply the methodologies to identify the parameters by using various statistical techniques	Upto K3
CO5	Compare the methodologies of estimation in various model	Upto 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	3	3	3	2	3	3	2	2
CLO2	3	3	2	3	3	2	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3	3	2
CLO4	3	3	3	2	2	3	3	3	2	2	3
CLO5	3	3	3	3	3	2	3	3	2	2	3

Assessment Schema**Components of CIA**

Component	Weight / Mark
Test	10
Assignment	5
Quiz	5
Seminar / Model display	5

Blueprint for Semester Examination

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 & 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	K3 & K4	1	K3	2(K4 & K4)	1(K4)
4	CLO 4	Up to K3	2	K2 & K3	1	K2	2(K3 & K3)	1(K3)
5	CLO 5	Up to K4	2	K3 & K4	1	K2	2(K4 & K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of section wise marks with K levels for Summative Examination

K Levels	Section A MCQs	Section B (Short Answers)	Section C (Either/or)	Section D (Open choice)	Total marks	% of marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
K5	-	-	-	-	-	-	-
Total marks	10	10	50	50	120	100	100%

Course Designer:

Dr. M. Venkateswaran

Title of the Course		Practical in R (Core-IV & VI based)					
TANSICHE Course type		Elective-VI					
Course Category		Elective (Discipline Specific)					
Nature of Course		Skill Development / Employability					
Category	Core	Year	I	Credits	1	Course Code	23P2SECP2
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		-	-		2		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic R Programming, Estimation and Time Series					
Objectives of the Course		- Understand the basic concepts of estimation theory and time series analysis. - Learn how to use R to estimate parameters and forecast future values of time series. - Apply estimation theory and time series analysis to real-world problems.					
Course Outline		List of Practicals using R programming: - Maximum likelihood estimation - Method of moments - Point estimation - Interval estimation - Sufficient statistics - Baye’s and minimax estimation - Good estimator - Finding stationarity - Fitting of ARIMA - Fitting of SARIMA - Finding ACF and PACF - Decomposition - Smoothing method					
Extended Professional Component		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Justification for nature of course	This course will enable the students to study on the various estimation techniques. Able to find the trend of the data and forecast by using various Time series techniques.
Websites and e-Learning resources	1. https://homerhanumat.github.io/elemStats/sampling-and-surveys.html 2. https://rstudio.github.io/r-manuals/r-intro/Probability-distributions.html 3. https://bookdown.org/siju_swamy/Stat_Lab/descriptive-statistics-probability-using-r.html

COURSE OUTCOMES:

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

	Course Outcome
CO1	Understand the basic concepts of estimation theory and learn how to use R to estimate parameters of statistical models.
CO2	Apply estimation theory to real-world problems using various techniques.
CO3	Understand the basic concepts of time series analysis and learn how to use R to analyze time series data.
CO4	Apply time series analysis to real-world problems using various techniques
CO5	Apply various models to forecast the data

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	2	3	3	3	3	3	3
CLO2	3	3	3	3	2	3	3	3	3	3	3
CLO3	3	3	3	2	3	3	3	3	3	3	3
CLO4	2	3	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	2	3	3	3	3	3	3

Course Designer:

1. Dr. A. Saberunnisa
2. Dr. M. Rabert

Title of the Course		Data Analysis in SPSS (Core IV & VI based)					
TANSICHE Course type		Elective-VI					
Course Category		Elective (Discipline Specific)					
Nature of Course		Skill Development / Employability					
Cate gory	Core	Year	I	Credits	1	Course Code	23P2SECP2
		Semester	II				
Instructional Hours per week	Lecture		Tutorial		Practical		Total
	-		-		2		2
Marks	CIA			Semester			Total
	25			75			100
Pre-requisite(s)		Basic Statistics knowledge and data					
Objectives of the Course		- Understand the basic concepts of estimation theory and time series analysis. - Learn how to use SPSS to estimate parameters and forecast future values of time series. - Apply estimation theory and time series analysis to real-world problems.					
Course Outline		List of Practicals using SPSS: 1. Maximum likelihood estimation 2. Method of moments 3. Point estimation 4. Interval estimation 5. Sufficient statistics 6. Baye’s and minimax estimation 7. Good estimator 8. Finding stationarity 9. Fitting of ARIMA 10. Fitting of SARIMA 11. Finding ACF and PACF 12. Decomposition 13. Smoothing method					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Justification for nature of course	SPSS is used by market researchers, health researchers, survey companies, government entities, education researchers, marketing organizations, data miners, and many more for processing and analyzing survey data
Websites and e-Learning resources	1. https://www.open.ac.uk/socialsciences/spsstutorial/files/tutorials/graphs.pdf 2. https://students.shu.ac.uk/lits/it/documents/pdf/analysing_data_using_spss.pdf 3. http://www.academia.dk/BiologiskAntropologi/Epidemiologi/PDF/SPSS_Statistical_Analyses_using_SPSS.pdf

COURSE OUTCOMES:

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

	Course Outcome
CO1	Understand the basic concepts of estimation theory and learn how to use SPSS to estimate parameters of statistical models.
CO2	Apply estimation theory to real-world problems using various techniques.
CO3	Understand the basic concepts of time series analysis and learn how to use SPSS to analyze time series data.
CO4	Apply time series analysis to real-world problems using various techniques
CO5	Apply various models to forecast the data

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	2	1	2	1	3	1	3	3	3	3	3
CLO2	2	1	2	2	3	1	3	3	3	3	3
CLO3	2	3	3	3	3	2	3	3	3	3	3
CLO4	2	3	3	3	3	2	3	3	3	3	3
CLO5	2	3	3	3	3	2	3	3	3	3	3

Course Designer:

Dr. M. Venkateswaran

Title of the Course		Statistical Survey					
TANSCHÉ Course type		NME					
Course Category		Skilled Enhancement Course (NME)					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23P2SSEN1
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2	-		-		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic Knowledge in data collection					
Objectives of the Course		- To give a practical knowledge as to how to organize a statistical survey. - The students will be able to understand the basic concepts of data collection.					
Course Outline		Unit I: Organizing a statistical survey- Planning the survey, Executing the survey – Drafting an effective questionnaire, difference between questionnaire and schedule.					
		Unit II: Survey techniques: Census and Sample. Principal steps in sample survey – Sampling and Non-sampling errors.					
		Unit III: Collection of data - Primary data - methods of collecting primary data, Secondary data – sources of secondary data and precautions while using secondary data.					
		Unit IV: Classification of data – Types of Classification - Chronological classification, Geographical classification, Quantitative classification and Qualitative classification. Formation of discrete frequency distribution and Formation of continuous frequency distribution.					
		Unit V: Tabulation of data - Parts of a table and general rules of tabulation. Types of tables - simple and complex table and cross tabulation.					
Skills acquired from this course		Knowledge, Professional Communication and Transferrable Skill					
Justification for nature of course		Students will gain the skills related to survey and data collection.					
Text Book(s)		1 R.S.N.Pillai and V. Bagavathi (2008), Statistics Theory and Practice (Seventh Revised Edition) , S.Chand & company, New Delhi 2 Gupta. S.P (1995), Statistical Methods, Sultan Chand & Sons, New Delhi.					
Reference Book(s)		1 Daroga singh and F. S. Chaudhary (1986), Theory and analysis of sample survey design, New age international publisher, New Delhi. 2. Vic Barnett (2009) Sample survey principles and Methods, Wiley. 3. Arijit Chaudhuri (2019), Survey sampling, CRC Press, Taylor & Francis group, NW. 4. P.C. Tulasian and Bharat Jhunjhnuwala (2010), Business Statistics, S.Chand & company, New Delhi.					

Websites and e-Learning resources	Sampling Survey methods: https://www.youtube.com/watch?v=-N3GBLeJRF8 Drafting questionnaire: https://www.youtube.com/watch?v=XPh7TjVTCso Survey methods: www.youtube.com/watch?v=SkiCtWyH3pw https://www.youtube.com/watch?v=v82xWthyuZY https://www.youtube.com/watch?v=AJdt2_qxulo Data Collection: https://www.youtube.com/watch?v=yOU_s0xzc-Y https://www.youtube.com/watch?v=rloOsJxluBk Classification of data: https://www.youtube.com/watch?v=1H8kV6bXHpk https://www.youtube.com/watch?v=gLoZrTnMKsQ Tabulation of data: https://www.youtube.com/watch?v=Xr0BgvtXWwA https://www.youtube.com/watch?v=bG-5GPjfT-I

COURSE OUTCOMES:

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

CLO's	Course Learning outcomes	K-level
CO1	Plan and organize a survey and frame the questionnaire.	Upto K2
CO2	Classify the census and survey methods and also know the errors of these methods.	Upto K2
CO3	Collect the data from difference sources under both primary and secondary mode.	Upto K2
CO4	Classify the data into different categories and construct frequency tables.	Upto K2
CO5	Construct the different types of tables for data analysis.	Upto K2

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	3	3	3	3	3	3	3	3
CLO2	3	2	3	3	3	3	3	3	2	3	2
CLO3	3	3	2	3	2	3	3	3	3	3	3
CLO4	3	3	3	2	2	2	3	3	3	2	3
CLO5	3	3	3	2	2	3	3	3	3	3	3

Assessment Schema
Components of CIA

Component	Weight / Mark
Assignment	5
Seminar / Quiz	5
Library	5

Summative Examination -Blue Print

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

Distribution of Marks with K Level for Summative Examination

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	10	-	50	60	46.15	100
K2	-	70	-	70	53.85	
K3	-	-	-	-	-	-
K4	-	-	-	-	-	-
Total Marks	10	35	50	130	100.00	100

Course designer: Dr. R. MADHANAGOPAL

<i>Department of Statistics</i>			<i>Class: PG Students</i>				
Course Type	Course Code	Course title	Credits	Contact Hours/week	CIA	EXT	Total
Certificate Course		Statistics for Competitive Examination	2	30	50	50	100

Course Objectives:

The main objectives of this course are to:

1. Learn basic concepts in statistics
2. Qualify in competitive exam using this statistics concepts

Unit	Description	Hours
1	Uses, Scope and limitation of Statistics, Collection, Classification and Tabulation of data, Diagrammatic and Graphical representation, Measures of location, dispersion, Skewness and Kurtosis – Correlation and regression	6
2	Probability - Addition, Multiplication, Probability distributions – Binomial, Poisson, Geometric and Hypergeometric. Continuous distributions – Uniform, exponential and normal. Sampling distributions and standard error	6
3	Estimation – Point estimation – properties of estimates Neyman – Fisher Factorization theorem(without proof) Cramer – Rao inequality, Rao – Blackwell theorem – MLE and method of Moments estimation	6
4	Simple random sample – stratified, systematic, Sample Survey – Organisation – CSO and NSSO – Sampling and Non-Sampling errors.	6
5	Definition, construction, interpretation and limitations of index numbers - Laspeyre's, Paasche's, Marshall–Edgeworth, Dorbish-Bowley, Fisher's index numbers and their comparisons for ideal index number - Construction for cost of living index and wholesale price index.	6
	Total number of hours	30

Book for references:

1. Fundamentals of Mathematical Statistics, S C Gupta, V K Kapoor.
2. Fundamentals of Applied Statistics, S C Gupta, V K Kapoor
3. Programmed Statistics, B L Agarwal

Course Designer:

Dr. M. Rabert

<i>Department of Statistics</i>			<i>Class: PG Students</i>				
Course Type	Course Code	Course title	Credits	Contact Hours/week	CIA	EXT	Total
Certificate Course		Documentation and computation in MS office	2	30	50	50	100

Course Objectives:

The main objectives of this course are to:

1. Learn basic concepts in statistics
2. Qualify in competitive exam using this statistics concepts

Unit	Description	Hours
1	Introduction to MS Word, Creating a new document, Saving a document, Opening a document, Typing text, Formatting text, Inserting images, Adding tables, Printing a document	6
2	Advanced features of MS Word, Using styles, Creating tables of contents, Creating indexes, Creating hyperlinks, Using mail merge, Equation editor	6
3	Introduction to MS PowerPoint, Creating a new presentation, Adding slides, Typing text, Formatting text, Inserting images, Adding videos, Creating animations, Presenting a presentation.	6
4	Advanced features of MS PowerPoint, Using themes, Creating SmartArt graphics, Creating transitions and animations, Recording a presentation, Collaborating on a presentation	6
5	Introduction to MS Excel, Creating a new workbook, Entering data, Formatting data, Using formulas, Creating charts, Creating pivot tables, Advanced features of MS Excel, Using functions, Working with data tables, Creating macros, Importing and exporting data	6
	Total number of hours	30

Book for references:

1. Microsoft Office 2021 Step by Step by Joan Lambert
2. Microsoft Office 365 for Beginners and Power Users by Lokesh Lalwani
3. Mastering Microsoft Office by Kumar Bittu
4. Microsoft Office 2019 Introductory by Shelley Fishel

Course Designers:

1. **Dr. R. Madhanagopal**
2. **Dr. M. Venkateswaran**

DEPARTMENT OF STATISTICS				CLASS: II B.Sc., Statistics				
Semester	Course Type	Course Code	Course Title	Credits	Contact Hours/ week	CIA	Ext	Total
III	Core	20U3SMC6	Sampling Techniques	5	4	25	75	100

Nature of Course

Knowledge	✓	Skill Oriented	✓
Employability Oriented	✓	Entrepreneurship Oriented	✓

COURSE OBJECTIVES

1. To help students understand the concepts underlying statistical quality control and to develop their ability to apply those concepts to the design and management of quality control processes in industries.
2. To understand the differences between attributes and variables.
3. To introduce the students the basics of Statistical Quality Control and to enable them to describe quality characteristics and relationships.

Unit	Description	Hours	K-level	CLO(s)
I	Basic Concept of Sample Surveys: Introduction, Fields of Application of Sampling Techniques and Limitations, Definitions and Preliminaries, Census and Sample Surveys, Advantages and Disadvantages, Principles of Sampling Theory, Probability and non-probability Sampling, Sampling Unit, Sampling Frame. Sampling and non- sampling Errors.	12	K2	1
II	Basic Methods of Simple Random Sampling: Simple Random Sampling, Procedures of Selecting a Random Sample, Estimation of Population Parameters, Estimation of Population Proportion, Combination of unbiased estimators, Confidence Limits, Estimation of Sample Size	12	K3	2
III	Stratified random sampling: Introduction, Principles of Stratification, Advantages of Stratification, Estimation of Population mean and its variance, Estimate of Variance, Formation of Strata, Determination of Number of Strata.	12	K3	3
IV	Systematic sampling: Introduction, Sample Selection Procedure, Advantages and Disadvantages, Estimation of mean and its variance, estimation of variance – Comparison of Systematic with of Random sampling, Comparison of Systematic with of Stratified Random sampling.	12	K4	4
V	Ratio estimators: Introduction, Definition and Notations– Bias of the ratio estimators, Approximate variance of Ratio Estimators, Confidence Limits.	12	K3	5

Books for study:

Daroga Singh & Chaudhary, F.S.(1986): Theory and Analysis of Sample Survey Designs.

Chapters:

Unit I: Chapters:1(1.1-1.5, 1.7 -1.9, 1.11)

Unit II: Chapters:2 (2.1 – 2.7)

Unit III: Chapters: 3 (3.1, 3.2, 3.3, 3.5, 3.6, 3.10, 3.11)

Unit IV: Chapters :4(4.1- 4.7)

Unit V: Chapters: 6(6.1 -6.4, 6.6)

Books for Reference:

Kapoor, V.K. and Gupta, S.P. (2007) Fundamentals of Applied Statistics, Sultan Chand& Sons

WebResources:

1. Analysis of Time series - <https://youtu.be/GVirvz8usyY>
2. Index numbers - <https://youtu.be/cv5iPhRmSAg>
3. Demand Analysis - https://youtu.be/cbeB9HI8_Ws

Rationale for Nature of the course

Applied Statistics includes planning for the collection of data, managing data, analyzing, interpreting and drawing conclusions from data and identifying problems, solutions and opportunities using analysis. This major builds critical thinking and problem solving skills in data analysis and empirical research.

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

- Seminar
- Assignment preparation
- Group discussion
- Quiz

Pedagogy

Chalk and Talk ,PPT, Seminar, Interaction, Problem solving.

COURSEOUTCOMES

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

CLO	Course Learning Outcomes	Knowledge Level
CLO 1	Define time series components. Explain time series with different structures. Explain trend, seasonality, cyclical irregularity. Explain stochastic components. Describe and use difference and lag operators	UptoK2
CLO 2	Run and interpret time series models and regression models for time series	Up toK3
CLO 3	Understand the concept and purpose of index Numbers. Calculate the indices to measure price and quantity changes over period of time. Understand different tests an ideal index Number satisfies. Understand consumer price index Numbers.	UptoK3
CLO 4	The index is used by government agencies and departments such as the Finance Ministry and RBI for policy making. To understand the concept of estimating the Gross Value Added of the manufacturing sector quarterly.	UptoK4
CLO 5	To understand the factors affecting the demand for a product or service in a market. Companies use this information to formulate strategies on pricing marketing communications, sales forecasting etc.	UptoK3

Mapping of Course Outcomes (COs) with Program Outcomes (PO) & Program Specified Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	3	3	-	-	2	2	2	1	2	3	3	3
CLO2	3	3	-	-	2	2	2	1	2	3	3	3
CLO3	3	2	-	-	2	1	1	1	2	3	3	2
CLO4	2	2	-	-	1	1	1	1	2	3	2	3
CLO5		2	-	-	1	1	1	1	2	3	2	2

3-AdvanceApplication

2-IntermediateLevel

1-BasicLevel

The Components of Assessment Shall be

S. No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K3
2	CLO5	Seminar	5	K2
3	CLO1,CLO2,CLO3, CLO4,CLO5	Quiz	5	K1

SUMMATIVE ASSESSMENT- BLUE PRINT

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of questions	K-Level	No. of questions	K-Level		
1	CLO1	UptoK2	2	K1&K2	1	K1	2(K2& K2)	1(K2)
2	CLO2	UptoK3	2	K1&K2	1	K1	2(K2&K2)	1(K3)
3	CLO3	UptoK3	2	K1&K2	1	K2	2(K3& K3)	1(K3)
4	CLO4	UptoK4	2	K1&K2	1	K2	2(K4& K4)	1(K4)
5	CLO5	UptoK3	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 off acts 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	-	-	09	7.50	41.67%
K2	5	6	20	10	41	34.16	
K3	-	-	20	30	50	41.67	41.67%
K4	-		10	10	20	16.67	16.66%
Total Marks	10	10	50	50	120	100	100%

LESSON PLAN

Unit	Topics	Hours	Mode
I	Basic Concept of Sample Surveys: Introduction, Fields of Application of Sampling Techniques and Limitations, Definitions and Preliminaries, Census and Sample Surveys, Advantages and Disadvantages.	6	PPT, Chalk and Talk.
	Principles of Sampling Theory, Probability and non-probability Sampling, Sampling Unit, Sampling Frame. Sampling and non-sampling Errors.	6	
II	Basic Methods of Simple Random Sampling: Simple Random Sampling, Procedures of Selecting a Random Sample, Estimation of Population Parameters	6	PPT, Chalk and Talk and Assignments
	Estimation of Population Proportion, Combination of unbiased estimators, Confidence Limits, Estimation of Sample Size	6	
III	Stratified random sampling: Introduction, Principles of Stratification, Advantages of Stratification.	6	PPT, Chalk and Talk, Assignments
	Estimation of Population mean and its variance, Estimate of Variance, Formation of Strata, Determination of Number of Strata.	6	
IV	Systematic sampling: Introduction, Sample Selection Procedure, Advantages and Disadvantages, Estimation of mean and its variance, estimation of variance .	6	PPT, Chalk and Talk, Assignments
	Comparison of Systematic with of Random sampling, Comparison of Systematic with of Stratified Random sampling.	6	
V	Ratio estimators: Introduction, Defintion and Notations– Bias of the ratio estimators.	6	Assignments and Seminar
	Approximate variance of Ratio Estimators, Confidence Limits.	6	

Course Designer:

Dr.S.VALLIRANI, Assistant Professor, Department of Mathematics and Statistics, The Madura College

DEPARTMENT OF STATISTICS				CLASS:IIB.Sc.,Statistics				
SEM	COURSE TYPE	COURSE CODE	COURSE TITLE	CREDITS	HRS	CIA	EXT	TOTAL
IV	Non-Major Elective II	20U4SNM2	MATRIX ALGEBRA	2	2	25	75	100

NATURE OF THE COURSE

Knowledge	✓	Skill Oriented	✓
Employability Oriented		Entrepreneurship Oriented	

COURSE OBJECTIVES:

- To illuminate the students in the concepts of Matrix Algebra
- Learn and develop understanding for solving mathematical problems on matrix algebra in few steps.
- Learn how to apply fundamental matrix algebra concepts in solving practical problems.

Unit	Description	Hours	K-level	CLO
I	Definition of Matrices – Addition, Subtraction and Multiplication of Matrices – Problems only	6	Upto K2	1
II	Transpose of a Matrix – Adjoint of a Matrix – Inverse of a Matrix – Problems only.	6	Upto K2	2
III	Introduction - Determinants, Fundamental properties of determinant, Symmetric, Skew Symmetric and Skew Determinants.	6	Upto K2	3
IV	Definition - Rank of a Matrix – Elementary Transformation of the Matrix - Finding the rank of a Matrix – Problems only.	6	Upto K2	4
V	Characteristic equation of a Matrix –Cayley Hamilton Theorem (statement only) – Verification of Cayley Hamilton Theorem – Simple Problems only.	6	Upto K2	5

Books for study:

Shanti Narayan& P.K.Mittal, A text book of Matrices, S.Chand& Company LTD, New Delhi, 2010

Chapters:

Unit I: Chapters: 1(1.4), 2(2.4, 2.5, 2.7)

Unit II: Chapters: 1(1.5.1), 2(2.13, 2.14)

Unit III: Chapters: 3 (3.1, 3.2, 3.3, 3.7)

Unit IV: Chapters : 4(4.1, 4.2, 4.3, 4.4)

Unit V: Chapters: 11(11.11, 11.11.1)

Books for Reference:

1. Matrix Operations, Richard Bronson, Schaum's Outline series, 2nd edition, 2011.
2. Matrices, Vasishta, KrishnaPrakashan media(P) Ltd, 19th edition.
3. Matrix Algebra Theory, Computations and Applications in statistics, James E. Gentle, 2nd edition, 2017.

Web Resources:

1. <https://courses.lumenlearning.com/sanjacinto-finitemath1/chapter/reading-matrices-and-matrix-operations/>
2. <https://www.teachoo.com/3158/684/Ex-3.4--16---Find-inverse-of-matrix--1-3--2--3-0-5/category/Ex-3.4/>
3. <https://www.toppr.com/guides/maths/determinants/determinant-of-a-matrix/>
4. <https://www.cliffsnotes.com/study-guides/algebra/linear-algebra/real-euclidean-vector-spaces/the-rank-of-a-matrix>
5. <https://yutsumura.com/linear-algebra/the-cayley-hamilton-theorem/>

Rationale for Nature of the course:

Matrix is a powerful tool of modern mathematics and its study is becoming important day by day due to its wide applications in every branch of knowledge.

Activities having direct bearing on Employability:

It enables the students to acquire knowledge about matrix algebra, this leads to applying right techniques in real world models like encryption, games, trend of business, shares, construction, animation, physics, geology and so on. This course provides career opportunities as various categories in employment orientation to the students.

Pedagogy:

Lecture, Seminar, Quiz, Problem Solving, Tutorial, Group Discussion, Assignments and Power Point presentation.

Lecture Schedule

Unit	Description	Hours		Mode
I	Introduction about Matrix	1	6	Lecture
	Addition of Matrix	5		Problem Solving
	Subtraction of Matrix			
	Multiplication of Matrix			
II	Transpose of Matrix	1	6	Lecture
	Adjoint of Matrix	2		Lecture
	Inverse of Matrix	3		Lecture, Problem
III	Introduction about determinants	1	6	Lecture
	Fundamental properties of determinant	1		Lecture
	Symmetric, Skew Symmetric and Skew Determinants.	2		Problem Solving
	Related problems	2		Problem Solving

IV	Introduction	1	6	Lecture
	Rank of Matrices using determinant method	1		Lecture
	Elementary transformations	1		Lecture
	Finding rank of Matrices using elementary transformation Related problems	3		Problem Solving, Quiz
V	Characteristic equation of a Matrix	2	6	PPT, Lecture,
	Cayley Hamilton Theorem (statement only)	3		Lecture, Assignment
	Verification of Cayley Hamilton Theorem	5		Lecture
	Related problems	4		Tutorial, Seminar,
Total Hours			30	

COURSE LEARNING OUTCOMES

Number	Course Outcome	Knowledge level
CLO 1	Perform algebraic operations on Matrices.	Up to K2
CLO 2	Write the inverse of a matrix, if it exists.	Up to K2
CLO 3	Write determinants and understand their relation to matrices. Explain the methodology for finding a determinant.	Up to K2
CLO 4	Discuss elementary transformations and determinants methods, to find the rank of matrix	Up to K2
CLO 5	Explain the Cayley Hamilton theorem for a given square matrix and find characteristic roots and corresponding vectors for a square matrix.	Up to K2

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

K1 - Remembering and recalling facts with specific answers

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

Mapping with Courses Learning Outcomes (CLOs)

CLO/ PO- PSO	PO					PSO							
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CLO 1	3	2	-	-	1	2	1	-	-	3	2	1	1
CLO 2	3	2	-	-	1	2	1	-	-	3	2	1	1
CLO 3	3	2	-	-	1	2	1	-	-	3	2	1	1
CLO 4	3	2	-	-	1	2	1	-	-	3	2	1	1
CLO 5	3	2	-	-	1	2	1	-	-	3	2	1	1

3 - Advanced Application

2 - Intermediate Level

1- Basic Level

The Components of Assessment Shall be

S. No.	CLO	Test Component	Marks	K Level
1	CLO5	Assignment	5	K2
2	CLO5	Seminar	5	K1
3	CLO1,CLO2,CLO3, CLO4,CLO5	Quiz	5	K1

SUMMATIVE EXAMINATION-BLUEPRINT

S.No.	CLOs	K – Level	Section A	Section B (Either/OR Choice)	Section C (Open Choice)	Total
			Short Answers			
1	CLO1	Upto K2	1(K1)	2(K2 &K2)	1(K1)	
2	CLO2	Upto K2	1(K1)	2(K2 &K2)	1(K1)	
3	CLO3	Upto K2	1(K1)	2(K2 &K2)	1(K1)	
4	CLO4	Upto K2	1(K1)	2(K2 &K2)	1(K1)	
5	CLO5	Upto K2	1(K1)	2(K2 &K2)	1(K1)	
No. of Questions to be asked			5	10	5	20
No. of Questions to be answered			5	5	3	13
Marks for each question			2	7	10	
Total Marks for each Section			10	35	30	75

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 without choice	Consolidated
K1	10	-	50	60	46.15	46%
K2	—	70	-	70	53.85	54%
Total Marks	10	70	50	120	100	100%

Course Designer:

Dr. B. SEETHALAKSHMI, Assistant Professor, Department of Mathematics & Statistics.



DEPARTMENT OF PHYSICS

Revised Curriculum

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

Academic Year 2023-2024 onwards

I and II semesters (B.Sc. Physics)

Allied Courses

I and II semesters (M.Sc. Physics)

THE MADURA COLLEGE, MADURAI
RESEARCH CENTRE & PG DEPARTMENT OF PHYSICS

VISION

To inculcate scientific temper and spirit of inquiry among students through academic programmes integrated with theoretical knowledge and practical applications enabling the students to apply knowledge and skills to achieve professional goals and ultimately the advancement of humanity.

MISSION

- To create globally competent citizens by providing quality physics education.
- To produce lifelong learners with scientific temper and spirit of inquiry for the advancement of science.
- To sensitize students to be deeply rooted to the society to which they belong.
- To produce innovators who provide solutions to the problems in the society and moot the advancement of humanity.
- To create dutiful citizens who are high on 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 Educational Objectives (PEOs)

After successful completion of the programme the graduate will

- **PEO-1** Apply knowledge and skills acquired in the disciplinary domain for providing solutions to real life problems.
- **PEO-2** Choose a suitable career option or higher education and excel in Competitive examination.
- **PEO-3** Acquire interpersonal skills, be social, be responsible, excel in team work and become leaders in their domain.
- **PEO-4** Communicate effectively and set high moral and ethical standards.
- **PEO-5** Adapt to the constantly evolving technology and be life-long learners

Programme specific learning outcomes (PSO) aligned with Graduate Attributes

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

	Programme specific learning outcomes	Graduate Attributes
PSO-1	Demonstrate a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics like Properties of Matter & Sound, Heat & Thermodynamics, Electricity, Electro Magnetism, Introductory Physics, Instrumentation physics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology.	Knowledge in corecompetency
PSO-2	Problem-solving skills that are required to solve different types of Physics-related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries.	Design and development of solution for complexproblems
PSO-3	Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.	Modern tool usage
PSO-4	Recognize the importance of mathematical modeling simulation and computing, and the role of approximation and mathematical approaches to describing the physical world.	Modern tool usage
PSO-5	Plan and execute Physics-related experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of Physics.	Individual and teamwork, project management, Communication.



The Madura College (Autonomous), Madurai – 625 011
Research Centre & PG Department of PHYSICS UG Programme Structure

Sem	Part	CourseCode	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	I	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	Language - I Tamil / Hindi / Sanskrit	6	3							
	II	23U1NENG1	Language - II English	6	3							
	III	23U1PCCT1	Properties of Matter and Acoustics	5	5			Y			Y	28
		23U1PCCP1	Practical –I	3	3			Y			Y	61
		23U1PGET1/23U3PGET1	Allied Physics-I	4	4			Y			Y	73
		23U1PGEP1/23U3PGEP1	Allied Practical – I	2	1			Y			Y	61
	IV	23U1PSED1 (SEC 1)	Physics of Everyday Life	2	2			Y			Y	100
		23U1PFCT1 (F C)	Introductory Physics	2	2			Y			Y	100

Sem	Part	CourseCode	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	
II	I	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	Language - I Tamil / Hindi / Sanskrit	6	3							
	II	23U2NENG2	Language - II English	6	3							
	III	23U2PCCT2	Heat, Thermodynamics and Statistical Physics	5	5			Y			Y	39
		23U2PCCP2	Practical – II	3	3			Y			Y	50
		23U2PGET2/23U4PGET2	Allied Physics- II	4	4			Y			Y	62
		23U2PGEP2/23U4PGEP2	Allied Practical – II	2	1						Y	50
	IV	23U2PSED2	Astro Physics	2	2			Y			Y	100
		23U2PSED3	Basic Instrumentation	2	2			Y			Y	0

Evaluation Pattern (Theory papers)**Internal Assessment : 25 Marks****External Assessment : 75 Marks****Total : 100 Marks****Continuous Internal Assessment: 25 Marks**

Components	Marks
Test (Average of two tests) Conducted for 25 marks and converted into 10 marks)	10
Assignment (2/3)	5
Quiz/ Documentation/ Case study / ICT based Assignment/ Mini Projects	5
Attendance	5
Total	25

Blueprint for Test component of CIA

	CLOs	K-Level	Section A (Short Answer)	Section B (Either/or)	Section C (Open choice)
CIA	CLO x	K2/ K3/ K4	1 (K1 / K2)	(K2 & K2) or (K3 & K3) or (K3 & K3) or	1 (K2) or 1 (K3) or 1 (K4) or
	CLO y	K2/ K3/ K4	1 (K1/ K2)	(K2 & K2) or (K3 & K3) or (K3 & K3) or	1 (K2) or 1 (K3) or 1 (K4) or
	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

Question Paper Pattern for External Examination: 75 Marks

Section	Marks
A- Multiple Choice Questions (10 X 1 mark)	10
B- Short answer type (5 X 2 mark)	10
C- Either/Or type (5 X 5 marks)	25
D- Open Choice type (3out of 5 X 10 marks)	30
Total	75

PRACTICAL		
Internal (Formative)	25 marks	
	Components of Internal Assessment	Marks
	Test	10
	Continuous observation	10
	Record	5
External (Summative)	75 marks	

ASSESSMENT RUBRICS

TEST

#	Timeline
1	36 th day
2	72 nd day
Retest	On genuine reasons / medical grounds (with prior permission)

Assessment Strategy

- Objective.
- Subjective.

Assessment of the learning level attained by the students against mapped course / Programmes Outcomes.

Rubrics:

Section A (Objective)

Criteria	Performance Marks
	1
Assessment	The answer is correct

Section B (Short Answer)

Criteria	Performance Marks	
	2 / 2.5 (CIA)	1
Assessment	The answer is relevant, correct and complete	The answer is irrelevant but incomplete

Section C (Paragraph Answer)

Criteria	Performance Marks				
	5	4	3	2	1
Assessment	The answer is relevant, answered at the appropriate K-level, conclusion or result drawn correctly.	The answer is relevant, answered at The appropriate K-level, arguments are correct but conclusion / result is inconclusive or incorrect.	The answer is relevant, answered at the appropriate K-level, arguments are correct but incomplete and inconclusive	The answer is relevant with few correct and few incorrect and inconclusive arguments	The answer is relevant but arguments are incorrect and inconclusive.

Section D

Criteria	Performance Marks					
	10	8-9	6-7	4-5	2-3	1
Assessment	The answer is correct and conclusive. The result is drawn correctly	The answer is correct and complete. The result is incorrect or inconclusive	The answer is mostly correct, most key points are correct but the result is incorrect or inconclusive	The answer is partly correct. A few key points are correct. Inference is drawn incorrectly or inconclusively	The answer is incomplete. Most key points are incorrect.	The answer is irrelevant

Question paper pattern for test component of Internal Assessment

(Duration 1 hour)

Pattern	No. of questions	Marks per question	Total marks
Part A (Short answer type - no choice)	2	2.5	5
Part B (Paragraph answer type - Either-or)	2	5	10
Part C (Essay type - openchoice – one question to be answered out of 2 question asked)	1/2	10	5
Total marks			25

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*
CLO Y	1*	1*	1*

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

Assessment methodology and weight:

Weight: 10 marks.

Calculated metric = Average of two tests.

SEMINAR

Timeline
Spread over the entire semester from days 20 to 80

Assessment Strategy

Rubric:

Component	3	2	1
Presentation	-	Presentation was done with ICT tools and the tools were appropriate for the content.	Usage of ICT tools was inadequate.
Content	Content was presented clearly and concisely, key points were answered well and arguments were established very well.	Content was relevant, key points were presented but inferences were ineffectively drawn or questions answered inadequately.	Content was presented but key points were not articulated effectively

Weight: 5 marks

ASSIGNMENT:

#	Timeline
1	30 th day
2	70 th day

Assessment Strategy

Rubric:

Component	3	2	1
Timely submission	-	-	The assignment is submitted on time
Content	-	-	Content is relevant and complete in all respects
Originality	-	-	Content is written in own words with paraphrasing
Library and Information resources usage	-	Library and N-list resources are used and the resources used are cited appropriately and adequately	Information resource usage (or) usage of other resources are inadequate or not properly referenced

Assessment methodology and weight

Weight: 5 marks

Assessment outcome: Best one score to be considered.

Quiz

#	Timeline
1	18 th day
2	48 th day
3	78 th day

(Or)

#	Timeline
1	40 th day
2	80 th day

Assessment strategy

- Objective

Assessment methodology and weight

Weight: 5 Marks.

Assessment outcome: Average of test 2 out of 3 quizzes (or) best one of 2 quizzes.

Title of the Course		PROPERTIES OF MATTER AND ACOUSTICS						
TANSCHÉ Course type		CC1						
Course Category		Core						
Nature of Course		Skill Development						
Category	CC	Year	I	Credits	5	Course Code	23U1PCCT1	
		Semester	I					
Instructional Hours per week		Lecture		Tutorial	Practical		Total	
		4		1			5	
Marks		CIA			Semester		Total	
		25			75		100	
Pre-requisite(s)		Higher Secondary Physics						
Objectives of theCourse		• Study of the properties of matter leads to information which is of practical value to both the physicist and the engineers. • It gives us information about the internal forces which act between the constituent parts of the substance. • Students who undergo this course are successfully bound to get a better insight and understanding of the subject.						
Course Outline		Unit I: Elasticity Hooke’s law – Stress-strain diagram – Elastic constants –Poisson’s ratio – Relation between elastic constants and Poisson’s ratio – Work done in stretching and twisting a wire – Twisting couple on a cylinder – Rigidity modulus by static torsion– Torsional pendulum (with and without masses)						
		Unit II: Bending Of Beams Cantilever– Expression for Bending moment – Expression for depression at the loaded end of the cantilever– Oscillations of a cantilever – Expression for time period – Experiment to find Young’s modulus – Theory of Non-uniform bending– Experiment to determine Young’s modulus by scale and telescope method – Uniform bending – Expression for elevation – Experiment to determine Young’s modulus using pin and Microscope.						
		Unit III: Fluid Dynamics Surface tension: Definition – Molecular forces– Excess pressure over curved surface – Application to spherical and cylindrical drops and bubbles – Determination of surface tension by Jaeger’s method– Variation of surface tension with temperature. Viscosity: Definition – Streamline and turbulent flow – Rate of flow of liquid in a capillary tube – Poiseuille’s formula – Terminal velocity and Stoke’s formula– Variation of viscosity with temperature.						
		Unit IV: Waves And Oscillations Simple Harmonic Motion (SHM) – Differential equation of						

	SHM – Graphical representation of SHM – Composition of two SHM in a straight line and at right angles – Lissajous's figures– Free, damped, forced vibrations –Resonance and Sharpness of resonance. Laws of transverse vibration in strings –Sonometer – Determination of AC frequency using Sonometer –Determination of frequency using Melde's string apparatus Unit V: Acoustics Of Buildings And Ultrasonics Intensity of sound – Decibel – Loudness of sound –Reverberation – Sabine's reverberation formula – Acoustic intensity – Factors affecting the acoustics of buildings. Ultrasonic waves: Production of ultrasonic waves – Piezoelectric crystal method – Magneto striction effect – Application of ultrasonic waves
Extended Professional Component	Identify the materials suitable for construction of buildings based on the moduli of elasticity.
Skills acquired from this course	Acquire knowledge in physics concepts and related problem solving Skills
Justification for nature of course	It renders the knowledge about materials and various properties like elastic limit, viscous nature of fluid etc.
Text Book(s)	1. D.S.Mathur, 2010, Elements of Properties of Matter, S.Chand & Co. 2. BrijLal & N. Subrahmanyam, 2003, Properties of Matter, S.Chand& Co 3. D.R.Khanna & R.S.Bedi, 1969, Textbook of Sound, AtmaRam & sons 4. BrijLal and N.Subrahmanyam, 1995, A Text Book of Sound, Second revised edition, Vikas Publishing House. 5. R.Murugesan, 2012, Properties of Matter, S.Chand& Co.
Reference Book(s)	1. C.J. Smith, 1960, General Properties of Matter, Orient Longman Publishers 2. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, R. Chand & Co. 3. A.P French, 1973, Vibration and Waves, MIT Introductory Physics, Arnold-Heinmann India.
Websites and e-Learning resources	1. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work 2. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html 3. https://www.youtube.com/watch?v=gT8Nth9NWPM 4. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s 5. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work 6. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/ 7. http://www.sound-physics.com/ 8. http://nptel.ac.in/courses/112104026/

COURSE OUTCOMES:

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

CLOs	Course Outcomes	K-level
CLO1	Analyze the elastic behavior in terms of three moduli of elasticity and working of torsion pendulum.	K4
CLO2	Able to appreciate concept of bending of beams and analyze the expression, quantify and understand nature of materials.	K2
CLO3	Apply the surface tension and viscosity of fluid and support the interesting phenomena associated with liquid surface, soap films provide an analogue solution to many engineering problems.	K3
CLO4	Develop the simple harmonic motions mathematically and apply them. Understand the concept of resonance and use it to evaluate the frequency of vibration. Set up experiment to evaluate frequency of ac mains	K3
CLO5	Understand the concept of acoustics, importance of constructing buildings with good acoustics. Able to apply their knowledge of ultrasonic's in real life, especially in medical field and assimilate different methods of production of ultrasonic waves	K3

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-pointscale 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	1	2	3	3	2	2	1	1
CLO2	3	3	3	2	2	2	3	3	2	2	1
CLO3	3	2	3	2	2	2	3	3	2	1	1
CLO4	3	2	2	1	1	1	3	2	1	1	1
CLO5	3	2	2	1	2	2	3	2	2	1	2

Summative – Blue-Print-Model(Mapping with CLOs)

Units	CLOs	K-Level	Section-A		Section-B		Sec-C	Sec-D
			MCQs.		Short Answers		(Either OR)	Open Choicee
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO1	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K4)
2	CLO2	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K2)
3	CLO3	Upto K3	2	K1&K2	1	K2	2(K1&K1)	1(K3)
4	CLO4	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)
5	CLO5	Upto K2	2	K1&K2	1	K1	2(K3&K3)	1(K3)
No. of Questions to be asked			10			5	10	5
No. of Questions to be answered			10			5	5	3
Marks for each question			1			2	5	10
Total Marks for each section			10			10	25	30

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented –Solving Problems

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

Distribution of Section-wise Marks with K Levels

K 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		PRACTICALS – I					
TANSCHE Course type		CORE					
Course Category		CC2					
Nature of Course		Skill Development					
Category	CC	Year	I	Credits	3	Course Code	23U1PCCP1
		Semester	I				
Instructional Hours perweek		Lecture		Tutorial		Practical	Total
		---		----		3	3
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher Secondary Physics Practicals					
Objectives of the Course		Apply various physics concepts to understand Properties of Matter, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results					
Course Outline		Properties of Matter (Any six experiments from the following) 1. Determination of rigidity modulus without mass using Torsional pendulum. 2. Determination of rigidity modulus with masses using Torsional pendulum. 3. Determination of moment of inertia of an irregular body. 4. Verification of parallel axes theorem on moment of inertia. 5. Verification of perpendicular axes theorem on moment of inertia. 6. Determination of moment of inertia and g using Bifilar pendulum. 7. Determination of Young’s modulus by stretching of wire with known masses. 8. Verification of Hook’s law by stretching of wire method. 9. Determination of Young’s modulus by uniform bending – load depression graph. 10. Determination of Young’s modulus by non-uniform bending –scale & telescope. 11. Determination of Young’s modulus by cantilever – load depression					

	graph. 12. Determination of Young's modulus by cantilever – oscillation method 13. Determination of Young's modulus by Koenig's method – (or unknown load) 14. Determination of rigidity modulus by static torsion. 15. Determination of Y, n and K by Searle's double bar method. 16. Determination of surface tension & interfacial surface tension by drop weight method. 17. Determination of co-efficient of viscosity by Stokes' method – terminal velocity. 18. Determination of critical pressure for streamline flow. 19. Determination of Poisson's ratio of rubber tube. 20. Determination of viscosity by Poiseuille's flow method. 21. Determination radius of capillary tube by mercury pelletmethod. 18. Determination of g using compound pendulum
Extended Professional Component	Employable and Skill Enhancement
Skills acquiredfrom this course	To expose the students to experiments in the areas of Mechanics, properties of matter, Heat and Sound. Laboratory techniques with accuracy in measurements and data analysis enhance effective comprehension of physics concepts.
Justification for nature ofcourse	This Experimental physics course provides hands– on learning experience in measuring the concepts that are learnt theoretically cansolve problems related to it practically.

Title of the Course		Allied Physics – I					
TANSCHÉ Course type		EC1					
Course Category		Generic Elective I					
Nature of Course		Skill Development					
Category	EC	Year	I / II	Credits	4	Course Code	23U1PGET1/ 23U3PGET1
		Semester	I / III				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		3	1				4
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher Secondary Physics					
Objectives of the Course		To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.					
Course Outline		Unit I: Waves, Oscillations And Ultrasonics: Simple harmonic motion (SHM) – Composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – Uses – Laws of transverse vibrations of strings – Determination of AC frequency using sonometer (steel and brass wires) – Ultrasound – Production – Piezoelectric method – Application of ultrasonics: Scientific application-Industrial uses - medical application .					
		Unit II: Properties Of Matter: <i>Elasticity:</i> Elastic constants – Bending of beam – Theory of non- uniform bending – Determination of Young’s modulus by non-uniform bending pin and microscope method – Theory of Torsion pendulum – Determination of rigidity modulus by torsional pendulum <i>Viscosity:</i> Streamline and turbulent motion – Critical velocity – Coefficient of viscosity – Poiseuille’s formula – Comparison of viscosities – Burette method.					
		Unit III: Heat And Thermodynamics: Joule-Kelvin effect-Joule-Thomson porous plug experiment-Theory- Temperature of inversion-Liquefaction of Oxygen-Linde’s process of liquefaction of air-Thermodynamic system-Thermodynamic equilibrium- Laws of thermodynamics - Heat engine-Carnot’s Engine-Carnot’s cycle- Efficiency-Entropy-Change of entropy in reversible and irreversible process.					
		Unit IV: Electricity And Magnetism: Potentiometer – Principle – Measurement of thermo emf using potentiometer – Magnetic field due to a current carrying conductor – Biot-Savart’s law – Field along the axis of the coil carrying current – Peak, average and RMS values of ac current and voltage – Power factor and current values in an AC circuit .					

	Unit V: Digital Electronics And Digital India: Logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – Universal building blocks – Boolean algebra – De Morgan’s theorem – Verification – K-Map(upto 3 variables)- Half adder - Full adder- Semiconductor laboratories under Dept. of Space – An introduction to Digital India
Extended Professional Component	Expert lectures, seminars, webinars, industry inputs, social accountability, patriotism.
Skills acquired from this course	Understanding the working of heat engines and thermodynamic efficiency. Applying the skills of Digital systems to real life systems.
Justification for nature of course	Solving problems on heat exchange mechanisms, efficiency of thermodynamic systems and magnetic systems for various applications.
Text Book(s)	1. R.Murugesan (2001), Allied Physics,S. Chand & Co, NewDelhi. 2. Brijlal and N.Subramanyam (1994), Waves and Oscillations,Vikas Publishing House, NewDelhi. 3. Brijlal and N.Subramaniam (1994), Properties of Matter, S.Chand &Co., NewDelhi. 4. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8 th edition), S.Chand &Co.,New Delhi. 5. R.Murugesan(2005), Optics and Spectroscopy, S.Chand & Co, NewDelhi. 6. A.Subramaniyam, Applied Electronics 2 nd Edn., National Publishing Co., Chennai.
Reference Book(s)	1. Resnick Halliday and Walker (2018). Fundamentals of Physics (11 th edition), JohnWilley and Sons, Asia Pvt. Ltd., Singapore. 2. V.R.Khanna and R.S.Bedi (1998), Text book of Sound 1 st Edn. Kedharnaath Publish & Co, Meerut. 3. N.S.Khare and S.S.Srivastava (1983), Electricity and Magnetism 10 th Edn., AtmaRam & Sons, New Delhi. 4. D.R.Khannaand H.R. Gulati(1979). Optics, S. Chand & Co.Ltd., New Delhi. 5. V.K.Metha(2004). Principles of electronics 6 th Edn. S.Chandand company.
Websites and e-Learning resources	1. https://youtu.be/M_5KYncYNyc 2. https://youtu.be/ljJLJgIvaHY 3. https://youtu.be/7mGqd9HQ_AU 4. https://youtu.be/h5jOA57OXM 5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/ 6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html https://www.youtube.com/watch?v=gT8Nth9NWPM https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s https://www.bioline.scientific.com/blog/what-are-surfactants-and-how-do-they-work

COURSE OUTCOMES:

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

COs	Course Outcomes	K-level
CO1	Analyse the types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically. Relate theory with practical applications in medical field.	K4
CO2	Explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life. Connect droplet theory with Corona transmission.	K2
CO3	Comprehend basic concept of thermodynamics concept of entropy and associated theorems able to interpret the process of flow temperature physics in the background of growth of this technology	K3
CO4	Articulate the knowledge about electric current resistance, capacitance in terms of potential electric field and electric correlate the connection between electric field and magnetic field and analyze them mathematically verify circuits and apply the concepts to construct circuits and study them	K3
CO5	Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. Infer operations using Boolean algebra and acquire elementary ideas of IC circuits. Acquire information about various Govt. programs/ institutions in this field.	K3

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	2	1	2	2	3	3	2	1	2
CLO2	3	2	3	1	2	3	3	3	3	1	2
CLO3	3	2	2	1	2	2	3	2	2	1	1
CLO4	3	2	3	1	2	2	3	2	2	1	1
CLO5	3	3	3	1	2	3	3	3	3	2	2

**Summative – Blue-Print-Model
(Mapping with CLOs)**

Units	CLOs	K-Level	Section-A		Section-B		Sec-C	Sec-D
			MCQs.		Short Answers		(Either OR)	Open Choice
			No. of Questions	K-Level	No. of Questions	K- Level		
1	CLO1	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K4)
2	CLO2	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K2)
3	CLO3	Upto K3	2	K1&K2	1	K2	2(K1&K1)	1(K3)
4	CLO4	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)
5	CLO5	Upto K2	2	K1&K2	1	K1	2(K3&K3)	1(K3)

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%

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

S.No.	CLOs	K-level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1.	CLO A	Upto K2	2	K1 & K2	1	K1	2(K2&K2)	2(K2&K2)	
2	CLO B	UptoK3	2	K1 & K2	2	K2	2(K3&K3)	1(K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each Question			1		2		5	10	
Total marks for each section			4		6		10	20	40

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	2	--	--	4	6.7	66.7
K2	2	4	10	20	36	60.0	
K3	-	-	10	10	20	33.3	33.3
Total Marks	4	6	20	30	60	100.00	100%

II Internal

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

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	--	--	--	2	3.3	33.3
K2	2	6	10		18	30.0	
K3	-	-	10	10	20	33.3	33.3
K4	-	-	-	20	20	33.3	33.3
Total Marks	4	6	20	30	60	100.00	100%

Title of the Course		ALLIED PRACTICAL – I					
TANSCHE Course type		EC1 –P					
Course Category		Generic Elective I (Practical)					
Nature of Course		Skill Development					
Category	ECP	Year	I / II	Credits	1	CourseCode	23U1PGEP1/ 23U3PGEP1
		Semester	I / III				
Instructional Hours per week		Lecture		Tutorial		Practical	Total
		---		---		2	2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher Secondary Physics					
Objectives of the Course		• Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyze, able to do error analysis and correlate results					
Course Outline		(Any six from the following list) 1. Young’s modulus by non-uniform bending using pin and microscope 2. Young’s modulus by non-uniform bending using optic lever, scale and telescope 3. Rigidity modulus by static torsion method. 4. Rigidity modulus by torsional oscillations without mass 5. Surface tension and interfacial Surface tension – drop weight method 6. Comparison of viscosities of two liquids – burette method 7. Specific heat capacity of a liquid – half time correction 8. Verification of laws of transverse vibrations using Sonometer 9. Calibration of low range voltmeter using potentiometer 10. Determination of thermo emf using potentiometer 11. Verification of truth tables of basic logic gates using ICs 12. Verification of De Morgan’s theorems using logic gate ICs. 13. Use of NAND as universal building block.					
Extended Professional Component		Students can design models from the practical’s.					

Skills acquired from this course	Students acquire practical knowledge from related theory
Justification for nature of course	Analysing the concepts of Physics through experiments in the laboratory will enhance effective comprehension.
Text Book(s)	1. M.N.Srinivasan, S.Balasubramanian, R.Ranganathan, A text book of Practical Physics, 2007, Sultan Chand & Sons. 2. Indu Prakash & Ramakrishnan , A text book of Practical Physics , 2011, Kitab Mahal Agencies, New Delhi 3. S.R. Govinda Rajan, T. Murugaiyan, S. Sundara Rajan, Practical Physics, 2007, Rochouse& Sons.
Websites and e-Learning resources	1. https://www.myphysicslab.com/ 2. https://phet.colorado.edu/ 3. https://www.edumedia-sciences.com/en/node/90-properties-of-matter 4. https://spark.iop.org/properties-matter-home-experiments

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledgelevel	Marks
CLO1	Domain knowledge which the experiments test	Upto K2	20
CLO2	Design of an appropriate experiment	Upto K3	15
CLO3	Skill in doing the experiment	Upto K3	15
CLO4	Analysis of data collected & representation is meaning form	Upto K4	20
CLO5	Communicating the finding	Upto K2	5

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) in the 3-pointscale 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	3	1	2	2	3	3	3	2	3
CLO2	3	2	3	2	3	2	3	2	2	1	2
CLO3	3	2	3	2	2	2	3	2	3	1	2
CLO4	3	2	3	2	2	2	3	2	3	1	3
CLO5	3	2	3	2	3	2	3	3	3	2	3

Title of theCourse		PHYSICS OF EVERYDAY LIFE					
TANSCHECourse type		SEC-1					
CourseCategory		Skill Enhancement Course					
Nature ofCourse		Skill development					
Category	SEC	Year	I	Credits	2	CourseCode	23U1PSED1
		Semesterr	1				
InstructionalHoursper week		Lecture	Tutorial		Practical		Total
		2	-		-		2
Marks		CIA			Semester		Total
		25			75		100
Pre-requisite(s)		Higher Secondary level Physics					
Objectives of theCourse		● To know where all physics principles have been put to use in daily and appreciate the concepts with a better understanding also to knabout Indian scientists who have made significant contributions Physics					
Course Outline		Unit I: Mechanical Objects Spring scales – bouncing balls –roller coasters –rockets and space travel.					
		Unit II : Optical Instruments And LASER Vision corrective lenses – Polaroid glasses – UV protective glass – Polaroid camera – colour photography – holography and laser.					
		Unit III: Physics Of Home Appliances Bulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners					
		Unit IV: Solar Energy Solar constant – General applications of solar energy – Solar water heaters –General applications of solar cells.					
		Unit V: Indian Physicist And Their Contributions C.V.Raman, HomiJehangirBhabha, Vikram Sarabhai, Subrahmanyam Chandrasekhar, VenkatramanRamakrishnan, Dr.APJ Abdul Kalam andtheir contribution to science and technology.					
Extended ProfessionalComponent		Preparation of models and charts to explain various physical phenomenon					

Skills acquired from this course	Students learned the working principle of home appliances, mechanical objects, applications of optical instruments and about the solar photo voltaic systems.
Justification for nature of course	Students learned the working principle of home appliances, mechanical objects, applications of optical instruments and about the solar photo voltaic systems.
Text Book(s)	1. The Physics in our Daily Lives, UmmeAmmara, Gugucol Publishing, Hyderabad, 2019. 2. For the love of physics, Walter Lawin, Free Press, New York, 2011.
Reference Book(s)	1. Sears, Zemansky, Hugh D. Young, Roger A. Freedman, 2021, University Physics with Modern Physics 15th Edition, Pearson.
Websites and e-Learning resources	1. https://www.youtube.com/watch?v=rLiW168r2oI 2. https://blog.pitsco.com/blog/how-do-bicycles-work-the-science-behind-this-simple-machine 3. https://www.grc.nasa.gov/www/k-12/rocket/TRCRocket/rocket_principles.html 4. https://www.revantoptics.com/blogs/the-lens/how-do-polarized-sunglasses-work 5. https://www.scienceabc.com/innovation/how-do-polaroid-pictures-work-instant-color-films.html 6. https://www.oreilly.com/library/view/engineering-physics/9788131775073/xhtml/ch12-sub12.2.xhtml#:~:text=In%20the%20holographic%20plate%2C%20both,is%20the%20principle%20of%20holography. 7. https://engineeringstuff.co.in/what-is-electric-fan-how-electric-fan-works/ 8. https://electronics.howstuffworks.com/tv.htm 9. https://www.youtube.com/watch?v=kp33ZprO0Ck 10. https://www.youtube.com/watch?v=L_q6LRgKpTw

COURSE OUTCOMES:

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

CLOs	Course Outcomes	K-level
CLO1	Understand the working of mechanical objects	K2
CLO2	Explain the working of application of optical instruments.	K2
CLO3	Understand the working of home appliances.	K2
CLO4	Explain the principles of photo voltaic for solar energy conversion	K2
CLO5	Illustrate the notable contribution of Indian scientists to the global advancement of science.	K2

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-pointscale 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	3	2	3	2	2	3	1	1	1
CLO2	3	1	2	2	1	1	1	2	3	1	2
CLO3	3	1	2	1	1	1	3	1	2	2	1
CLO4	3	1	2	2	1	1	2	2	3	1	1
CLO5	3	1	2	1	1	1	1	2	1	1	1

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

Unit	CLOs	K-Level	Section A		Section B		Section C (Either or Choice)	SectionD (Open Choice)
			MCQs		Short answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K2	2	K1 & K2	1	K2	2 (K2 & K1)	1 (K2)
2	CLO 2	Up to K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K2)
3	CLO 3	Up to K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
4	CLO 4	Up to K2	2	K1 & K2	1	K1	2 (K2 & K2)	1 (K2)
5	CLO 5	Up to K3	2	K1 & K2	1	K2	2 (K2 & K3)	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 question			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	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	SectionD (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	15	--	24	20.00	95.83%
K2	5	6	30	50	91	75.83	
K3	-	-	5	-	5	04.17	4.17%
K4	-	-		-	-	-	-
Total Marks	10	10	50	50	120	100.00	100%

Title of the Course		INTRODUCTORY PHYSICS					
TANSCHÉ Course type		FC					
Course Category		Foundation Course					
Nature of Course		Introductory					
Category	FC	Year	I	Credits	2	Course Code	23U1PFCT1
		Semester	1				
Instructional Hours perweek	Lecture		Tutorial		Practical		Total
	2		-		-		2
Marks	CIA			Semester		Total	
	25			75		100	
Pre-requisite(s)		Higher Secondary with Physics and Mathematics					
Objectives ofthe Course		• To help students get an overview of Physics before learning their c courses. • To serve as a bridge between the school curriculum and the deg programme.					
Course Outline		Unit I: Significant figures – Setting up of an experiment – Instrument – Least count and precision – systematic errors and random errors - eliminating systematic errors and minimizing random errors - error propagation – standard deviation about the mean – techniques for plotting graphs – error plots.					
		Unit II: Vectors, scalars –examples for scalars and vectors from physical quantities – addition, subtraction of vectors – resolution and resultant of vectors – units and dimensions– standard physics constants - Different types of forces– gravitational, electrostatic, magnetic, electromagnetic, nuclear – mechanical forces like, centripetal, centrifugal, friction, tension, cohesive,adhesive forces.					
		Unit III: Different forms of energy– conservation laws of momentum, energy –types of collisions –angular momentum– alternate energy sources–real life Examples					

	Unit IV:
	Types of motion– linear, projectile, circular, angular, simple harmonic motions – satellite motion – banking of a curved roads – streamlined and turbulent motions – wave motion – comparison of light and sound waves – free, forced, damped oscillations.
	Unit V:
	Surface tension – shape of liquid drop – angle of contact – viscosity – lubricants – capillary flow – diffusion – real life examples– properties and types of materials in daily use- conductors, insulators – thermal and electric.
Extended Professional Component	Preparation of models and charts to explain various physical phenomenon
Skills acquired from this course	Introductory course aimed at refreshing and bridging the gap in understanding with practical applications.
Justification for nature of course	The course aims to bridge the gap in understanding of basic concepts in physics with practical applications.
Text Book(s)	1. D.S.Mathur, 2010, Elements of Properties of Matter, S.Chand & Co 2. BrijLal & N. Subrahmanyam, 2003, Properties of Matter, S.Chand & Co.
Reference Book(s)	1. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, S.Chand & Co
Websites and Learning resources	2. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html 3. https://science.nasa.gov/ems/ 4. https://eesc.columbia.edu/courses/ees/climate/lectures/radiation_hays/

COURSE OUTCOMES:

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

CLOs	Course Outcomes	K-level
CLO1	Understanding experimental techniques and errors in measurement while applying concepts of error analysis to experimentation Techniques	K2
CLO2	Appreciate different forces present in Nature while learning about phenomena related to these different forces while also learning about vectors and manipulation with vectors.	K2
CLO3	Quantify energy in different process and relate momentum, velocity and energy	K3
CLO4	Differentiate different types of motions they would encounter in various courses and understand their basis	K3
CLO5	Relate various properties of matter with their behavior and connect them with different physical parameters involved.	K4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-pointscale 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	3	2	3	2	3	2	3	2	3
CLO2	3	1	2	2	1	1	3	1	1	1	2
CLO3	3	1	2	1	1	1	2	1	1	1	2
CLO4	3	1	2	2	1	1	3	1	1	1	2
CLO5	3	1	2	1	1	1	3	2	1	1	2

Blueprint for Semester Examination

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

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	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		HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS					
TANSCHÉ Course type		CC3					
Course Category		Core					
Nature of Course		Skill Development					
Category	CC	Year	I	Credits	5	Course Code	23U2PCCT2
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher Secondary Physics					
Objectives of the Course		The course focuses to understand a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales. Practical exhibition and explanation of transmission of heat in good and bad conductor. Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation					
Course Outline		Unit I: Calorimetry Specific heat capacity – specific heat capacity of gases CP& CV– Meyer’s relation – Joly’s method for determination of CV – Regnault’s method for determination of CP Low Temperature Physics: Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect –Boyle temperature – temperature of inversion – liquefaction of gas by Linde’s Process – adiabatic Demagnetization					
		Unit II: Thermodynamics-I Zeroth law and first law of thermodynamics – P-V diagram – heat engine – efficiency of heat engine – Carnot’s engine, construction, working and efficiency of petrol engine and diesel engines – comparison of engines.					
		Unit III: Thermodynamics-II Second law of thermodynamics –entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram – thermodynamical scale of temperature – Maxwell’s thermodynamical relations –Clasius - Clapeyron’s equation (first latent heat equation) – third law of thermodynamics – unattainability of absolute zero – heat death.					
		Unit IV: Heat Transfer					

	Modes of heat transfer: conduction, convection and radiation. Conduction: thermal conductivity – determination of thermal conductivity of a good conductor by Forbe’s method – determination of thermal conductivity of a bad conductor by Lee’s disc method. Radiation: Black body radiation (Ferry’s method) – distribution of energy in black body radiation – Wien’s law and Rayleigh Jean’s law – Planck’s law of radiation – Stefan’s law – deduction of Newton’s law of cooling from Stefan’s law.
	Unit V: Statistical Mechanics Definition of phase-space – micro and macro states – ensembles – different types of ensembles – classical and quantum Statistics – Maxwell-Boltzmann statistics – expression for distribution function – Bose-Einstein statistics – expression for distribution function – Fermi-Dirac statistics –expression for distribution function – comparison of three statistics.
Extended Professional Component	Problem solving and analyzing real life heat engines for doing a variety of our day to day task and understating the thermodynamic functioning of our universe.
Skills acquired from this course	Understanding the working of heat engines and thermodynamic efficiency. Applying the skills of thermodynamic systems to real life systems.
Justification for nature of course	Solving problems on heat exchange mechanisms, efficiency of thermodynamic systems, estimating the power of engines and designthermodynamic systems for various applications.

Text Book(s)	1. Brijlal&N. Subramaniam, 2000, Heat and Thermodynamics,S.Chand& Co. 2. Narayanamoorthy&KrishnaRao, 1969 ,Heat,Triveni Publishers, Chennai. 3. V.R.Khanna&R.S.Bedi, 1998 1st Edition, Text book of Sound, Kedharnaath Publish & Co, Meerut 4. Brijlal and N. Subramanyam, 2001, Waves and Oscillations,Vikas Publishing House, New Delhi. 5. Ghosh, 1996, Text Book of Sound, S.Chand&Co. 6. R.Murugeshan&KiruthigaSivaprasath, Thermal Physics,S.Chand& Co.
Reference Book(s)	1. J.B.Rajam&C.L.Arora, 1976, Heat and Thermodynamics, 8th edition, S.Chand& Co. Ltd. 2. D.S.Mathur, Heat and Thermodynamics, Sultan Chand & Sons. 3. Gupta, Kumar, Sharma, 2013, Statistical Mechanics, 26th Edition, S. Chand & Co. 4. Resnick, Halliday&Walker,2010, Fundamentals of Physics, 6th Edition. 5. Sears, Zemansky, Hugh D. Young,Roger A. Freedman, 2021 University Physics with Modern Physics 15th Edition,Pearson.
Websites and e- Learning resources	1. https://youtu.be/M_5KYncYNyc 2. https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

COURSE OUTCOMES:

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

CLOs	Course Outcomes	K-level
CLO1	Acquires knowledge on how to distinguish between temperature and heat. Introduce him/her to the field of thermometry and explain practical measurements of high temperature as well as low temperature physics. Student identifies the relationship between heat capacity, specific heat capacity. The study of Low temperature Physics sets the basis for the students to understand cryogenics, superconductivity, super fluidity and Condensed Matter Physics	K1
CLO2	Derive the efficiency of Carnot's engine. Discuss the implications of the laws of Thermodynamics in diesel and petrol engines	K4
CLO3	Able to analyze performance of thermodynamic systems viz efficiency by problems. Gets an insight into thermodynamic properties like enthalpy, entropy	K3
CLO4	Study the process of thermal conductivity and apply it to good and bad conductors. Quantify different parameters related to heat, relate them with various physical parameters and analyse them	K3
CLO5	Interpret classical statistics concepts such as phase space, ensemble, Maxwell-Boltzmann distribution law. Develop the statistical interpretation of Bose-Einstein and Fermi-Dirac. Apply to quantum particles such as photon and electron	K2

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	2	2	1	2	3	2	2	1	2
CLO2	3	1	2	3	1	1	3	3	3	3	2
CLO3	3	1	2	2	1	2	3	3	2	3	2
CLO4	3	1	2	2	1	2	3	3	2	3	2
CLO5	3	1	2	2	1	2	3	2	2	3	2

Blueprint for Semester Examination

Units	CLOs	K-Level	Section A		Section B		Section C (Either or Choice)	SectionD (Open Choice)
			MCQs		Short answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1	CLO 1	Up to K4	2	K1 &K2	1	K2	2 (K4& K4)	1 (K4)
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 (K1& K1)	1 (K3)
4	CLO 4	Up to K3	2	K1 &K2	1	K1	2 (K3 & K3)	1 (K3)
5	CLO 5	Up to K2	2	K1 &K2	1	K2	2 (K2& K2)	1 (K2)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total marks for eachsection			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	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		PRACTICAL- II					
TANSCHE Course type		CORE					
Course Category		CC4					
Nature of Course		Skill Development					
Category	CC	Year	I	Credits	3	CourseCode	23U2PCCP2
		Semester	2				
Instructional Hours per week		Lecture		Tutorial		Practical	Total
		---		---		3	3
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher Secondary Physics Practicals					
Objectives of the Course		Apply their knowledge gained about the concept of heat and sound waves, resonance, calculate frequency of ac mains set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results					
Course Outline		HEAT, OSCILLATIONS, WAVES & SOUND (Any six from the list below)					
		1. Determination of specific heat by cooling – graphical method.					
		2. Determination of thermal conductivity of good conductor by Searle’s method.					
		3. Determination of thermal conductivity of bad conductor by Lee’s disc method.					
		4. Determination of thermal conductivity of bad conductor by Charlton’s method.					
		5. Determination of specific heat capacity of solid.					
		6. Determination of specific heat of liquid by Joule’s electrical heating method (applying radiation correction by Barton’s correction/graphical method),					
		7. Determination of Latent heat of a vaporization of a liquid.					
		8. Determination of Stefan’s constant for Black body radiation.					
		9. Verification of Stefan’s-Boltzmann law.					
		10. Determination of thermal conductivity of rubber tube.					

	11. Helmholtz resonator. 12. Velocity of sound through a wire using Sonometer. 13. Determination of velocity of sound using Kunds tube. 14. Determination of frequency of an electrically maintained tuning fork 15. To verify the laws of transverse vibration using Sonometer. 16. To verify the laws of transverse vibration using Melde's apparatus. 17. To compare the mass per unit length of two strings using Melde's apparatus. Frequency of AC by using Sonometer.
Extended Professional Component	Employable and Skill Enhancement
Skills acquired from this course	To expose the students to experiments in the areas of heat, oscillations, waves & sound. Laboratory techniques with accuracy in measurements and data analysis enhance effective comprehension of physics concepts.
Justification for nature of course	This Experimental physics course provides hands on learning experience in measuring the concepts that are learnt theoretically can solve problems related to it practically.
Reference Book(s)	1. M.N.Srinivasan, S.Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, 2007, Sultan Chand & Sons. 2. Indu Prakash & Ramakrishna, A Text Book of Practical Physics, 2011, Kitab Mahal Agencies, New Delhi. . 3. S.R. Govinda Rajan, T. Murugaiyan, S. Sundara Rajan, Practical Physics, 2007, Rochouse & Sons.
Websites and e-Learning resources	1. https://javalab.org/en/category/chemistry_en/heat_en/ 2. https://www.leybold-shop.com/physics/physics-experiments/heat.html 3. https://physicsworld.com/a/oscillating-temperature-gradient-boosts-heat-flow-in-fluids/ 4. https://www.mona.uwi.edu/physics/physics/courses/phys0412/introduction-oscillations-and-heat 5. https://spark.iop.org/light-sound-and-waves-home-experiments-and-simulations-0

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledgelevel	Marks
CLO1	Domain knowledge which the experiments test	Upto K2	20
CLO2	Design of an appropriate experiment	Upto K3	15
CLO3	Skill in doing the experiment	Upto K3	15
CLO4	Analysis of data collected & representation is meaning Form	Upto K4	20
CLO5	Communicating the finding	Upto K2	5

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-pointscale 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	3	1	2	2	3	3	3	2	3
CLO2	3	2	3	2	3	2	3	2	2	1	2
CLO3	3	2	3	2	2	2	3	2	3	1	2
CLO4	3	2	3	2	2	2	3	2	3	1	3
CLO5	3	2	3	2	3	2	3	3	3	2	3

Title of the Course		Allied Physics – II						
TANSCHÉ Course type		EC2						
Course Category		Generic Elective - II						
Nature of Course		Skill Development						
Category	EC	Year	I / II	Credits	4	Course Code	23U2PGET2/ 23U4PGET2	
		Semester	II / IV					
Instructional Hours per week		Lecture	Tutorial		Practical		Total	
		3	1				4	
Marks		CIA		Semester			Total	
		25		75			100	
Pre-requisite(s)		Higher Secondary Physics						
Objectives of the Course		To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semiconductor physics and electronics.						
Course Outline		Unit I: Optics: Interference – Interference in thin films –Colors of thin films – Air wedge – Determination of diameter of a thin wire by air wedge – Diffraction – Diffraction of light vs sound – Normal incidence – Experimental determination of wavelength using diffraction grating (no theory) – Polarization – Polarization by double reflection – Brewster’s law – Optical activity .						
		Unit II: Atomic Physics: Atom models – Bohr atom model – Mass number – Atomic number – Nucleons – Vector atom model – Various quantum numbers – Pauli’s exclusion principle – Electronic configuration – Periodic classification of elements – Bohr magneton – Photo electric effect – Einstein’s photoelectric equation .						
		Unit III: Nuclear Physics: Nuclear models – Liquid drop model – Magic numbers –Mass defect – Binding energy – Radioactivity – Uses – Half life – Mean life - Radio isotopes and uses – Controlled and uncontrolled chain reaction – Nuclear fission – Energy released in fission – Chain reaction – Atom bomb – Nuclear reactor – Breeder reactor – Nuclear fusion – Thermonuclear reactions – Differences between fission and fusion.						
		Unit IV: Introduction To Relativity And Gravitational Waves: Frame of reference – Postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – Derivation –						

	Length contraction – Time dilation – Twin paradox – Mass-energy equivalence – Introduction on gravitational waves. Unit V: Semiconductor Physics: P-N junction diode – Forward and reverse biasing – Characteristic of diode – Zener diode – Characteristic of zener diode – Full wave bridge rectifier – Construction and working – Advantages (no mathematical treatment) – Introduction to e-vehicles and EV charging stations
Extended Professional Component	Expert lectures, Seminars, Webinars, Industry inputs, Social accountability, patriotism.
Skills acquired from this course	Solving related problems in optics, relativity, bohr atom model and binding energy. Applying the skills of radio isotopes to real life systems.
Justification for nature of course	Understanding the concept of Optics, nuclear reactor and nuclear fission, fusion Principles.
Text Book(s)	1. R.Murugesan (2005), Allied Physics, S.Chand & Co, NewDelhi. 2. K.Thangaraj and D.Jayaraman(2004), Allied Physics, Popular Book Depot, Chennai. 3. Brijlal and N.Subramanyam (2002), Text book of Optics, S.Chand & Co, NewDelhi. 4. R.Murugesan (2005), ModernPhysics, S.Chand&Co, NewDelhi. 5. A.Subramaniyam Applied Electronics, 2ndEdn., National Publishing Co., Chennai.
Reference Book(s)	1. Resnick Halliday and Walker (2018), Fundamentals of Physics, 11thEdn., John Willey and Sons, Asia Pvt. Ltd., Singapore. 2. D.R.Khanna and H.R. Gulati (1979).Optics, S.Chand &Co.Ltd., New Delhi. 3. A.Beiser (1997), Concepts of Modern Physics, Tata McGraw Hill Publication, NewDelhi. 4. Thomas L. Floyd (2017), Digital Fundamentals, 11thEdn., Universal Book Stall, NewDelhi. 5. K.Metha (2004), Principles of electronics, 6th Edn. ,S.Chand and Company, New Delhi.
Websites and e-Learning resources	1. https://www.berkshire.com/learning-center/delta-p-facemask/ https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo 2. https://www.youtube.com/watch?v=JrRrp5F-Qu4 3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/ 4. https://www.atoptics.co.uk/atoptics/blsky.htm - 5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

COURSE OUTCOMES:

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

COs	Course Outcomes	K-level
CO1	Analyse the concepts of interference diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns	K4
CO2	Develop the basic foundation of different atom models and various experiments establishing quantum concepts. Relate the importance of interpreting improving theoretical models based on observation. Appreciate interdisciplinary nature of science and in solar energy related applications.	K3
CO3	Solve the problems on half-life and mean-life. Interpret nuclear processes like fission and fusion. Summarize the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. Understand the importance of nuclear energy, safety measures carried and get our Govt. agencies like DAE guiding the country in the nuclear field.	K3
CO4	Build the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and vice versa. Relate this with current research in this field and get an overview of research projects of National and International importance, like LIGO, ICTS, and opportunities available.	K3
CO5	Summarize the working of semiconductor devices like junction diode, Zener diode and practical devices we daily use like USB chargers and EV charging stations.	K2

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	3	1	2	1	3	2	2	2	2
CLO2	3	2	2	1	2	1	3	2	2	1	1
CLO3	3	2	3	1	2	1	3	3	2	1	1
CLO4	3	2	2	1	2	1	3	2	1	1	1
CLO5	3	1	1	1	1	2	3	1	1	2	2

Summative – Blue-Print-Model
(Mapping with CLOs)

Units	CLOs	K-Level	Section-A		Section-B		Sec-C	Sec-D
			MCQs.		Short Answers		(Either OR)	Open Choice
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO1	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K4)
2	CLO2	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)
3	CLO3	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)
4	CLO4	Upto K3	2	K1&K2	1	K1	2(K1&K1)	1(K3)
5	CLO5	Upto K2	2	K1&K2	1	K1	2(K2&K2)	1(K2)

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%

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

S.No.	CLOs	K-level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1.	CLO A	Upto K2	2	K1 & K2	1	K1	2(K2&K2)	2(K2&K2)	
2	CLO B	UptoK3	2	K1 & K2	2	K2	2(K3&K3)	1(K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each Question			1		2		5	10	
Total marks for each section			4		6		10	20	40

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	2	--	--	4	6.7	66.7
K2	2	4	10	20	36	60.0	
K3	-	-	10	10	20	33.3	33.3
Total Marks	4	6	20	30	60	100.00	100%

II Internal

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

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	--	--	--	2	3.3	33.3
K2	2	6	10		18	30.0	
K3	-	-	10	10	20	33.3	33.3
K4	-	-	-	20	20	33.3	33.3
Total Marks	4	6	20	30	60	100.00	100%

Title of the Course		ALLIED PRACTICAL – II					
TANSCHE Course type		ECP2					
Course Category		Generic Elective II (Practical)					
Nature of Course		Skill Development					
Category	ECP	Year	I / II	Credits	1	Course Code	23U2PGEP2/ 23U4PGEP2
		Semester	II / IV				
Instructional Hours per week		Lecture		Lecture		Tutorial	Practical
		---		---		---	2
Marks		CIA		Semester		Total	
		25		75		75	
Pre-requisite(s)		Higher Secondary Physics					
Objectives of the Course		● Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyze, able to do error analysis and correlate results					
Course Outline		(Any six from the following list) 1. Radius of curvature of lens by forming Newton’s rings 2. Thickness of a wire using air wedge 3. Wavelength of mercury lines using spectrometer and grating 4. Refractive index of material of the lens by minimum deviation 5. Refractive index of liquid using liquid prism 6. Determination of AC frequency using Sonometer 7. Specific resistance of a wire using PO box 8. Thermal conductivity of poor conductor using Lee’s disc 9. Determination of figure of merit table galvanometer 10. Determination of Earth’s magnetic field using field along the axis of a coil 11. Characterization of Zener diode 12. Construction of Zener/IC regulated power supply 13. Construction of AND, OR, NOT gates using diodes and transistor 14. NOR gate as a universal building block					

Extended Professional Component	Students can design models from the practicals.
Skills acquired from this course	Students acquire practical knowledge from related theory
Justification for nature of course	Analysing the concepts of Physics through experiments in the laboratory will enhance effective comprehension.
Text Book(s)	1. M.N.Srinivasan, S.Balasubramanian, R.Ranganathan, A text book of Practical Physics, 2007, Sultan Chand & Sons. 2. Indu Prakash & Ramakrishnan, A text book of Practical Physics, 2011, Kitab Mahal Agencies, New Delhi 3. S.R. Govinda Rajan, T. Murugaiyan, S. Sundara Rajan, Practical Physics, 2007, Rochouse& Sons.
Websites and e-Learning resources	1. https://v1.nitj.ac.in/physics/Downloads/Newton_Rings_nitj8793.pdf 2. https://www.youtube.com/watch?v=pQffvbqk1nI 3. https://vlab.amrita.edu/?sub=1&brch=194&sim=353&cnt=1 4. https://vlab.amrita.edu/?sub=1&brch=281&sim=334&cnt=1 5. https://vlab.amrita.edu/?sub=1&brch=282&sim=1522&cnt=1

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledgelevel	Marks
CLO1	Domain knowledge which the experiments test	Upto K2	20
CLO2	Design of an appropriate experiment	Upto K3	15
CLO3	Skill in doing the experiment	Upto K3	15
CLO4	Analysis of data collected & representation is meaning Form	Upto K4	20
CLO5	Communicating the finding	Upto K2	5

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) in the 3-pointscale 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	3	1	2	2	3	3	3	2	3
CLO2	3	2	3	2	3	2	3	2	2	1	2
CLO3	3	2	3	2	2	2	3	2	3	1	2
CLO4	3	2	3	2	2	2	3	2	3	1	3
CLO5	3	2	3	2	3	2	3	3	3	2	3

Title of the Course		ASTROPHYSICS					
TANSCHÉ Course type		SEC-2					
Course Category		Skill Enhancement Course					
Nature of Course		Skill Development					
Category	SEC	Year	I	Credit	2	Course Code	23U2PSED2
		Semester	II				
Instructional Hours perweek		Lecture	Tutorial		Practical		Total
		2	-		-		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher secondary Physics subject					
Objectives of the Course		• To introduce principles of astrophysics describing the science of formation and evolution of stars • Interpretation of various heavenly phenomena • Provides an understanding of the physical nature of celestial bodies along with the instrumentation and techniques used in astronomical research					
Course Outline		Unit I: Telescopes: Optical telescopes – magnifying power, brightness, resolving power and f/a ratio – types of reflecting and refracting telescopes – detectors and image processing – radio telescopes – Hubble space telescope.					
		Unit II: Solar System: Bode’s law of planetary distances – meteors, meteorites, comets, asteroids – Kuiper belt – Oort cloud – detection of gravitational waves – recent advancements in astrophysics.					
		Unit III: Eclipses: Types of eclipses – solar eclipse – total and partial solar eclipse – lunar eclipse – total and partial lunar eclipse – transits. The Sun: Physical and orbital data – solar atmosphere –photosphere – chromosphere – solar corona – prominences – sunspots – 11year solar cycle – solar flares.					
		Unit IV: Stellar Evolution: H-R diagram – birth & death of low mass, intermediate mass and massive stars – Chandrasekar limit – white dwarfs – neutron stars – pulsars – black holes – supernovae.					

	Galaxies: classification of galaxies – galaxy clusters – interactions of galaxies, dark matter and super clusters – evolving universe.
	Unit V: Activities In Astrophysics: (i) Develop models to demonstrate eclipses/planetary motion (ii) Night sky observation (iii) Conduct case study pertaining to any topic in this paper
Extended Professional Component	You tube video lectures on Eclipses and Stellar evolution
Skills acquired from this course	1. Student can develop models to demonstrate eclipses/planetary motion 2. Student can conduct case study pertaining to any topic in this paper
Justification for nature of course	Fundamental knowledge provided in this course is highly essential for science students those who wish to apply and appear for recruitment procedures for vacancy positions in national observatories and space research organizations.
Text Book(s)	1. Baidyanath Basu, An introduction to Astrophysics, Fourth printing, Prentice – Hall of India (P) Ltd, 2001, New Delhi. 2. K.S.Krishnaswamy, Astrophysics – a modern perspective, New Age International (P) Ltd, 2002, New Delhi. 3. B. S. Shylaja, & H. R. Madhusudan, Eclipse: A Celestial Shadow Play, Orient BlackSwan, 1999.
Reference Book(s)	1. K. D. Abhyankar, Astrophysics, University press (India) Ltd., 2001, Hyderabad. 2. David Catling, Astrobiology: A very short introduction, Oxford University Press, 2013.
Websites and e-Learning resources	1. https://www.space.com/2621 2. https://en.wikipedia.org/wiki/Astrophysics8-astrophysics.html https://science.nasa.gov/astrophysics

COURSE OUTCOMES:

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

CLO'S	Course Learning Outcomes	K-level
CLO1	Classify the types of telescopes	K2
CLO2	Explain Bode's law in estimating the planetary distances	K2
CLO3	Discuss total and partial eclipses	K2
CLO4	Describe H-R diagram for identifying the spectral classification of a star	K2
CLO5	Demonstrate eclipses by developing models	K2

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) and Program Specific Outcomes (**PSO**) in 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	1	3	3	1	2	1	1
CLO2	3	2	1	1	1	3	3	1	2	1	1
CLO3	3	2	1	1	1	3	3	1	2	1	1
CLO4	3	2	1	1	1	3	3	1	2	1	1
CLO5	3	2	1	1	1	3	3	1	2	1	2

Assessment Schema
Blueprint for Semester Examination
Mapping with Course Learning Outcomes (CLOs)

Unit	CLOs	K-Level	Section A		Section B		Section C (Either or Choice)	SectionD (Open Choice)
			MCQs		Short answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K2	2	K1 & K2	1	K2	2 (K2 & K1)	1 (K2)
2	CLO 2	Up to K2	2	K1 & K2	1	K2	2 (K2 & K2)	1 (K2)
3	CLO 3	Up to K2	2	K1 & K2	1	K1	2 (K1 & K1)	1 (K2)
4	CLO 4	Up to K2	2	K1 & K2	1	K1	2 (K2 & K2)	1 (K2)
5	CLO 5	Up to K2	2	K1 & K2	1	K2	2 (K2 & K3)	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			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	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	SectionD (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	15	--	24	20.00	95.83%
K2	5	6	30	50	91	75.83	
K3	-	-	5	-	5	04.17	4.17%
K4	-	-		-	-	-	-
Total Marks	10	10	50	50	120	100.00	100%

Title of the Course		BASIC INSTRUMENTATION					
TANSCHE Course type		SEC-3					
Course Category		Skill Enhancement Course					
Nature of Course		Skill Development					
Category	SEC	Year	I	Credits	2	Course Code	23U2PSED3
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		1	1				2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher Secondary Physics					
Objectives of the Course		• To Learn errors in measurements and also to understand the construction of multi-meter. Acquire the skill in using multi-meter to measure various ranges of current, voltage and resistance • To understand the construction of CRO. To acquire the skill in using CRO for various physical measurements. • To understand the working of various generators the skill in using Q-meter • To learn the bridge circuit and to acquire the skill in measuring R L C values. • To understand the working of various types of recorders and acquire the skill of selecting a best recorder for particular system.					
Course Outline		Unit I: Basics of Measurement: Performance characteristics – Static Characteristics – Error in measurement – Types of Static error. Multi meter: DC Ammeter – multi range ammeters – DC voltmeter – Multirange voltmeter – Loading – AC voltmeter using rectifiers – multi range AC voltmeter – ohmmeter.					
		Unit II: Cathode Ray Oscilloscope: Introduction – Basic Principle- CRT features- Basic Principle of signal display - Block diagram of oscilloscope (Explanation only– no mathematical treatment),. Applications of Oscilloscope – Voltage measurements – Period and frequency measurements.					

	Unit III: Signal Generators and Analysis Instruments: Introduction- basic signal generators(sine wave) – standard signal generator – AF sine and square wave generator - function generator –square and pulse generators – Q meter.
	Unit IV: Impedance Bridges: Whetstone's bridge – sensitivity- applications – AC bridges – capacitance comparison bridge – Schering's bridge - inductance Comparison Bridge – Maxwell's bridge precautions to be taken when using a bridge.
	Unit V: Recorders: Introduction – Strip Chart recorder - Potentiometric type recorders – magnetic recorders – Recorder Selections for particular applications –Recorder specifications - applications of strip chart recorders.
Extended Professional Component	May design and manufacture simple multi meter of his own.
Skills acquired from this course	Students will perform experiments using devices like ammeter, voltmeter, CRO etc
Justification for nature of course	The student will be able to use effectively Multi meter, CRO for electrical parameter measurements. Understand the working of bridges and use them for electrical component measurements.
Text Book(s)	1. H.S. Kalsi, Electronic Instrumentation (Technical Education Serie) Fourth reprint (2002) Tata McGraw Hill New Delhi
Reference Book(s)	1. Electronic Devices and circuits, S. Salivahanan, N. S.Kumar, & A. Vallavaraja 11 th reprint, 2010, Tata Mc-Graw Hill 2. A text book in Electrical Technology - B L Theraja - S Chand and Co. 3. Performance and design of AC machines - M G Say ELBS Edn. 4. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill. 5. Logic circuit design, Shimon P. Vingron, 2012, Springer. 6. Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.
Websites and e-Learning resources	1. https://www.elprocus.com/what-are-errors-in-measurement-types-of-errors-with-calculation/ 2. https://www.yourelectricalguide.com/2017/01/multimeter-construction-working.html 3. https://www.elprocus.com/cro-cathode-ray-oscilloscope-working-and-application/#:~:text=The%20CRO%20recruit%20the%20cathode,electron%20beam%20strikes%20with%20it

	4. https://www.electricalengineeringinfo.com/2016/03/cathode-ray-oscilloscope-cro-construction-of-cathode-ray-oscilloscope-cro.html 5. https://www.electronics-notes.com/articles/test-methods/signal-generators/what-is-a-signal-generator.php#:~:text=A%20signal%20generator%20is%20piece,used%20with%20other%20test%20instruments. 6. https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_signal_generators.htm 7. https://electronicscoach.com/ac-bridges.html , 8. https://dkpandey.weebly.com/uploads/1/3/5/3/13534845/lecture6-8_dkp.pdf 9. http://www.darshan.ac.in/Upload/DIET/Documents/EE/EMMI_Ch%206_13092018_031526AM.pdf , 10. https://instrumentationtools.com/recorders/

COURSE OUTCOMES:

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

CLOs	Course Outcomes	K-level
CLO1	Analyze construction and operational aspects of different measuring instruments along with their application domains	K4
CLO2	Apply the fundamental measurement method of resistance, capacitance, inductance, etc. by using various a.c bridges and other techniques	K3
CLO3	Apply the impact of electrical measurement methods and use modern sophisticated instruments/systems for human utilities and industrial application	K3
CLO4	Solve problems relating to ranging of level instruments	K3
CLO5	Understand the various devices for recording values	K2

Mapping With Programme Outcomes:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) in the 3-pointscale 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	3	1	2	2	3	3	2	1	2
CLO2	3	2	1	1	2	2	3	1	1	1	2
CLO3	3	2	1	1	2	2	3	1	1	2	2
CLO4	3	1	2	1	1	1	3	2	1	2	1
CLO5	3	1	1	1	1	1	3	1	2	2	2

Summative – Blue-Print-Model(Mapping with CLOs)

Units	CLOs	K-Level	Section-A		Section-B		Sec-C	Sec-D
			MCQs.		Short Answers		(Either OR)	Open Choice
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO1	Upto K4	2	K1&K2	1	K2	2(K4&K4)	1(K4)
2	CLO2	Upto K3	2	K1&K2	1	K2	2(K3&K3)	1(K3)
3	CLO3	Upto K3	2	K1&K2	1	K2	2(K1&K1)	1(K3)
4	CLO4	Upto K3	2	K1&K2	1	K1	2(K2&K2)	1(K3)
5	CLO5	Upto K2	2	K1&K2	1	K1	2(K3&K3)	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	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%

THE MADURA COLLEGE, MADURAI
RESEARCH CENTRE & PG DEPARTMENT OF PHYSICS
Curriculum – M.Sc. Physics

	Programme specific learning outcomes	Graduate Attributes
PSO–1	Demonstrate a fundamental/systematic or coherent understanding of the academic field of physics its different core learning areas like Classical, Statistical and Quantum mechanics, Electro Magnetic theory, Modern optics, Condensed Matter Physics, Nuclear and Particle Physics and also in applied areas like spectroscopy, Instrumentation, Electronics and Communication and also in non domain areas of interest to the students.	Knowledge in core Competency
PSO–2	Apply the principles of mathematical modelling and the power of computation to describing the physical world.	Problem analysis
PSO–3	Plan and execute physics related experiments or investigations analyze and interpret data/information collected using appropriate methods including the use of appropriate software such as programming languages and purpose – written packages, and report accurately the findings of the experiments/investigations while relating the conclusion/findings to relevant theories of physics.	Design and development of solution for complex problems
PSO–4	Apply skills in areas related to his specialization within the disciplinary area of physics and also in current and emerging developments in the field of physics.	Modern tool usage
PSO–5	Demonstrate relevant generic skills and global competencies such as (i) problem solving skills that are required to solve different types of physics –related problems with well defined solutions and tackle open- ended problems that belong to the disciplinary-area boundaries; (ii) Investigate skills, including skills of independent investigation of physics-related issues and problems; (iii) Communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature; (iv) Analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to physics and ability to translate them with popular language when needed; (v) ICT skills; (vi) Personal skills such as the ability to work both independently and in a group.	Individual and teamwork, project management, communication, Lifelong learning

PROGRAMME EDUCATION OBJECTIVES

- PEO1.** To produce graduates with ethical values and professional skills who excel in the competencies in the rapidly evolving global community and contribute to the development of the society.
- PEO2.** To motivate the students to prepare for competitive examinations and pursue higher education in the reputed institutions globally with focus on research and development.
- PEO3.** To endow the students with critical and analytical thinking, problem solving skills which will equip them to become entrepreneurs?
- PEO4.** To promote capacity to work effectively in diverse teams in classroom, and in laboratory.
- PEO5.** To enhance the digital efficiency to use computation and appropriate software's, e-library to retrieve and evaluate Physics information.



The Madura College (Autonomous), Madurai – 625 011
Department of Physics
PG Programme Structure

Sem	Tansche Code	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	CC1	23P1PCCT1	Mathematical Physics	6	5			Y			Y	38
	CC2	23P1PCCT2	Classical Mechanics & Relativity	6	5			Y			Y	69
	CC3	23P1PCCP1	Practical I	6	4			Y				93
	EC1	23P1PECT1	Linear and Digital ICs & Applications	5	3			Y			Y	61
		23P1PECT1	Digital Communication									100
	EC2	23P1PECT2	Energy Physics	5	3			Y			Y	
		23P1PECT2	Physics of Nano Science & Technology									100
	SEC1	23P1PSED1	Astrobiology	2	2	Y	Y	Y				100
			Total Credits		22							
II	CC4	23P2PCCT3	Statistical Mechanics	6	5			Y			Y	45
	CC5	23P2PCCT4	Quantum Mechanics –I	6	5			Y			Y	31
	CC6	23P2PCCP2	Practical II	6	4			Y			Y	95
	EC3	23P2PECT3	Bio Physics	5	3	Y					Y	100
		23P2PECT3	Plasma Physics									100
	EC4	23P2PECT4	Advanced Optics	5	3	Y					Y	88
		23P2PECT4	Solid Waste Management									100
	SEC2	23P2PSEN1	Basic Environmental Physics	2	2			Y			Y	100
			Total Credits		22							

Title of the Course		MATHEMATICAL PHYSICS					
TANSICHE Course type		CC1					
Course Category		Core					
Nature of Course		Skill Development					
Category	CC	Year	I	Credits	5	CourseCode	23P1PCCT1
		Semester	1				
Instructional Hours per week		Lecture		Tutorial		Practical	Total
		4		1		-	6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Matrices, vectors, differentiation, integration, differential equations					
Objectives of the Course		• To equip students with the mathematical techniques needed for understanding theoretical treatment in different courses taught in their program • To extend their manipulative skills to apply mathematical techniques in their fields • To help students apply Mathematics in solving problems of Physics					
Course Outline		Unit I Basic concepts – Definitions- examples of vector space – Linear independence - Scalar product- Orthogonality – Gram-Schmidt orthogonalization procedure –linear operators – Dual space- ket and bra notation – orthogonal basis – change of basis – Isomorphism of vector space – projection operator –Eigen values and Eigen functions – Direct sum and invariant subspace – orthogonal transformations and rotation					
		Unit II: Review of Complex Numbers -de Moivre’s theorem-Functions of a Complex Variable- Differentiability -Analytic functions- Harmonic Functions- Complex Integration- Contour Integration, Cauchy – Riemann conditions – Singular points – Cauchy’s Integral Theorem and integral Formula - Zeros and poles – Residue theorem and its Application: Potential theory - (1) Heat problems - Parallel plates and coaxial cylinders					
		Unit III: Types of Matrices and their properties, Rank of a Matrix - Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix - Hermitian and Unitary Matrices -Trace of a matrix- Transformation of matrices - Characteristic equation - Eigen values and Eigen vectors -					

	Cayley–Hamilton theorem –Diagonalization
	Unit IV: Definitions -Fourier transform and its inverse - Transform of Gaussian function and Dirac delta function -Fourier transform of derivatives - Cosine and sine transforms - Convolution theorem. Application: Diffusion equation: Flow of heat in an infinite and in a semi - infinite medium. Laplace transform and its inverse - Transforms of derivatives and integrals – Differentiation and integration of transforms - Dirac delta functions.
	Unit V: Second order differential equation-Hermite polynomials - Generating function - Orthogonality properties - Recurrence relations – Legendre polynomials - Generating function - Rodrigue formula – Orthogonality properties
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this Course	Mathematical skills for modelling physical systems and solving real life physical problems.
Justification for nature of course	Mathematical Physics course offers the necessary skills required for modelling real life physical systems and solving real life physical systems. Linear vector spaces offer the mathematical basis for solving problems in quantum mechanics. Solutions of differential equations by way of special functions help in solving physical systems.
Text Book(s)	1. George Arfken and Hans J Weber, 2012, Mathematical Methods for Physicists – A Comprehensive Guide (7th edition), Academicpress. 2. P.K. Chattopadhyay, 2013, <i>Mathematical Physics</i> (2nd edition), New Age, New Delhi 3. A W Joshi, 2017, Matrices and Tensors in Physics, 4th Edition(Paperback), New Age International Pvt. Ltd., India 4. B. D. Gupta, 2009, <i>Mathematical Physics</i> (4th edition), Vikas Publishing House, New Delhi. 5. H. K. Dass and Dr. Rama Verma, 2014, Mathematical Physics, Seventh Revised Edition, S. Chand & Company Pvt. Ltd., New Delhi.
Reference Book(s)	1. E. Kreyszig, 1983, Advanced Engineering Mathematics, Wiley Eastern, New Delhi, 2. D. G. Zill and M. R. Cullen, 2006, Advanced Engineering Mathematics, 3rd Ed. Narosa, New Delhi. 3. S. Lipschutz, 1987, Linear Algebra, Schaum's Series, McGraw -Hill, New

	York 3. E. Butkov, 1968, Mathematical Physics Addison - Wesley, Reading, Massachusetts. 4. P. R. Halmos, 1965, Finite Dimensional Vector Spaces, 2nd Edition, Affiliated East West, New Delhi. 5. C. R. Wylie and L. C. Barrett, 1995, Advanced Engineering Mathematics, 6th Edition, International Edition, McGraw-Hill, New York
Websites and e-Learning resources	1. www.khanacademy.org 2. https://youtu.be/LZnRIOA1_2I 3. http://hyperphysics.phy-astr.gsu.edu/hbase/hmat.html#hmath 4. https://www.youtube.com/watch?v=_2jymuM7OUU&list=PLhkiT_RYTEU27vS_SlED56gNjVJGO2qaZ 5. https://archive.nptel.ac.in/courses/115/106/115106086/

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Understand use of bra-ket vector notation and explain the meaning of complete orthonormal set of basis vectors, and transformations and be able to apply them	K2
CLO2	Able to understand analytic functions, do complex integration, by applying Cauchy Integral Formula. Able to compute many real integrals and infinite sums via complex integration.	K3
CLO3	Analyze characteristics of matrices and its different types, and the process of diagonalization.	K4
CLO4	Solve equations using Laplace transform and analyze the Fourier transformations of different function, grasp how these transformations can speed up analysis and correlate their importance in technology	K4
CLO5	Find the solutions for physical problems using linear differential equations and to solve boundary value problems using Green's function. Apply special functions in computation of solutions to real world problems	K4
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-pointscale 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	3	2	3	2	3	2	3	1	2
CLO2	3	2	3	2	2	2	3	2	2	2	2
CLO3	3	2	3	2	2	2	3	2	3	1	2
CLO4	3	2	3	2	2	2	3	2	3	1	2
CLO5	3	2	3	2	2	2	3	2	3	2	2

Assessment Scheme

Blueprint for Semester Examination

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

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

K Levels	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice
K1	2	4	10	-	16	13.33
K2	2	4	10	10	26	21.67
K3	4	2	10	20	36	30.00
K4	2	-	20	20	42	35.00
Total Marks	10	10	50	50	120	100.00

Title of theCourse		CLASSICAL MECHANICS AND RELATIVITY						
TANSCHE Course type		CC2						
Course Category		Core						
Nature of Course		Skill Development						
Category	CC	Year	I	Credits	5	Course Code	23P1PCCT2	
		Semester	I					
Instructional Hours per Week		Lecture		Tutorial		Practical		Total
		4		1		-		6
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Fundamentals of mechanics, Foundation in mathematical methods.						
Objectives of the Course		• To understand fundamentals of classical mechanics. • To understand Lagrangian formulation of mechanics and apply it tosolve equation of motion. • To understand Hamiltonian formulation of mechanics and apply it tosolve equation of motion. • To discuss the theory of small oscillations of a system. • To learn the relativistic formulation of mechanics of a system.						
Course Outline		Unit I: Principles Of Classical Mechanics Mechanics of a single particle – mechanics of a system of particles – conservation laws for a system of particles – constraints – holonomic & non-holonomic constraints – generalized coordinates – configuration space – transformation equations – principle of virtual work.						
		Unit II: Lagrangian Formulation D’Alembert’s principle – Lagrangian equations of motion for conservative systems – applications: (i) simple pendulum (ii) Atwood’s machine (iii) projectile motion.						
		Unit III: Hamiltonian Formulation Phase space – cyclic coordinates – conjugate momentum – Hamiltonian function – Hamilton’s canonical equations of motion – applications: (i) simple pendulum (ii) one dimensional simple harmonic oscillator (iii)motion of particle in a central force field.						
		Unit IV: Small Oscillations General theory of small oscillation-Secular equation and eigen value equation- solution of the Eigen value equation-small oscillation in normal co-ordinates- Example of two coupled oscillator and double pendulum- vibration of linear triatomic molecule.						

	Unit V: Relativity Inertial and non-inertial frames – Lorentz transformation equations – length contraction and time dilation – relativistic addition of velocities – Einstein’s mass-energy relation – Minkowski’s space – four vectors – position, velocity, momentum, acceleration and force in for vector notation and their transformations.
Extended Professional Component	Expert Lectures, Online Seminars – Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism.
Skills acquired from this course	Lagrangian and Hamiltonian equations of motion derived for different systems develops the application of mathematical and simulation skills to understand various practical applications involving macroscopic and microscopic objects in motion.
Justification for nature of course	In this course, Classical Mechanics which is the study of macroscopic mechanical systems is considered from different perspectives of Lagrangian and Hamiltonian methods. Practical applications of these general principles towards simple problems of oscillatory systems would enhance comprehension of the principles of Classical Mechanics and develop the skills necessary to analyse the behaviour of the mechanical systems based on variety of mathematical models of Classical Mechanics.
Text Book(s)	1. H. Goldstein, 2002, <i>Classical Mechanics</i> , 3rd Edition, Pearson Edu. 2. J. C. Upadhyaya, <i>Classical Mechanics</i> , Himalaya Publishing. Co. New Delhi. 3. R. Resnick, 1968, <i>Introduction to Special Theory of Relativity</i> , Wiley Eastern, New Delhi. 4. R. G. Takwala and P.S. Puranik, <i>Introduction to Classical Mechanics – Tata – McGraw Hill</i> , New Delhi, 1980. 5. N. C. Rana and P.S. Joag, <i>Classical Mechanics - Tata McGraw Hill</i> , 2001
ReferenceBook(s)	1. K. R. Symon, 1971, <i>Mechanics</i> , Addison Wesley, London. 2. S. N. Biswas, 1999, <i>Classical Mechanics</i> , Books & Allied, Kolkata. 3. Gupta and Kumar, <i>Classical Mechanics</i> , Kedar Nath. 4. T.W.B. Kibble, <i>Classical Mechanics</i> , ELBS. 5. Greenwood, <i>Classical Dynamics</i> , PHI, New Delhi.
Websites and e-Learning	1. http://poincare.matf.bg.ac.rs/~zarkom/Book_Mechanics_Goldstein_Classical_Mechanics_optimized.pdf 2. https://pdfcoffee.com/classical-mechanics-j-c-upadhyay-2014- editionpdf-

resources	pdf-free.html 3. https://nptel.ac.in/courses/122/106/122106027/ 4. https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/lecture-notes/ 5. https://www.britannica.com/science/relativistic-mechanics

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Understand the fundamentals of classical mechanics.	K2
CLO2	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	K3
CLO3	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	K4
CLO4	Analyze the small oscillations in systems and determine their normal modes of oscillations.	K4
CLO5	Understand and apply the principles of relativistic kinematics to the mechanical systems.	K3
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

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	2	3	3	2	3	3	3	2	2	2	3
CLO2	2	3	3	2	3	3	3	2	2	2	3
CLO3	2	3	3	2	3	3	3	2	2	2	3
CLO4	2	3	3	2	3	3	3	2	2	2	3
CLO5	2	3	3	2	3	3	3	2	2	2	3

Assessment scheme

Blueprint for Semester Examination

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

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

Distribution of Section-wise Marks with K Levels

K Levels	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	Section D(Open Choice)	Total Marks	% of Marks without choice
K1	2	4	10	-	16	13.33
K2	2	4	10	10	26	21.67
K3	4	2	10	20	36	30.00
K4	2	-	20	20	42	35.00
Total Marks	10	10	50	50	120	100.00

Title of the Course		PRACTICAL – I					
TANSCHÉ Course type		CC3					
Course Category		Core					
Nature of Course		Skill Development					
Category	CC	Year	I	Credits	4	Course Code	23P1PCCP1
		Semester	I				
Instructional Hours per week		Lecture	Lecture		Tutorial		Practical
		---	---		---		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Knowledge and hands on experience of basic general and electronics experiments of Physics					
Objectives of the Course		• To understand the concept of mechanical behavior of materials and calculation of same using appropriate equations. • To calculate the thermodynamic quantities and physical properties of materials. • To analyze the optical and electrical properties of materials.					
Course Outline		(Any Twelve Experiments from the following) 1. Determination of Young’s modulus and Poisson’s ratio by Hyperbolic fringes - Cornu’s Method 2. Determination of Viscosity of the given liquid – Meyer’sdisc 3. Measurement of Coefficient of linear expansion- Air wedgeMethod 4. B-H loop using Anchor ring. 5. Determination of Thickness of the enamel coating on a wire by diffraction 6. Determination of Rydberg’s Constant - Hydrogen Spectrum 7. FP Etalon 8. Determination of Thickness of air film. 9. Solar spectrum – Hartmann’s formula. Edser and Butlerfringes. 10. Measurement of Band gap energy- Thermistor 11. Determination of Planck Constant – LED Method 12. Determination of Specific charge of an electron – Thomson’s method. 13. Determination of Compressibility of a liquid usingUltrasonics 14. Determination of Wavelength, Separation of wavelengths - Michelson Interferometer 15. GM counter – Characteristics, inverse square law and absorption					

	coefficient. 16. Measurement of Conductivity - Four probe method. 17. Arc spectrum – Iron. 18. Molecular spectra – AlO band. 19. Measurements of Standing wave and standing wave co-efficient, Law of Inverse square, Receiver end transmitter behavior, Radiation Pattern - Microwave test bench 20. UV-Visible spectroscopy – Verification of Beer-Lambert's law and identification of wavelength maxima – Extinction coefficient 21. Construction of relaxation oscillator using UJT 22. FET CS amplifier- Frequency response, input impedance, output impedance 23. Study of important electrical characteristics of IC741. 24. V- I Characteristics of different colours of LED. 25. Study of attenuation characteristics of Wien's bridge network and design of Wien's bridge oscillator using Op- Amp. 26. Study of attenuation characteristics of Phase shift network and design of Phase shift oscillator using Op-Amp. 27. Construction of Schmidt trigger circuit using IC 741 for a given hysteresis- application as squarer. 28. Construction of square wave Triangular wave generator using IC 741 29. Construction of a quadrature wave using IC 324 30. Construction of pulse generator using the IC 741 – application as frequency divider 31. Construction of Op-Amp- 4 bit Digital to Analog converter (Binary Weighted and R/2R ladder type) 32. Study of Binary to Gray and Gray to Binary code conversion. 33. Study of R-S, clocked R-S and D-Flip flop using NAND gates 34. Study of J-K, D and T flip flops using IC 7476/7473 35. Arithmetic operations using IC 7483- 4-bit binary addition and subtraction. 36. Study of Arithmetic logic unit using IC 74181. 37. Construction of Encoder and Decoder circuits using ICs.
Skills acquired from this course	Experimental skills
Justification for nature of course	Analysing the concepts of Physics through experiments in the laboratory will enhance effective comprehension.

Text Book(s)	1. Practical Physics, Gupta and Kumar, Pragati Prakasan. 2. Kit Developed for doing experiments in Physics- Instruction manual, R. Srinivasan K.R Priolkar, Indian Academy of Sciences. 3. Electronic Laboratory Primer a design approach, S. Poornachandra, B. Sasikala, Wheeler Publishing, New Delhi. 4. Electronic lab manual Vol I, K A Navas, Rajath Publishing. 5. Electronic lab manual Vol II, K A Navas, PHI eastern Economy Edition
Reference Book(s)	1. Advanced Practical Physics, S.P Singh, Pragati Prakasan. 2. An advanced course in Practical Physics, D. Chattopadhyay, C.R Rakshit, New Central Book Agency Pvt. Ltd 3. Op-Amp and linear integrated circuit, Ramakanth A Gaykwad, Eastern Economy Edition. 4. A course on experiment with He-Ne Laser, R.S. Sirohi, John Wiley & Sons (Asia) Pvt. Ltd. 5. Electronic lab manual Vol II, Kuriachan T.D, Syam Mohan, Ayodhya Publishing.
Websites and e-Learning resources	1. https://www.electronics-tutorials.ws/power/unijunction-transistor.html 2. https://www.geeksforgeeks.org/4-bit-binary-adder-subtractor/ 3. https://www.electronicshub.org/ic-741-op-amp-basics/ 4. https://www.physicsglobe.com/2021/03/four-point-probe-method-engineering.html

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge level	Marks
CLO1	Understand the given problem in terms of domain knowledge in the field of physics.	Upto K2	15
CLO2	Design appropriate Experiment /Test for the given problem.	Upto K3	10
CLO3	Demonstrate skill in doing the experiment by choosing the appropriate technique and instruments and record data.	Upto K3	15
CLO4	Analyze the data collected and infer the outcome and represent the analysis in meaningful form.	Upto K4	20
CLO5	Communicate the findings in appropriate scientific terminology.	Upto K2	5
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate			

Mapping of CLO's with PSOs

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

Title of the Course		LINEAR AND DIGITAL ICs & APPLICATIONS					
TANSCHE Course type		EC 1					
Course Category		Elective					
Nature of Course		Skill Development					
Category	EC	Year	I	Credits	3	CourseCode	23P1PECT1(A)
		Semester	1				
Instructional Hours per week		Lecture		Tutorial		Practical	Total
		4		1		-	5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Knowledge of semiconductor devices, basic concepts of digital andanalog electronics					
Objectives of the Course		• To introduce the basic building blocks of linear integratedcircuits. • To teach the linear and non-linear applications of operationalamplifiers. • To introduce the theory and applications of PLL. • To introduce the concepts of waveform generation and introduce one special function ICs. • Exposure to digital IC’s					
Course Outline		UNIT I: Integrated Circuits And Operational Amplifier Introduction, Classification of IC’s, basic information of Op-Amp 741 and its features-Basic information of Op-Amp-power supply connections- The ideal Operational amplifier-Open Loop operation of Op-Amp-Feedback in Ideal Op-Amp-The inverting amplifier - Op-Amp internal circuit-Differential Amplifier and Op-Amp Characteristics.					
		UNIT II:Applications Of OP-AMP Linear Applications Of OP-AMP: Solution to simultaneous equations and differential equations, Instrumentation amplifiers, V to I and I to V converters. Non-Linear Applications Of OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Monostable Multivibrator.					
		UNIT III:Active Filters &Timer And Phase Locked Loops Active Filters: Introduction, Butterworth filters – 1st order low pass and high pass filters, band pass filters.					

	Timer And Phase Locked Loops: Introduction to IC 555 timer, description of functional diagram, 555 as a Monostable multivibrator, monostable operation- Monostable multivibrator application – Frequency divider- 555 as a astable multivibrators, astable operation- astable multivibrator application-Squarewave oscillator.
	UNIT IV: D to A And A to D Converters & Registers Voltage D to A And A to D Converters: Introduction, basic DAC techniques - weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters -parallel comparator - type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC - Specifications. Shift Registers- siso-sipo-piso and pipo registers
	UNIT V: CMOS Logic, Combinational Circuits & Sequential Circuits Using TTL 74XX ICs CMOS LOGIC: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic. Solving digital problems using maps – SOP & POS reduction (4 & 5-variables only) – Incompletely specified functions – Flip-flops – Ripple counters- synchronous counters – Type T and JK design.
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this Course	Develop skills to design linear and non-linear applications circuits and solving real life physical problems.
Justification for nature of course	This course offers the necessary skills required for the circuit configuration to design the linear integrated circuits and develops skill to solve problems real life physical systems and solving real life physical systems. The knowledge about PLL will help to develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it.
Text Book(s)	1. D. Roy Choudhury, Shail B. Jain (2012), Linear Integrated Circuit, 4th edition, New Age International Pvt. Ltd., New Delhi, India 2. Ramakant A. Gayakwad, (2012), OP-AMP and Linear Integrated Circuits, 4th edition, Prentice Hall / Pearson Education, New Delhi. 3. B.L. Theraja and A.K. Theraja, 2004, A Textbook of Electrical technology, S. Chand & Co.

	4. V.K. Mehta and Rohit Mehta, 2008, Principles of Electronics, S. Chand & Co, 12th Edition. 5. V. Vijayendran, 2008, Introduction to Integrated electronics (Digital & Analog), S. Viswanathan Printers & Publishers Private Ltd, Reprint. V.
Reference Book(s)	1. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi. 2. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi. 3. Malvino and Leach (2005), Digital Principles and Applications 5th Edition, Tata McGraw Hill, New Delhi 4. Floyd, Jain (2009), Digital Fundamentals, 8th edition, Pearson Education, New Delhi. 5. Integrated Electronics, Millman & Halkias, Tata McGraw Hill, 17th Reprint (2000)
Websites and e-Learning resources	1. https://nptel.ac.in/course.html/digital circuits/ 2. https://nptel.ac.in/course.html/electronics/operational amplifier/ 3. https://www.allaboutcircuits.com/textbook/semiconductors/chpt-7/field-effect-controlled-thyristors/ 4. https://www.electrical4u.com/applications-of-op-amp/ 5. https://www.geeksforgeeks.org/digital-electronics-logic-design- tutorials/

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Learn about the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve problems	K4
CLO2	Develop skills to design linear and non-linear applications circuits using Op-Amp and design the active filters circuits.	K3
CLO3	Gain knowledge about PLL, and develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it.	K4
CLO4	Learn about various techniques to develop A/D and D/A converters.	K2
CLO5	Acquire the knowledge about the CMOS logic, combinational and sequential circuits	K4
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-pointscale 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	3	1	2	2	3	3	3	2	3
CLO2	3	2	3	2	3	2	3	2	2	1	2
CLO3	3	2	3	2	2	2	3	2	3	1	2
CLO4	3	2	3	2	2	2	3	2	3	1	3
CLO5	3	2	3	2	3	2	3	3	3	2	3

Assessment Scheme
Blueprint for Semester Examination

**Learning Outcome Based Education (LOBE) & Assessment Articulation Mapping-K Levels
with Courses Learning Outcomes (CLOs)**

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented –Solving Problems

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

Distribution of Section-wise Marks with K Levels

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		DIGITAL COMMUNICATION					
TANSCHÉ Coursetype		EC 1					
Course Category		Elective (Discipline Specific)					
Nature of Course		Skill Development					
Category	EC	Year	I	Credits	3	Course Code	23P1PECT1(B)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		---		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Exposure to Fourier transform, pulse modulation, multiplexing, noises in communication signals					
Objectives of theCourse		1. To understand the use of Fourier, transform in analyzing the signals 2. To learn about the quanta of transmission of information 3. To make students familiar with different types of pulse modulation 4. To have an in depth knowledge about the various methods of error controlling codes 5. To acquire knowledge about spread spectrum techniques in getting secured communication					
Course Outline		UNIT I: Signal Analysis Fourier transforms of gate functions, delta functions at the origin – Two delta function and periodic delta function – Properties of Fourier transform – Frequency shifting –Time shifting - Convolution – Graphical representation – Convolution theorem – Time Convolution theorem –Frequency Convolution theorem –Sampling theorem.					
		UNIT II: Information Theory Communication system – Measurement of information – Coding – Bandot Code CCITT Code –Hartley Law – Noise in an information Carrying Channel- Effects of noise- Capacity of noise in a channel – Shannon Hartley theorem –Redundancy.					
		UNIT III: Pulse Modulation Pulse amplitude modulation - natural sampling – Instantaneous sampling - Transmission of PAM Signals -Pulse width modulation – Time division multiplexing – Band width requirements for PAM Signals. Pulse Code Modulation –Principles of PCM –Quantizing noise – Generation and demodulation of PCM -Effects of noise – Companding – Advantages and application					

	UNIT IV: Error Control Coding Introduction to Linear Block Codes, Hamming Codes, BCH Coding, RS Coding, Convolutional Coding, Coding Gain Viterbi Coding
	UNIT V: Spread Spectrum Systems Pseudo Noise sequences, generation and Correlation properties, direct sequence spread spectrum systems, frequency HOP Systems, processing gain, anti-jam and multipath performance
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this course	Students will learn the fundamentals of system level design (information theory) and signal analysis of digital communication system.
Justification for nature of course	This course will provide the basic knowledge about the digital communication system and provide the knowledge to undertake communication system through the physics principals
Text Book(s)	1. B.P. Lathi, <i>Communication system</i> , Wiley Eastern. 2. George Kennedy, <i>Electronic Communication Systems</i> , 3 rd Edition, Mc Graw Hill. 3. Simon Haykin, <i>Communication System</i> , 3 rd Edition, John Wiley & Sons. 4. George Kennedy and Davis, 1988, <i>Electronic Communication System</i> , Tata McGraw Hill 4 th Edition. 5. Taub and Schilling, 1991, " <i>Principles of Communication System</i> ", Second edition Tata McGraw Hill.
Reference Book(s)	1. John Proakis, 1995, <i>Digital Communication</i> , 3 rd Edition, McGraw Hill, Malaysia. 2. M. K. Simen, 1999, <i>Digital Communication Techniques, Signal Design and Detection</i> , Prentice Hall of India. 3. Dennis Roddy and Coolen, 1995, <i>Electronics communications</i> , Prentice Hall of India IV Edition. 4. Wave Tomasi, 1998, " <i>Advanced Electronics communication System</i> " 4 th Edition Prentice Hall, Inc. 5. M.Kulkarni, 1988, " <i>Microwave and Radar Engineering</i> ", Umesh Publications.

Websites and e- Learning resources	1. https://www.youtube.com/watch?v=WgzynezPiyc 2. https://www.youtube.com/watch?v=ShQWwobpW60 3. https://www.ukessays.com/essays/physics/fiber-optics-and-it-applications.php 4. https://www.youtube.com/watch?v=0kEvr4DKGRI 5. http://optics.byu.edu/textbook.aspx

COURSE OUTCOMES:

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

CLOs	Course Outcomes	K-level
CLO1	Summarize the techniques of Fourier transform, convolution and sampling theorems in signal processing	K2
CLO2	Apply different information theories in the process of study of coding of information, storage and communication	K3
CLO3	Explain and compare the various methods of pulse modulation techniques	K4
CLO4	Apply the error control coding techniques in detecting and correcting errors- able to discuss, analyze and compare the different error control coding	K3
CLO5	Apply, discuss and compare the spread spectrum techniques for secure communications	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	1	2	3	3	3	2	1
CLO2	3	3	3	2	1	2	3	3	3	2	1
CLO3	3	3	3	3	1	1	3	3	3	3	1
CLO4	3	3	3	2	1	1	3	3	3	2	1
CLO5	3	3	3	3	1	1	3	3	3	3	1

Assessment Scheme
Blueprint for Semester Examination
Learning Outcome Based Education (LOBE) & Assessment Articulation Mapping-K Levels
with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Qns	K- Level	No. of Qns	K- Level		
1	CLO 1	Up to K2	2	K1 & K2	1	K1	2 (K1&K3)	1 (K2)
2	CLO 2	Up to K3	2	K1 & K2	1	K1	2 (K1&K2)	1 (K3)
3	CLO 3	Up to K4	2	K3 & K4	1	K2	2 (K4&K4)	1 (K4)
4	CLO 4	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K3	2	K3 & K3	1	K2	2 (K2&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	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	SectionD (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	--	16	15.83	13.33 %
K2	2	4	10	10	26	25.83	21.67%
K3	4	2	10	20	36	41.67	30.00 %
K4	2	-	20	20	42	16.67	35.00 %
Total Marks	10	10	50	50	120	100.00	100%

Title of the Course		ENERGY PHYSICS					
TANSCHÉ Course type		EC 2					
Course Category		Elective					
Nature of Course		Skill Development					
Category	EC	Year	I	Credits	3	Course Code	23P1PECT2(A)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Knowledge of conventional energy resources					
Objectives of the Course		1. To learn about various renewable energy sources. 2. To know the ways of effectively utilizing the oceanic energy. 3. To study the method of harnessing wind energy and itsadvantages. 4. To learn the techniques useful for the conversion of biomass intouseful energy. 5. To know about utilization of solar energy.					
Course Outline		Unit – 1: Introduction To Energy Sources Conventional and non-conventional energy sources and their availability–prospects of Renewable energy sources– Energy from other sources–chemical energy–Nuclear energy– Energy storage and distribution.					
		Unit – 2: Energy From The Oceans Energy utilization–Energy from tides–Basic principle of tidal power–utilization of tidal energy – Principle of ocean thermal energy conversion systems					
		Unit – 3: Wind Energy Sources Basic principles of wind energy conversion–power in the wind– forces in the Blades– Wind energy conversion–Advantages and disadvantages of wind energy conversion systems (WECS) – Energy storage– Applications of wind energy.					

	Unit – 4: Energy From Bio Mass Biomass conversion Technologies– wet and dry process– Photosynthesis - Biogas Generation: Introduction–basic process: Aerobic and anaerobic digestion – Advantages of anaerobic digestion–factors affecting bio digestion and generation of gas.
	Unit – 5: Solar Energy Sources Solar radiation and its measurements–solar cells: Solar cells for direct conversion of solar energy to electric powers–solar cell parameter–solar cell electrical characteristics–solar water Heater –solar distillation– solar cooking–solar greenhouse – Solar pond and its applications.
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this course	Students will learn the basic principal and functions of some energy harvesting instruments.
Justification for nature of course	This course will provide the basic knowledge about the energy sources and harvesting techniques.
Text Book(s)	1. G.D. Rai, 1996, Non – convention sources of, 4th edition, Khanna publishers, New Delhi. 2. S. Rao and Dr. Paru Lekar, Energy technology. 3. M.P. Agarwal, Solar Energy, S. Chand and Co., New Delhi (1983). 4. Solar energy, principles of thermal collection and storage by S.P.Sukhatme, 2nd edition, Tata McGraw-Hill Publishing Co. Lt., New Delhi (1997). 5. Energy Technology by S.Rao and Dr.Parulekar.
ReferenceBook(s)	1. Renewable energy resources, John Twidell and Tonyweir, Taylor and Francis group, London and New York. 2. Applied solar energy, A.B.Meinel and A.P.Meinal 3. John Twidell and Tony Weir, Renewable energy resources, Taylor and Francis group, London and New York. 4. Renewal Energy Technologies: A Practical Guide for Beginners C.S. Solanki-PHI Learning Introduction to Non-Conventional Energy Resources -Raja et.al., Sci. Tech Publications

Websites and e-Learning resources	1. https://www.open.edu/openlearn/ocw/mod/oucontent/view.php?id=2411&printable=1 2. https://www.nationalgeographic.org/encyclopedia/tidal-energy/ 3. https://www.ge.com/renewableenergy/wind-energy/what-is-wind-energy 4. https://www.reenergyholdings.com/renewable-energy/what-is-biomass/ 5. https://www.acciona.com/renewable-energy/solar-energy/

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Identify various forms of renewable and non-renewable energy sources	K2
CLO2	Understand the principle of utilizing the oceanic energy and apply it for practical applications.	K4
CLO3	Discuss the working of a windmill and analyze the advantages of wind energy.	K3
CLO4	Distinguish aerobic digestion process from anaerobic digestion.	K4
CLO5	Understand the components of solar radiation, their measurement and apply them to utilize solar energy.	K4
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAMME OUTCOMES:

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

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

Assessment Schema

Blueprint for Semester Examination

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

Units	CLOs	K-Level	Section A		Section B		Section C (Either or Choice)	Section D (Open Choice)
			MCQs		Short answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1&K1	1	K1	2 (K1& K1)	1 (K2)
2	CLO 2	Up to K3	2	K2&K2	1	K2	2 (K2& K2)	1 (K3)
3	CLO 3	Up to K4	2	K3&K3	1	K2	2 (K3& K3)	1 (K3)
4	CLO 4	Up to K4	2	K3&K3	1	K1	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K4	2	K4&K4	1	K3	2 (K4 &K4)	1 (K4)
No. of Questions to be Asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total marks for each			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	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	SectionD (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	--	16	15.83	13.33 %
K2	2	4	10	10	26	25.83	21.67%
K3	4	2	10	20	36	41.67	30.00 %
K4	2	-	20	20	42	16.67	35.00 %
Total Marks	10	10	50	50	120	100.00	100%

Title of the Course		PHYSICS OF NANOSCIENCE AND TECHNOLOGY					
TANSCHÉ Course type		EC 2					
Course Category		Elective					
Nature of Course		Skill Development					
Category	EC	Year	I	Credits	3	Course code	23P1PECT2(B)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic knowledge in Solid State Physics					
Objectives of the Course		- Physics of Nanoscience and Technology is concerned with the study, creation, manipulation and applications at nanometer scale. - To provide the basic knowledge about nanoscience and technology. - To learn the structures and properties of nanomaterials. - To acquire the knowledge about synthesis methods and characterization techniques and its applications.					
Course Outline		UNIT I: Fundamentals of Nano science and Technology Fundamentals of NANO – Historical Perspective on Nanomaterial and Nanotechnology — Classification of Nanomaterials – Metal and Semiconductor Nanomaterials - 2D, 1D, 0D nanostructured materials - Quantum dots – Quantum wires – Quantum wells - Surface effects of nanomaterials.					
		UNIT II: Properties of Nanomaterials Physical properties of Nanomaterials: Melting points, specific heat capacity, and lattice constant - Mechanical behavior: Elastic properties – strength - ductility – super plastic behavior - Optical properties: - Surface Plasmon Resonance – Quantum size effects - Electrical properties - Conductivity, Ferroelectrics and dielectrics - Magnetic properties – super para magnetism – Diluted magnetic semiconductor (DMS).					
		UNIT III: Synthesis and Fabrication Physical vapour deposition - Chemical vapour deposition - sol-gel – Wet deposition techniques - electrochemical deposition method – Plasma arching – Electros pinning method - ball milling technique - pulsed laser deposition - Nanolithography: photolithography – Nano manipulator.					

	UNIT IV: Characterization Techniques Powder X-ray diffraction – X-ray photoelectron spectroscopy (XPS) - UV-visible spectroscopy – Photoluminescence - Scanning electron microscopy (SEM) - Transmission electron microscopy (TEM) - Scanning probe microscopy (SPM) - Scanning tunneling microscopy (STM) – Vibrating sample Magnetometer. UNIT V: Applications of Nanomaterials Sensors: Nano sensors based on optical and physical properties - Electrochemical sensors – Nano-biosensors. Nano Electronics: Nano bots - display screens - GMR read/write heads - Carbon Nano tube Emitters – Photo catalytic application: Air purification, water purification -Medicine: Imaging of cancer cells – biological tags - drug delivery - photodynamic therapy - Energy: fuel cells - rechargeable batteries - supercapacitors - photovoltaic's.
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this course	Nanoscience and technology has emerged recently as a promising area in the knowledge bank with lots of scope for innovation to address the challenging problems faced by science, society and humanity.
Justification for nature of course	This course aims to present a number of topics in nanotechnology and science, with emphasis on the role of size on mechanical, optical, thermal and electrical properties of materials. The course also introduces various modern techniques developed to produce Nanostructures and Nano devices and to characterize them. The course incorporates Lab visits.
Text Book(s)	1. A textbook of Nanoscience and Nanotechnology, Pradeep T., Tata McGraw-Hill Publishing Co. (2012). 2. Principles of Nanoscience and Nanotechnology, M.A. Shah, Tokeer Ahmad, Narosa Publishing House Pvt Ltd., (2010). 3. Introduction to Nanoscience and Nanotechnology, K. K. Chattopadhyay and A.N. Banerjee, PHI Learning Pvt. Ltd., New Delhi, (2012). 4. Nanostructured Materials and Nanotechnology, Hari Singh Nalwa, Academic Press, (2002). 5. Nanotechnology and Nanoelectronics, D.P. Kothari, V. Velmurugan and Rajit Ram Singh, Narosa Publishing House Pvt. Ltd, New Delhi. (2018)

Reference Book(s)	1. Nanostructures and Nanomaterials – Huozhong Gao – Imperial College Press (2004). 2. Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc. USA 3. Nano particles and Nano structured films; Preparation, Characterization and Applications, J. H. Fendler John Wiley and Sons. (2007) 4. Textbook of Nanoscience and Nanotechnology, B. S. Murty, et al., Universities Press. (2012) 5. The Nanoscope (Encyclopedia of Nanoscience and Nanotechnology), Dr. Parag Diwan and Ashish Bharadwaj (2005) Vol. IV - Nanoelectronics Pentagon Press, New Delhi.
Websites and e-Learning resources	1. www.its.caltec.edu/feyman/plenty.html 2. http://www.library.ualberta.ca/subject/nanoscience/guide/index.cfm 3. http://www.understandingnano.com 4. http://www.nano.gov 5. http://www.nanotechnology.com

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Describe the basic of nanoscience and explore the different types of nanomaterials and should comprehend the surface effects of the nanomaterials.	K2
CLO2	Categorize the various physical, mechanical, optical, electrical and magnetic properties of nanomaterials.	K4
CLO3	Demonstrate the process and mechanism of synthesis and fabrication of nanomaterials.	K3
CLO4	Analyze the various characterization of Nano-products through diffraction, spectroscopic, microscopic and other techniques.	K4
CLO5	Apply the concepts of nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy devices.	K3
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

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	1	2	3	3	3	3	3	2	3
CLO2	3	3	1	2	3	3	3	3	3	2	3
CLO3	3	3	1	2	3	3	3	3	3	3	3
CLO4	3	3	2	2	3	3	3	3	3	3	3
CLO5	3	3	3	2	3	3	3	3	3	3	3

Assessment scheme
Distribution of Section-wise Marks with K Levels
Blueprint for Semester Examination

Units	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	CLO 1	Up to K2	2	K1&K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K4	2	K3&K4	1	K1	2 (K3&K3)	1(K4)
3	CLO 3	Up to K3	2	K2&K3	1	K2	2 (K4&K4)	1(K3)
4	CLO 4	Up to K4	2	K3&K4	1	K3	2 (K4&K4)	1(K4)
5	CLO 5	Up to K3	2	K2&K3	1	K2	2(K3&K3)	1(K3)
No. of Questions to be asked			10			5	10	5
No. of Questions to be answered			10			5	5	3
Marks for each question			1			2	5	10
Total Marks for each Section			10			10	25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice
K1	2	4	10	-	16	13.33
K2	2	4	10	10	26	21.67
K3	4	2	10	20	36	30.00
K4	2	-	20	20	42	35.00
Total Marks	10	10	50	50	120	100.00

Title of the Course		ASTROBIOLOGY									
TANSCHÉ Course Type		SEC1									
Course Category		Skill Enhancement Course									
Nature of Course		Employability / Entrepreneurship / Skill Development									
Category	SEC	Year	I	Credits	2	Course Code	23P1PSED1				
		Semester	1								
Instructional Hours per week		Lecture		Tutorial		Practical		Total			
		2		-		-		2			
Marks		CIA			Semester			Total			
		25			75			100			
Pre-requisite(s)		Basic biology, basic astronomy, Physics at UG level									
Objectives of the Course		• To introduce the students to the interdisciplinary field of Astrobiology. • To make the students appreciate the scope of astrobiology in light of our understanding of life, as we know it in the present form and the on the basis of discovery of exoplanets in the habitable zone. • To appreciate the origin of life and environment of our earth and extrapolate the findings to our solar system.									
Course Outline		Unit I: Astronomy and Astrobiology Introduction - Life from the perspective of physics - the bare necessities of life - Basic astronomy - Formation of stars and galaxies - nucleosynthesis - HR diagram - spectral classification of stars - theory of formation of planets - the age of earth and moon.									
		Unit II: Origin of life and environment The early earth - origin of life - signs of earliest life - role of atmosphere - the great oxidation event - advent of animal life - snowball earth - occurrence of advanced life									
		Unit III: Life in the solar system Habitable bodies in the solar system - Sunlight's effect on habitability of inner planets - Life on Venus - early atmosphereand climate on mars - Interest on europa and titan									
		Unit IV: Life outside solar system Hunt for exoplanets (astrometry, stellar Doppler shift, transit telemetry, gravitational microlensing) - the habitable zone – bio signatures									

	Unit V: Extra terrestrial intelligence Drake's equation - SETI - Fermi's paradox - Rare earth Hypothesis
Extended Professional Component	Study of recent Nobel Prize in Physics in related topics
Skills acquired from this course	Basic astronomy – techniques for exoplanets discovery – Understanding of habitability of planets.
Justification for nature of course	The course introduces the students to the basic astronomy along with the multi-disciplinary
Text Book(s)	1. Astrobiology : A Very short introduction, David C. Catling, Oxford University Press, 2013
Reference Book(s)	1. Des Marais, David J., et al. <i>The NASA Astrobiology Roadmap</i> . Larchmont, NY: Mary Ann Liebert, Inc., 2008. 2. Dick, Steven J., and Mark L. Lupisella. <i>Cosmos and Culture: Cultural Evolution in a Cosmic Context</i> . Washington, DC: National Aeronautics and Space Administration, 2009. ISBN: 9780160831195 3. Kaufman, Marc. <i>First Contact: Scientific Breakthroughs in the Hunt for Life Beyond Earth</i> . New York, NY: Simon and Schuster, 2011. ISBN: 9781439109007 4. Meltzer, Michael. <i>When Biospheres Collide: A History of NASA's Planetary Protection Programs</i> . Washington, DC: NASA Aeronautics and Space Administration: For sale by the Supt. of Docs., U.S. Govt. Print. Off., 2011. ISBN: 9780160853272 5. <i>An Astrobiology Strategy for the Exploration of Mars</i> . Washington, DC: National Academies Press, 2007. ISBN: 9786610934669
Websites and e-Learning resources	1. https://www.terc.edu/terc_products/astrobiology-an-integrated-science-approach/ 2. https://guides.lib.uw.edu/c.php?g=341353&p=2303542 3. http://astrobiology.com/

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Understand the origin of universe and its evolution	K2
CLO2	Explain the early universe and appreciate the factors that led to the occurrence of advanced life on earth.	K3
CLO3	Comprehend the idea of habitability and identify objects in the solar system that can / could have harbored life.	K4
CLO4	Understand the techniques used to detect exoplanets and look for bio signatures.	K3
CLO5	Understand Drake's equation and its implication to extra terrestrial intelligent life forms.	K4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) in the 3-pointscale 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	3	3	2	2	1	1
CLO2	3	1	2	2	2	3	3	2	2	1	2
CLO3	3	1	3	3	3	3	3	2	2	1	1
CLO4	3	2	3	3	3	3	3	2	2	1	2
CLO5	3	3	3	3	2	3	3	2	2	1	1

Assessment Schema
Blueprint for Semester Examination
Learning Outcome Based Education (LOBE) & Assessment Articulation Mapping-K Levels
with Courses Learning Outcomes (CLOs)

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented –Solving Problems

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

Distribution of Section-wise Marks with K Levels

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		STATISTICAL MECHANICS						
TANSCHÉ Course type		CC4						
Course Category		Core						
Nature of Course		Skill Development						
Category	CC	Year	I	Credits	5	Course Code	23P2PCCT3	
		Semester	II					
Instructional Hours per week		Lecture	Tutorial		Practical	Total		
		5	1		0	6		
Marks		CIA		Semester		Total		
		25		75		100		
Pre-requisite(s)		Laws of thermodynamics, phase transition, entropy, ensembles, partition function, classical and quantum statistics, thermal equilibrium, Brownian motion						
Objectives of the Course		- To acquire the knowledge of thermodynamic potentials and to understand phase transition in thermodynamics - To identify the relationship between statistic and thermodynamic quantities - To comprehend the concept of partition function, canonical and grand canonical ensembles - To grasp the fundamental knowledge about the three types of statistics - To get in depth knowledge about phase transitions and fluctuation thermodynamic properties that vary with time						
Course Outline		Unit I: Phase Transitions Thermodynamic potentials - Phase Equilibrium - Gibb’s phase rule - Phase transitions and Ehrenfest’s classifications –Third law of Thermodynamics. Order parameters – Landau’s theory of phase transition - Critical indices - Scale transformations and dimensional Analysis						
		Unit II: Statistical mechanics and Thermodynamics Foundations of statistical mechanics - Specification of states of a system - Micro canonical ensemble - Phase space – Entropy - Connection between statistics and thermodynamics – Entropy of an ideal gas using the micro canonical ensemble - Entropy of mixing and Gibb’s paradox.						
		Unit III: Canonical and Grand Canonical Ensembles Trajectories and density of states - Liouville’s theorem - Canonical and grand canonical ensembles - Partition function - Calculation of statistical quantities - Energy and density fluctuations.						

	Unit IV: Classical and Quantum Statistics Density matrix - Statistics of ensembles - Statistics statistics – Ideal Fermi gas – Degeneracy - Bose-Einstein statistics - Plank radiation formula - Ideal Bose gas - Bose-Einstein condensation.
	Unit V: Real gas, Ising model and Fluctuations Cluster expansion for classical gas - Virial equation of state - Ising model - Exact solutions in one dimension - Correlation of space- time dependent fluctuations - Fluctuations and transport phenomena - Brownian motion - Langevin theory - Fluctuation-dissipation theorem - The Fokker-Planck equation
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this course	Understanding the statistical mechanics with mathematical problems is acquire the knowledge to prepare for the CSIR NET, GATE Examinations
Justification for nature of course	Students gain knowledge of numerous statistical phenomena, their applications, and the laws that govern them. This course also works to refine the concepts for creating the models that are made available to students.
Text Book(s)	1. S. K. Sinha, 1990, <i>Statistical Mechanics</i> , Tata McGraw Hill, New Delhi. 2. B. K. Agarwal and M. Eisner, 1998, <i>Statistical Mechanics</i> , Second Edition New Age International, New Delhi. 3. J. K. Bhattacharjee, 1996, <i>Statistical Mechanics: An Introductory Text</i> , Allied Publication, New Delhi. 4. F. Reif, 1965, <i>Fundamentals of Statistical and Thermal Physics</i> , McGraw -Hill, New York. 5. M. K. Zemansky, 1968, <i>Heat and Thermodynamics</i> , 5 th edition, McGraw-Hill New York.
Reference Book(s)	1. R. K. Pathria, 1996, <i>Statistical Mechanics</i> , 2 nd edition, Butter WorthHeinemann, New Delhi. 2. L. D. Landau and E. M. Lifshitz, 1969, <i>Statistical Physics</i> , Pergamon Press, Oxford. 3. K. Huang, 2002, <i>Statistical Mechanics</i> , Taylor and Francis, London 4. W. Greiner, L. Neise and H. Stoecker, <i>Thermodynamics and Statistical Mechanics</i> , Springer Verlag, New York. 5. A. B. Gupta, H. Roy, 2002, <i>Thermal Physics</i> , Books and Allied, Kolkata.

Websites and e-Learning resources	1. https://byjus.com/chemistry/third-law-of-thermodynamics/ 2. https://web.stanford.edu/~peastman/statmech/thermodynamics.html 3. https://en.wikiversity.org/wiki/Statistical_mechanics_and_thermodynamics 4. https://en.wikipedia.org/wiki/Grand_canonical_ensemble 5. https://en.wikipedia.org/wiki/Ising_model

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Examine and elaborate the effect of changes in thermodynamic quantities on the states of matter during phase transition	K4
CLO2	Summarize the basic properties of Statistical Mechanics and Thermodynamics	K2
CLO3	Develop the relation between thermo dynamical quantities and partition function	K3
CLO4	Analyze behaviour of ideal gas using the different statistical concepts.	K4
CLO5	Examine the thermo dynamical behaviour of gases under inflection and also using Ising model	K4
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) in the 3-pointscale 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	3	2	3	2	3	2	3	2	3
CLO2	3	1	2	2	1	1	3	1	1	1	2
CLO3	3	1	2	1	1	1	2	1	1	1	2
CLO4	3	1	2	2	1	1	3	1	1	1	2
CLO5	3	1	2	1	1	1	3	2	1	1	2

Assessment Scheme
Blueprint for Semester Examination
Learning Outcome Based Education (LOBE) & Assessment Articulation Mapping-K Levels
with Courses Learning Outcomes (CLOs)

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented –Solving Problems

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

Distribution of Section-wise Marks with K Levels

K 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		QUANTUM MECHANICS – I					
TANSCHÉ Course type		CC5					
Course Category		Core					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	5	CourseCode	23P2PCCT4
		Semester	II				
Instructional Hours per week		Lecture		Tutorial		Practical	Total
		5		1		-	6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Newton’s laws of motion, Schrodinger’s equation, integration, differentiation.					
Objectives of the Course		• To develop the physical principles and the mathematical background important to quantum mechanical descriptions. • To describe the propagation of a particle in a simple, one- dimensional potential. • To formulate and solve the Schrodinger’s equation to obtain eigenvectors and energies for particle in a three-dimensional potential. • To explain the mathematical formalism and the significance of constants of motion, and see their relation to fundamental symmetries in nature • To discuss the Approximation methods like perturbation theory, Variational and WKB methods for solving the Schrödinger equation.					
Course Outline		Unit I: Basic Formalism Interpretation of the wave function – Time dependent Schrodinger equation – Time independent Schrodinger equation – Stationary states – Ehrenfest’s theorem – Linear vector space – Linear operator – Eigen functions and Eigen Values – Hermitian Operator – Postulates of Quantum Mechanics – Simultaneous measurability of observables – General Uncertainty relation					

	Unit II: One Dimensional And Three-Dimensional Energy Eigen Value Problems Square – well potential with rigid walls – Square well potential with finite walls – Square potential barrier – Alpha emission – Linear harmonic oscillator: Operator method – Particle moving in a spherically symmetric potential – System of two interacting particles – Hydrogen atom – Rigid rotator
	Unit III: General Formalism Dirac notation – Equations of motions – Schrodinger representation – Heisenberg representation – Interaction representation – Coordinate representation – Momentum representation – Symmetries and conservation laws – Unitary transformation Unit IV: Approximation Methods Time independent perturbation theory for non-degenerate energy levels – Degenerate energy levels – Stark effect in Hydrogen atom – Ground and excited state – Variation method – Helium atom – WKB approximation – Connection formulae (no derivation) – WKB quantization – Application to simple harmonic oscillator. Unit V: Angular Momentum Eigenvalue spectrum of general angular momentum – Ladder operators and their algebra – Matrix representation – Spin angular momentum – Addition of angular momenta – CG Coefficients – Symmetry and anti – symmetry of wave functions – Construction of wave-functions and Pauli's exclusion principle.
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this course	One dimensional and three dimensional wave equations for quantum mechanical systems could be solved to explain the behaviour of atoms and sub-atomic particles.
Justification for nature of Course	This course will help to learn quantum mechanics and build problem solving skill and quantitative reasoning skill using quantum mechanical principles/concepts.

Text Book(s)	1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 2nd edition(37th Reprint),Tata McGraw-Hill, New Delhi, 2010. 2. G. Aruldas, Quantum Mechanics, 2nd edition, Prentice Hall of India, New Delhi, 2009. 3. David J Griffiths, Introduction to Quantum Mechanics. 4th edition, Pearson, 2011. 4. SL Gupta and ID Gupta, Advanced Quantum Theory and Fields,1st Edition, S.Chand& Co., New Delhi, 1982. 5. A. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, 4thEdition, Macmillan, India, 1984.
Reference Book(s)	1. E. Merzbacher, Quantum Mechanics, 2nd Edition, John Wileyand Sons, New York, 1970. 2. V. K. Thankappan, Quantum Mechanics, 2nd Edition, Wiley Eastern Ltd, New Delhi, 1985. 3. L. D. Landau and E. M. Lifshitz, Quantum Mechanics, 1st edition, Pergomon Press, Oxford, 1976. 4. S. N. Biswas, Quantum Mechanics, Books and Allied Ltd.,Kolkata, 1999. 5. V. Devanathan, Quantum Mechanics, 2nd edition, Alpha Science International Ltd, Oxford , 2011.
Websites and e-Learning resources	1. http://research.chem.psu.edu/lxjgroup/download_files/chem565-c7.pdf 2. http://www.feynmanlectures.caltech.edu/III_20.html 3. http://web.mit.edu/8.05/handouts/jaffe1.pdf 4. https://hepwww.pp.rl.ac.uk/users/haywood/Group_Theory_Lectures/Lecture_1.pdf 5. https://theory.physics.manchester.ac.uk/~xian/qm/chapter3.pdf

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Demonstrates a clear understanding of the basic postulates of quantum mechanics which serve to formalize the rules of quantumMechanics	K2
CLO2	Able to apply and analyze the Schrodinger equation to solve one dimensional problems and three dimensional problems	K4
CLO3	Discuss the various representations, space time symmetries and formulations of time evolution.	K3
CLO4	Formulate and analyze the approximation methods for various quantum mechanical problems	K4
CLO5	Apply non-commutative algebra for topics such as angular and spinangular momentum and hence explain spectral line splitting.	K3
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-pointscale 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	3	2	2	2	3	2	2	2	3
CLO2	3	2	3	2	2	2	3	2	2	2	3
CLO3	3	2	3	2	2	2	3	2	2	2	3
CLO4	3	2	3	2	2	2	3	2	2	2	3
CLO5	3	2	3	2	2	2	3	2	2	2	3

Assessment Scheme
Blueprint for Semester Examination
Learning Outcome Based Education (LOBE) & Assessment Articulation Mapping-K Levels
with Courses Learning Outcomes (CLOs)

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

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice
K1	2	4	10	-	16	13.33
K2	2	4	10	10	26	21.67
K3	4	2	10	20	36	30.00
K4	2	-	20	20	42	35.00
Total Marks	10	10	50	50	120	100.00

Title of the Course		PRACTICAL- II					
TANSCHÉ Course type		CC6					
Course Category		Core					
Nature of Course		Skill Development					
Category	CC	Year	I	Credits	4	Course Code	23P2PCCP2
		Semester	2				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		-	-		6		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Knowledge and handling of basic general and electronics experiments of Physics					
Objectives of the Course		• To understand the concept of mechanical behavior of materials and calculation of same using appropriate equations. • To calculate the thermodynamic quantities and physical properties of materials. • To analyze the optical and electrical properties of materials. • To observe the applications of FET and UJT. • To study the different applications of operational amplifier circuits. • To learn about Combinational Logic Circuits and Sequential Logic Circuits					
Course Outline		(Any Twelve Experiments from the following) 1. Determination of Young’s modulus and Poisson’s ratio by Elliptical fringes - Cornu’s Method 2. Determination of Stefan’s constant of radiation from a hotbody 3. Measurement of Coefficient of linear expansion- Air wedge Method 4. Measurement of Susceptibility of liquid - Quincke’s method 5. B-H curve using CRO 6. Measurement of Magnetic Susceptibility - Guoy’s method 7. LG Plate 8. Arc spectrum: Copper 9. Determination of Solar constant					

	10. Determination of e/m - Millikan's method 11. Miscibility measurements using ultrasonic diffraction method 12. Determination of Thickness of thin film. - Michelson Interferometer 13. GM counter – Feather's analysis: Range of Beta rays 14. Iodine absorption spectra 15. Molecular spectra – CN bands 16. Determination of Refractive index of liquids using diode Laser/He – Ne Laser 17. Determination of Numerical Apertures and Acceptance angle of optical fibers using Laser Source. 18. Measurement of Dielectricity - Microwave test bench 19. Hall Effect in Semiconductor. Determine the Hall coefficient, carrier concentration and carrier mobility 20. Interpretation of vibrational spectra of a given material. 21. Determination of I-V Characteristics and efficiency of solar cell. 22. IC 7490 as scalar and seven segment display using IC 7447 23. Solving simultaneous equations – IC 741 / IC LM324 24. Op-Amp –Active filters: Low pass, High pass and Band pass filters (Second Order) Butterworth filter 25. Construction of Current to Voltage and Voltage to Current Conversion using IC 741. 26. Construction of second order Butterworth multiple feedback narrow band pass filter 27. Realization of analog to digital converter (ADC) using 4-bit DAC and synchronous counter IC 74193 28. Construction of square wave generator using IC 555 – Study of VCO 29. Construction of Schmidt trigger circuit using IC 555 for a given hysteresis – Application as squarer 30. Construction of pulse generator using the IC 555 – Application as frequency divider 31. BCD to Excess-3 and Excess-3 to BCD code conversion 32. Study of binary up / down counters - IC 7476 / IC 7473 33. Shift register and Ring counter and Johnson counter- IC 7476/IC 7474 34. Study of synchronous parallel 4-bit binary up/down counter using IC 74193 35. Study of asynchronous parallel 4-bit binary up/down counter using IC 7493 36. Study of Modulus Counter 37. Construction of Multiplexer and Demultiplexer using ICs.

Skills acquired from this course	Experimental skills
Justification for nature of course	Analysing the concepts of Physics through experiments in the laboratory will enhance effective comprehension.
Text Book(s)	1. Practical Physics, Gupta and Kumar, Pragati Prakasan 2. Kit Developed for doing experiments in Physics- Instruction manual, R. Srinivasan K.R Priolkar, Indian Academy of Sciences 3. Op-Amp and linear integrated circuit, Ramakanth A Gaykwad, Eastern Economy Edition. 4. Electronic lab manual Vol I, K A Navas, Rajath Publishing 5. Electronic lab manual Vol II, K A Navas, PHI eastern Economy Edition
Reference Book(s)	1. An advanced course in Practical Physics, D. Chattopadhyay, C.R Rakshit, New Central Book Agency Pvt. Ltd 2. Advanced Practical Physics, S.P Singh, Pragati Prakasan 3. A course on experiment with He-Ne Laser, R. S. Sirohi, John Wiley & Sons (Asia) Pvt. Ltd 4. Electronic lab manual Vol II, Kuriachan T.D, Syam Mohan, Ayodhya Publishing 5. Electronic Laboratory Primer a design approach, S. Poornachandra, B. Sasikala, Wheeler Publishing, New Delhi
Websites and e-Learning resources	• https://vlab.amrita.edu/index.php?sub=1&brch=192&sim=854&cnt=1 • https://pubmed.ncbi.nlm.nih.gov/20733898/ • https://www.electronics-tutorials.ws/waveforms/555_oscillator.html • https://www.hackatronic.com/ic74193-up-down-counter-pin-configuration-datasheet/

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge level	Marks
CLO1	Understand the given problem in terms of domain knowledge in the field of physics.	Upto K2	15
CLO2	Design appropriate Experiment /Test for the given problem.	Upto K3	10
CLO3	Demonstrate skill in doing the experiment by choosing the appropriate technique and instruments and record data.	Upto K3	15
CLO4	Analyze the data collected and infer the outcome and represent the analysis in meaningful form.	Upto K4	20
CLO5	Communicate the findings in appropriate scientific terminology.	Upto K2	5
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate			

Mapping of CLO's with PSOs

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

Title of the Course		BIO PHYSICS					
TANSCHE Course type		EC 3					
Course Category		Elective					
Nature of Course		Skill Development					
Category	EC	Year	I	Credits	3	Course Code	23P2PECT3(A)
		Semester	2				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Fundaments Concepts of Physics and Biology					
Objectives of the Course		1. The aim of this course is to bring knowledge about the cell functions in terms of physical principles. 2. To understand the fundamentals of macromolecular structures involved in propagation of life, biophysical functions of membrane and neurons, various kinds of radiation and their effects on living systems. 3. To bring the knowledge about the hazardous effect of radiation and precautionary measurements. 4. To understand the physical principles behind the various techniques available for interrogating biological macromolecules.					
Course Outline		Unit – 1: Cellular BioPhysics: Architecture and Life Cycle of cells – Organelles of Prokaryotic and Eukaryotic cell – Cell size and shape – Fine structure of Prokaryotic and Eukaryotic cell organization – Compartment & assemblies membrane system – Extracellular matrix - Molecular mechanisms of Vesicular traffic - Electrical activities of cardiac and neuronal cells.					
		Unit – 2: Molecular BioPhysics Macromolecular structure: Protein structure – amino acids, peptide bonds, primary, secondary, tertiary, and quaternary structures of proteins Nucleic acid structure: nucleosides and nucleotides, RNA structure, DNA structure and conformation. Special Bio-macromolecules: Metalloproteins, nucleoproteins					
		Unit – 3: Membrane And Neuro BioPhysics:					

	Models' membranes - Biological membranes and dynamics – Membrane Capacitors – Transport across cell and organelle membranes – Ion channels. Nervous system: Organization of the nervous system –Membrane potential – Origins of membrane potential - Electrochemical potentials – Nernst equation – Goldman equation.
	Unit – 4: Radiation Bio Physics: X-Ray: Effects on bio-macromolecules – Gamma Radiation: Molecular effects of gamma radiation, Radiation effects on nucleic acids and membranes, Effects on cell and organelles – UV radiation: Effects on bio-macromolecules and proteins – Radiation hazards and protection – use of radiations in cancer Unit – 5: Physical Methods In Biology: Spectroscopy: UV-Visible absorption spectrophotometry – Optical Rotatory Dispersion (ORD) – Structure Determination: X-ray Crystallography, Electron spin resonance (ESR) and biological applications. Chromatography: Gas liquid chromatography (GLC) – Centrifugation: Differential centrifugation, density gradient centrifugation. Electrophoresis: Gel electrophoresis,
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this course	Students will learn the function of biomedical instruments such as Principle, operations and operating procedures which are used to find the basic role of Biomolecule in the biological system
Justification for nature of course	This course will provide the basic knowledge about the biological system and provide the knowledge to investigate the biological system through the physics principals.
Text Book(s)	1. The cell: A molecular approach, Geoffrey M. Cooper, ASM Press, 2013. 2. Biophysics, VasanthaPattabhi, N. Gautham, Narosa Publishing, 2009 3. Biophysics, P. S. Mishra VK Enterprises, 2010. 4. Biophysics, M. A Subramanian, MJP Publishers, 2005. 5. Bioinstrumentation, L. Veerakumari, MJP Publishers, 2006.
Reference Book(s)	1. Chemical Biophysics by Daniel A Beard (Cambridge University Press, 2008). 2. Essential cell biology by Bruce Albert et al (Garland Science) 3. Biophysics, W. Hoppe, W. Lohmann, H. Markl and H. Ziegler. Springer Verlag, Berlin (1983).

	4. Membrane Biophysics by Mohammad Ashrafuzzaman, Jack A. Tuszynski, (Springer science & business media). 5. Biological spectroscopy by Iain D. Campbell, Raymond A. Dwek
Websites and e-Learning resources	1. General Bio: http://www.biology.arizona.edu/DEFAULT.html 2. Spectroscopy: http://www.cis.rit.edu/htbooks/nmr/inside.htm 3. Electrophoresis: http://learn.genetics.utah.edu/content/labs/gel/ 4. Online biophysics programs: http://mw.concord.org/modeler/https://blanco.biomol.uci.edu/WWWResources.html

COURSE OUTCOMES:

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

CLOs	Course Learning Outcomes	Knowledge Level
CLO1	Understand the structural organization and function of living cells and should able to apply the cell signaling mechanism and its electrical activities.	K2
CLO2	Comprehension of the role of bio molecular conformation to function.	K4
CLO3	Conceptual understanding of the function of biological membranes and also to understand the functioning of nervous system.	K3
CLO4	To know the effects of various radiations on living systems and how to prevent ill effects of radiations.	K4
CLO5	Analyze and interpret data from various techniques viz., spectroscopy, crystallography, chromatography etc.,	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

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

Assessment Scheme
Blueprint for Semester Examination

Units	CLOs	K-Level	Section A		Section B		Section C (Either or Choice)	SectionD (Open Choice)
			MCQs		Short answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1&K1	1	K1	2 (K1& K1)	1 (K2)
2	CLO 2	Up to K4	2	K3&K3	1	K2	2 (K3& K3)	1 (K3)
3	CLO 3	Up to K3	2	K2&K2	1	K2	2 (K2& K2)	1 (K3)
4	CLO 4	Up to K4	2	K3&K3	1	K1	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K4	2	K4&K4	1	K3	2 (K4 &K4)	1 (K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total marks for eachSection			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	SectionA (No Choice)	SectionB (No Choice)	Section C (Either/or)	SectionD (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	--	16	15.83	13.33 %
K2	2	4	10	10	26	25.83	21.67%
K3	4	2	10	20	36	41.67	30.00 %
K4	2	-	20	20	42	16.67	35.00 %
Total Marks	10	10	50	50	120	100.00	100%

Title of the Course		Plasma Physics					
TANSICHE Course type		EC 3					
Course Category		Elective					
Nature of Course		Skill Development					
Category	EC	Year	I	Credits	3	Course Code	23P2PECT3(B)
		Semester	2				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Fundamentals of Electricity and Magnetism, Electromagnetic theory, Maxwell’s equation, Basic knowledge of electrical and electronics instrumentation.					
Objectives of the Course		- To explore the plasma universe by means of in-site and ground-based observations. - To understand the model plasma phenomena in the universe. - To explore the physical processes which occur in the space environment.					
Course Outline		Unit – 1: Fundamental Concepts of Plasma Kinetic pressure in a partially ionized - mean free path and collision cross section - Mobility of charged particles - Effect of magnetic field on the mobility of ions and electrons-Thermal conductivity- Effect of magnetic field-Quasi- neutrality of plasma Debye shielding distance - Optical properties of plasma.					
		Unit - 2: Motion of Charged Particles in Electric andMagnetic Field Particle description of plasma- Motion of charged particle in electrostatic field-Motion of charged particle in uniform magnetic field - Motion of charged particle in electric and magnetic fields- Motion of charged particle inhomogeneous magnetic field - Motion of charged particle in magnetic mirror confinement - motion of an electron in a time varying electric field- Magneto-hydrodynamics - Magneto-hydrodynamic equations – Condition for magneto hydrodynamic behaviour.					
		Unit - 3: Plasma Oscillations and Waves Introduction, theory of simple oscillations - electron oscillation in a plasma – Derivations of plasma oscillations by using Maxwell’s equation - Ion oscillation and waves in a magnetic field - thermal effects on plasma oscillations - Landau damping - Hydro magnetic waves - Oscillations in an electron beam.					

	Unit - 4: Plasma Diagnostics Techniques Single probe method - Double probe method - Use of probe technique for measurement of plasma parameters in magnetic field - microwave method - spectroscopic method - -laser as a tool for plasma diagnostics-X-ray diagnostics of plasma - acoustic method - conclusion.
	Unit - 5: Applications of Plasma Physics Magneto hydrodynamic Generator - Basic theory - Principle of Working-Fuel in MHD Generator - Generation of Microwaves Utilizing High Density Plasma - Plasma Diode.
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this course	Students will learn the fundamentals of plasma and its applications in various electrical and electronic instruments.
Justification for nature of course	This course will provide the fundamental knowledge about the occurrence of plasma state and provide the knowledge to analyze the propagation of charged particles.
Text Book(s)	1. Plasma Physics- Plasma State of Matter - S. N. Sen, Pragati Prakashan, Meerut. 2. Introduction to Plasma Physics-M. Uman 3. Krall, N. A., and A. W. Trivelpiece. Principles of Plasma Physics. Berkeley, CA: San Francisco Press, 1986. ISBN: 9780911302585.Tanenbaum, B. S. Plasma Physics. New York, NY: McGraw-Hill, 1967. ISBN: 9780070628120. 4. Goldston, R. J., and P. H. Rutherford. Introduction to Plasma Physics. Philadelphia, PA: IOP Publishing, 1995. ISBN: 9780750301831. 5. Hutchinson, I. H. Principles of Plasma Diagnostics. Cambridge, UK: Cambridge University Press, 2005. ISBN: 9780521675741.
Reference Book(s)	1. Chen, F. F. Introduction to Plasma Physics. 2nd ed. New York, NY: Springer, 1984. ISBN: 9780306413322. 2. Introduction to Plasma Theory-D.R. Nicholson 3. Shohet, J. L. The Plasma State. San Diego, CA: Academic Press Inc., 1971. ISBN: 9780126405507. 4. Hazeltine, R. D., and F. L. Waelbroeck. The Framework of Plasma Physics. Boulder, CO: Westview Press, 2004. ISBN: 9780813342139. 5. Huddleston, R. H., and S. L. Leonard. Plasma Diagnostic Techniques. San Diego, CA: Academic Press, 1965

Websites and e-Learning resources	1. https://fusedweb.llnl.gov/Glossary/glossary.html 2. http://farside.ph.utexas.edu/teaching/plasma/lectures1/index.html 3. http://www.plasmas.org/ 4. http://www.phy6.org/Education/whplasma.html 5. http://www.plasmas.org/resources.htm

COURSE OUTCOMES:

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

CO1	Understand the collision, cross section of charged particles and to able to correlate the magnetic effect of ion and electrons in plasma state.	K2
CO2	Understand the plasma and learn the magneto-hydrodynamics concepts applied to plasma.	K3
CO3	Explore the oscillations and waves of charged particles and thereby apply the Maxwell's equation to quantitative analysis of plasma.	K3
CO4	Analyze the different principle and techniques to diagnostics of plasma.	K4
CO5	Learn the possible applications of plasma by incorporating various electrical and electronic instruments.	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	3	2	1	1	2	2	1	2
CLO2	3	3	2	1	2	1	3	3	3	2	1
CLO3	3	2	3	2	3	3	3	2	2	2	2
CLO4	3	2	1	3	3	3	3	3	3	2	1
CLO5	3	3	2	2	2	1	3	2	3	1	2

Assessment Schema
Blueprint for Semester Examination

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 K3	2	K1&K2	1	K1	2 (K1& K1)	1 (K3)
3	CLO 3	Up to K3	2	K1&K2	1	K2	2 (K3& K3)	1 (K3)
4	CLO 4	Up to K4	2	K1&K2	1	K2	2 (K3& K3)	1 (K4)
5	CLO 5	Up to K4	2	K1&K2	1	K2	2 (K4& K4)	1 (K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total marks for each			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	41.66 %
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	41.66 %
K4	-	-	10	10	20	16.67	16.66 %
Total Marks	10	10	50	50	120	100.00	100 %

Title of the Course		ADVANCED OPTICS						
TANSCHÉ Coursetype		EC 4						
Course Category		Elective (Discipline Specific)						
Nature of Course		Skill Development						
Category	EC	Year	I	Credits	3	Course Code	23P2PECT4(A)	
		Semester	II					
Instructional Hours per week		Lecture	Tutorial		Practical		Total	
		4	1		---		5	
Marks		CIA		Semester		Total		
		25		75		100		
Pre-requisite(s)		Knowledge of ray properties and wave nature of light						
Objectives of theCourse		1. To know the concepts behind polarization and could pursue research work on application aspects of laser 2. To impart an extensive understanding of fiber and non-linear optics 3. To study the working of different types of LASERS 4. To differentiate first and second harmonic generation 5. Learn the principles of magneto-optic and electro-opticeffects and its applications						
Course Outline		Unit I: Polarization And Double Refraction Classification of polarization – Transverse character of light waves – Polarizer and analyzer – Malu’s law – Production of polarized light – Wire grid polarizer and the polaroid – Polarization by reflection – Polarization by double refraction – Polarization by scattering – The phenomenon of double refraction - Interference of polarized light: Quarter and half wave plates.						
		Unit II: LASERS Basic principles – Spontaneous and stimulated emissions – Components of the laser – Resonator and lasing action – Types of lasers and its applications – Solid state lasers – Ruby laser – gas lasers – He-Ne laser – CO2 laser – HCl laser – Semiconductor laser.						
		Unit III: Fiber Optics Introduction – Total internal reflection – The optical fiber – Glass fibers – The coherent bundle – The numerical aperture – Attenuation in optical fibers – multi-mode fibers – Pulse dispersion in multimode optical fibers – Ray dispersion in multimode step index fibers – Fiber-optic sensor: precision displacement sensor-Precision vibration sensor						
		Unit IV: Non-Linear Optics Basic principles – Harmonic generation – Second harmonic generation – Phase matching – Third harmonic generation – Optical mixing – Parametric generation of light – Self-focusing oflight						

	Unit V: Magneto-Optics And Electro-Optics Magneto-optical effects – Faraday effect – Voigt effect – Cotton-mouton effect – Kerr magneto-optic effect – Electro-optical effects – Kerr electro-optic effect – Pockels electro-optic effect
Extended Professional Component	Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism
Skills acquired from this course	Students will do some experiments in the laboratory related to lasers and also solve the problems in polarisation and fibreoptics.
Justification for nature of course	Aim of the course to provide basic knowledge in all the main fields of Advanced optics, including polarisation, lasers, fibre optics, NLO methods and magneto optics effects.
Text Book(s)	1. B. B. Laud, 2017, Lasers and Non – Linear Optics, 3 rd Edition, New Age International (P) Ltd. 2. Ajoy Ghatak, 2017, Optics, 6 th Edition, McGraw – Hill Education Pvt. Ltd. 3. William T. Silfvast, 1996, Laser Fundamentals Cambridge University Press, New York 4. J. Peatros, Physics of Light and Optics, a good (and free!) electronic book 5. B. Saleh, and M. Teich, Fundamentals of Photonics, Wiley-Interscience,
Reference Book(s)	1. F. S. Jenkins and H. E. White, 1981, Fundamentals of Optics, (4 th Edition), McGraw – Hill International Edition. 2. Dieter Meschede, 2004, Optics, Light and Lasers, Wiley – VCH, Varley GmbH. 3. Lipson, S. G. Lipson and H. Lipson, 2011, Optical Physics, 4 th Edition, Cambridge University Press, New Delhi, 2011. 4. Y. B. Band, Light and Matter, Wiley and Sons (2006) 5. R. Guenther, Modern Optics, Wiley and Sons (1990)
Websites and e- Learning resources	1. https://www.youtube.com/watch?v=WgzynezPiyc 2. https://www.youtube.com/watch?v=ShQWwobpW60 3. https://www.ukessays.com/essays/physics/fiber-optics-and-it-applications.php 4. https://www.youtube.com/watch?v=0kEvr4DKGRI 5. http://optics.byu.edu/textbook.aspx

COURSE OUTCOMES:

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

CLOs	Course Outcomes	K-level
CLO1	Analyze the transverse character of light waves and different polarization phenomenon	K4
CLO2	Able to understand all the fundamental processes involved in laser devices and to apply the design and operation of the devices	K3
CLO3	Demonstrate the basic configuration of a fiber optic – communication system and advantages	K4
CLO4	Discuss the properties of nonlinear interactions of light and matter	K2
CLO5	Interpret the group of experiments which depend for their action on an applied magnetic and electric field	K4

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-pointscale 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	2	1	2	1	3	2	2	2	2
CLO2	3	2	1	1	2	2	3	1	2	3	1
CLO3	3	2	2	1	2	3	3	3	2	3	2
CLO4	3	1	1	1	1	1	3	1	1	2	1
CLO5	3	2	1	1	2	2	3	3	2	3	1

Assessment Scheme
Blueprint for Semester Examination
Learning Outcome Based Education (LOBE) & Assessment Articulation Mapping-K Levels
with Courses Learning Outcomes (CLOs)

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

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	41.66 %
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	41.66 %
K4	-	-	10	10	20	16.67	16.66 %
Total Marks	10	10	50	50	120	100.00	100 %

Title of the Course		SOLID WASTE MANAGEMENT					
TANSCHÉ Course type		EC 4					
Course Category		Elective					
Nature of Course		Skill Development					
Category	EC	Year	I	Credits	3	Course Code	23P2PECT4(B)
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		---		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic knowledge of solid waste and its type					
Objectives of the Course		- To gain basic knowledge in solid waste management procedures. - To gain industry exposure and be equipped to take up a job. - To harness entrepreneurial skills. - To analyze the status of solid waste management in the nearby areas. - To sensitize the importance of healthy practices in waste managements.					
Course Outline		UNIT I: SOLID WASTE MANAGEMENT Introduction - Definition of solid waste - Types – Hazardous Waste: Resource conservation and Renewal act – Hazardous Waste: Municipal Solid waste and non-municipal solid waste.					
		UNIT II: SOLID WASTE CHARACTERISTICS Solid Waste Characteristics: Physical and chemical characteristics - SWM hierarchy - factors affecting SW generation.					
		UNIT III: TOOLS AND EQUIPMENT Tools and equipment - Transportation - Disposal techniques - Composting and land filling technique.					
		UNIT IV: ECONOMIC DEVELOPMENT SWM for economic development and environmental protection Linking SWM and climate change and marine litter.					
		UNIT V: INDUSTRIAL VISIT SWM Industrial visit – data collection and analysis – presentation.					
Extended Professional Component		Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism.					

Skills acquired from this course	Stu This course renders the employability and entrepreneurial skills in the field of solid waste management.
Justification for nature of course	Solid waste management is an extremely indispensable criterion to preserve the ecological sustainability of the nature.
Text Book(s)	1. Handbook of Solid Waste Management /Second Edition, George Tchobanoglous, McGraw Hill (2002). 2. Prospects and Perspectives of Solid Waste Management, Prof. B B Hosetti, New Age International (P) Ltd (2006). 3. Solid and Hazardous Waste Management, Second Edition, M.N Rao, PSB / snoitacilbuP SBBooks (2020). 4. Integrated Solid Waste Management Engineering Principles and Management, Tchobanoglous, McGraw Hill (2014). 5. Solid Waste Management (SWM), Vasudevan Rajaram, PHI learning private limited (2016).
Reference Book(s)	1. Municipal Solid Waste Management, Christian Ludwig, Samuel Stucki, Stefanie Hellweg, Springer Berlin Heisenberg, 2012 2. Solid Waste Management Bhide A. D Indian National Scientific Documentation Centre, New Delhi Edition 1983 ASIN: B0018MZ0C2 3. Solid Waste Techobanoglous George; Kreith, Frank McGraw Hill Publication, New Delhi 2002, ISBN 9780071356237 4. Environmental Studies Manjunath D. L. Pearson Education Publication, New Delhi, 2006 ISBN-I3: 978-8131709122 5. Solid Waste Management Sasikumar K. PHI learning, New Delhi, 2009 ISBN 8120338693
Websites and e-Learning resources	1. https://www.meripustak.com/Integrated-Solid-Waste-Management-Engineering-Principles-And-Management-Issues-125648 2. https://testbook.com/learn/environmental-engineering-solid-waste-management/ 3. https://www.meripustak.com&gclid=Cj0KCQjwuKXBhCRARIsAgM0iVpismAJN93CHA1sX6NuNeOKLXfQJ_jxHCOVH3QXjJiACq30KofoaAmFsEALw_wcB 4. https://images.app.goo.gl/tYiW2gUPfS2cxdD28 5. https://amzn.eu/d/5VUSTDI

COURSE OUTCOMES:

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

CLOs	Course Outcomes	K- level
CLO1	Gained knowledge in solid waste management	K1
CLO2	Equipped to take up related job by gaining industry exposure	K5
CLO3	Develop entrepreneurial skills	K3
CLO4	Will be able to analyze and manage the status of the solid wastes in the nearby areas	K4
CLO5	Adequately sensitized in managing solid wastes in and around his/her locality	K5
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;		

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	3	3	1	1	2	2
CLO2	3	2	3	3	3	3	3	3	3	3	3
CLO3	3	2	2	2	2	3	3	3	2	2	2
CLO4	3	2	3	3	2	3	3	3	3	2	2
CLO5	3	3	3	3	3	3	3	3	3	3	3

Assessment Scheme
Blueprint for Semester Examination
Learning Outcome Based Education (LOBE) & Assessment
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Un its	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 K1	2	K1 & K1	1	K1	2 (K1&K1)	1 (K1)
2	CLO 2	Up to K5	2	K1 & K2	1	K3	2 (K4&K4)	1 (K5)
3	CLO 3	Up to K3	2	K1 & K1	1	K2	2 (K3&K3)	1 (K3)
4	CLO 4	Up to K4	2	K1 & K1	1	K2	2 (K3&K3)	1 (K4)
5	CLO 5	Up to K5	2	K1 & K2	1	K3	2 (K5&K5)	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
K1	2	4	10	-	16	13.33
K2	2	4	10	10	26	21.67
K3	4	2	10	20	36	30.00
K4	2	-	20	20	42	35.00
Total Marks	10	10	50	50	120	100.00

Title of the Course		Basic Environmental Physics					
TANSCHE Course type		NME					
Course Category							
Nature of Course		Skill development					
Category	CC	Year	I	Credits	2	Course Code	23P2PSEN1
		Semester	II				
Instructional Hours per week	Lecture		Tutorial		Practical		Total
	2						2
Marks	CIA			Semester		Total	
	25			75		100	
Pre-requisite(s)							
Objectives of the Course		• To provide a basis for understanding the impact of human on the environment. • To understand the essentials for environmental stewardship • To understand the application of the principles of Physics to environmental process and problems.					
Course Outline		Unit I: Enviromental Science and technology Environmental Physics - Light as an electromagnetic radiation - Matter and cycles of matter- Endogenic and Exogenic cycles - Carbon cycle-Nitrogen cycle - Oxygen cycle - Human Impact and pollution - Pollution of various spheres of the environment - Technology: The problem it poses and the solution it offers.					
		Unit II: Essentials of Environmental Physics Structure of the atmosphere- Major gases – Important trace gases – Principle layers – Exosphere – Thermosphere – Mesosphere – Stratosphere – Troposphere – Applications: Water vapour and global climate change – Composition of air – Greenhouse effect					
		Unit III : Mode of Energy Transfers Energy transfers – Conduction – Convection - Radiation – Evaporation – Conservation of mass and energy – Stability of the atmosphere – stable atmosphere – inversions - the Neutral atmosphere – Unstable atmosphere - conditional instability.					
		Unit IV : Environmental Pollution and degradation Elementary fluid dynamics – Equations of fluid dynamics – Compressive vs incompressible flow – Forms of pollution –Sources and causes –Effects – Environment – Greenhouse gases and global warming- Pollution control – Air and water quality standards					

	Unit V: Environmental Changes and remote sensing Energy Sources – Petroleum – Coal – Natural gas –Renewable Sources of energy – Solar energy – Energy from the Sun – Industrial uses –Environmental Effects.
Extended Professional Component	Identify the causes of pollution and methods of pollution control.
Skills acquired from this course	Understands the problems and the solution of technology to environment .
Justification for nature of course	It renders the knowledge about environmental changes and degradation due to various pollutions and methods of pollution control.
Text Book(s)	1. Basic Environmental Physics , Pankaraja Eingham and Tanweer Ahmad Wani, Pragati Prakashan Educational Publishers, 2011 Edition.
Reference Book(s)	1. Basics of Environmental Science – Allaby, Michael, 2 nd edition 2000, New York Routledge. 2. Comprehensive Environmental studies, Krishna Gopal Bhattacharya, Arunima Sarma, Alpha Science International Ltd. 2015, Oxford, England.
Websites and e- Learning resources	1. https://soilcrop.tamu.edu/program/environmental-physics/ 2. https://www.conserve-energy-future.com/causes-and-effects-of-environmental-degradation.php 3. https://education.nationalgeographic.org/resource/greenhouse-effect/

COURSE OUTCOMES:

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

CLOs	Course Outcomes	K-level
CLO1	Acquire knowledge about the different cycles of matter	K2
CLO2	Understand the various layers of atmosphere	K2
CLO3	Study the methods of energy transfer to maintain atmosphere stability	K2
CLO4	Understand the Greenhouse gases and global warming.	K2
CLO5	Comprehend the Energy Sources and the environmental effects.	K2
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;		

MAPPING WITH PROGRAMME OUTCOMES:

Mapping of Course Outcomes (**CLO**) against Programme Outcomes (**PO**) in the 3-pointscale 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	2	2	3	3			3	2
CLO2	3	3	1	3	2	3	3			3	2
CLO3	3	2	1	2	2	3	3			3	2
CLO4	3	2	1	2	2	3	3			3	2
CLO5	3	3	2	3	2	3	3			3	2

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

Distribution of Section-wise Marks with K Levels

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	15	--	24	20.00	95.83%
K2	5	6	30	50	91	75.83	
K3	-	-	5	-	5	04.17	4.17%
K4	-	-		-	-	-	-
Total Marks	10	10	50	50	120	100.00	100%



DEPARTMENT OF CHEMISTRY

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 semesters (B.Sc. Chemistry)

Allied Courses

I and II semesters (M.Sc. Chemistry)

DEPARTMENT OF CHEMISTRY

Vision & Mission of the Department

Vision

- To produce disciplined and committed students through effective teaching-learning for the professional growth and research aimed at a greener environment and healthier living of humankind.

Mission

- To ensure the quality and knowledgeable chemistry graduates capable of creating new developments for the society and applicable in daily life to become entrepreneurs.
- Inspiring students to fulfil the expectations of local, national and global needs
- Motivate the students to pursue higher studies and research to cater the need of industries

INTRODUCTION

B.Sc. Chemistry: Programme Outcome, Programme Specific Outcome and Course Outcome

Chemistry is the study of composition and transformation of matter. A science that is central to energy production, health care, new material development for electronics and other applied fields and environmental protection. Bachelor's degree in chemistry is the culmination of in-depth knowledge of Inorganic, Organic and Physical chemistry, and specialized courses such as Pharmaceutical Chemistry, spectroscopy, Nanoscience, Forensic Science, Cosmetics & Personal Grooming, Food chemistry, Dairy Chemistry and so on. Thus, this programme helps learners in building a solid foundation for higher studies in Chemistry. The hands-on experience the students gain in Practicals enables them to apply theory to solve problems in everyday life, think critically and innovatively. An aptitude for research is instilled through project work and industrial internship. Students completing this programme will be able to present the concepts of Chemistry clearly and precisely. They can find solutions to pressing problems that mankind is facing today. They can interpret data and present their findings to both scientific community and laymen and have ability to work as a team and evolve to become an entrepreneur Completion of this programme will also enable the learners to join teaching profession, conducting research in Industry and Government run research labs. A B.Sc chemistry student has the option to diversify to other branches such as Biochemistry, Biotechnology, Forensic Science etc...They have employability opportunities in public and private sector jobs in energy, pharmaceutical, Food, cosmetic industries etc...

PROGRAMME OUTCOMES (PO)

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 based on 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 analyze, 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

- PSO1:** Students acquire in-depth knowledge of the fundamental concepts in all disciplines of chemistry.
- PSO2:** Students can disseminate the basics of chemistry and advanced topics and analytical skills in organic, inorganic, and physical chemistry.
- PSO3:** Students will be able develop creativity in academics and research.
- PSO4:** Students will be able apply digital tools to collect, analyze and interpret data and present scientific findings and apply the concepts of chemistry to solve problems in community, entrepreneurial and research pursuits.
- PSO5:** Gain competence to pursue higher education and career opportunities in chemistry and allied fields.
- PSO6:** Exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities and exhibit competence in educational, industrial and research pursuits.

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	- Choose - Define - Find - How - Label - List - Match - Name - Omit - Recall - Relate - Select - Show - Spell - Tell - What - When - Where - Which - Who - Why	- Classify - Compare - Contrast - Demonstrate - Explain - Extend - Illustrate - Infer - Interpret - Outline - Relate - Rephrase - Show - Summarize - Translate	- Apply - Build - Choose - Construct - Develop - Experiment with - Identify - Interview - Make use of - Model - Organize - Plan - Select - Solve - Utilize	- Analyze - Assume - Categorize - Classify - Compare - Conclusion - Contrast - Discover - Dissect - Distinguish - Divide - Examine - Function - Inference - Inspect - List - Motive - Relationships - Simplify - Survey - Take part in - Test for - Theme	- Agree - Appraise - Assess - Award - Choose - Compare - Conclude - Criteria - Criticize - Decide - Deduct - Defend - Determine - Disprove - Estimate - Evaluate - Explain - Importance - Influence - Interpret - Judge - Justify - Mark - Measure - Opinion - Perceive - Prioritize - Prove - Rate - Recommend - Rule on - Select - Support - Value	- Adapt - Build - Change - Choose - Combine - Compile - Compose - Construct - Create - Delete - Design - Develop - Discuss - Elaborate - Estimate - Formulate - Happen - Imagine - Improve - Invent - Make up - Maximize - Minimize - Modify - Original - Originate - Plan - Predict - Propose - Solution - Solve - Suppose - Test - Theory

Anderson, L. W., & Krathwohl, D. R. (2001). A taxonomy for learning, teaching, and assessing, Abridged Edition. Boston, MA: Allyn and Bacon.

EVALUATION PATTERN (THEORY PAPERS)

Internal Assessment	:	25 Marks
External Assessment	:	75 Marks
Total	:	100 Marks

Continuous Internal Assessment : 25 Marks

Components	Marks
Test (Average of two tests) Conducted for 25 marks and converted into 10 marks)	10
Assignment (2/3)	5
Quiz/ Documentation/ Case study / ICT based Assignment/ Mini Projects	5
Attendance	5
Total	25

Blueprint for Test component of CIA

CIA	CLOs	K-Level	Section A (Short Answer)	Section B (Either/or)	Section C (Open choice)
	CLO x	K2/ K3/ K4	1 (K1 / K2)	(K2 & K2) or (K3 & K3) or (K3 & K3) or	1 (K2) or 1 (K3) or 1 (K4) or
	CLO y	K2/ K3/ K4	1 (K1/ K2)	(K2 & K2) or (K3 & K3) or (K3 & K3) or	1 (K2) or 1 (K3) or 1 (K4) or
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

Question Paper Pattern for External Examination: 75 Marks

Section	Marks
A- Multiple Choice Questions (10 X 1 mark)	10
B- Short answer type (5 X 2 mark)	10
C- Either/Or type (5 X 5 marks)	25
D- Open Choice type (3out of 5 X 10 marks)	30
Total	75

**EVALUATION
(PRACTICAL)**

Continuous Internal Assessment	: 25 Marks
External Assessment	: 75 Marks
Total	: 100 Marks

Blueprint for Test component of CIA

Component	Mark
Internal test	10
Observation /Record	5
Continuous class assessment	5
Short Procedure	5
Total	25

Blueprint for Semester Examination

Components	Marks
Test	30
Observation/Record	10
Procedure	10
Continuous class assessment	20
Short procedure	05
Total	75

UG Programme in Chemistry
Credit Distribution for UG Programme in Chemistry
B.Sc Chemistry

B.Sc., FIRST YEAR – SEMESTER I

Part	List of Courses	Course Code	Credits	Hours
Part – I	Language (Tamil Ilakkiya varalaru-I/ Hindi-I/ Sanskrit-I)	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	3	6
Part – II	General English - I	23U1NENG1	3	6
Part – III	Core (T1) : General Chemistry – I	23U1CCCT1	5	5
	Core (P1) : Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations	23U1CCCP1	3	3
	Allied Physics - I	23U1PGET1(C)	4	4
	Allied Practical -I	23U1PGEP1	1	2
Part – IV	Foundation Course (T)	23U1CFCT1	2	2
	Skill Enhancement Course (SEC - I) Food Chemistry	23U1CSED1	2	2
			23	30

B.Sc., FIRST YEAR – SEMESTER II

Part	List of Courses	Course Code	Credits	Hours
Part - I	Language (Tamil Ilakkiya varalaru-II/ Hindi-II/ Sanskrit-II)	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	3	6
Part – II	General English- II	23U2NENG2	3	6
Part – III	Core (T2) : General Chemistry – II	23U2CCCT2	5	5
	Core (P2): Qualitative Organic Analysis And Preparation Of Organic Compounds	23U2CCCP2	3	3
	Allied Physics - II	23U2PGET2(C)	4	4
	Allied Practical - II	23U2PGEP2	1	2
Part – IV	Skill Enhancement Course (SEC – 2) Dairy Chemistry	23U2CSED2	2	2
	Skill Enhancement Course (SEC - 3) Cosmetics and Personal Grooming	23U2CSED3	2	2
			23	30

Ancillary syllabus for Mathematics / Zoology / Biotechnology
Semester- I

Part	List of Courses	Course Code	Credits	Hours
Part - III	Ancillary (T1) : Chemistry for Physical Sciences - I (for Mathematics)	23U1CGET1 (M)	4	4
	Ancillary (T2) : Chemistry for biological : sciences - I (for Zoology)	23U1CGET1 (Z)		
	Ancillary (T3) : Biological chemistry (for Biotechnology)	23U1CGET1 (L)		
	Ancillary (P1) : Chemistry Practical for Physical and Biological sciences - I (for Mathematics / Zoology)	23U1CGEP1	1	2
	Ancillary (P2) : Chemistry practical for Biotechnology – Biological Chemistry - I (for Biotechnology)	23U1CGEP1		
			05	06

Ancillary syllabus for Mathematics / Zoology / Biotechnology
Semester- II

Part	List of Courses	Course Code	Credits	Hours
	Ancillary (T4) : Chemistry for Physical Sciences - II (for Mathematics)	23U2CGET2 (M)	4	4
	Ancillary (T5) : Chemistry for biological sciences - II (for Zoology)	23U2CGET2 (Z)		
	Ancillary (T6) : Bioinstrumentation (for Biotechnology)	23U2CGET2 (L)		
	Ancillary (P3) : Chemistry Practical for Physical and Biological sciences - II (for Mathematics / Zoology)	23U2CGEP2	1	2
	Ancillary (P4) : Chemistry Practical for Biotechnology – Bioinstrumentation – II (for Biotechnology)	23U2CGEP2		
			05	06

Semester wise mapping of courses with Programme outcomes (POs)

Semester-I

	Programme outcomes	General chemistry I	Basic Concepts of Volumetric Analysis	Quantitative Inorganic Estimation (Titrimetric) and Inorganic Preparations	Chemistry for biological : sciences - II	Chemistry for Physical: sciences - II	Chemistry Practical for Physical and Biological sciences - II	Foundation Course	SEC – 1
GRADUATE ATTRIBUTES	PO–1 Disciplinary Knowledge	3	3	3	3	3	3	3	3
	PO–2 Critical Thinking	2	2	2	2	2	2	2	2
	PO–3 Problem Solving	2	2	2	2	3	2	2	2
	PO–4 Analytical Reasoning	2	3	2	2	3	2	2	2
	PO–5 Scientific Reasoning	2	3	2	2	3	2	2	2
	PO–6 Self-directed & Lifelong Learning	2	2	2	2	2	2	2	2

Semester wise mapping of courses with Programme outcomes (POs)

Semester-II

	Programme outcomes	General chemistry II	Qualitative Organic Analysis And Preparation Of Organic Compounds	Chemistry for biological sciences - II	Chemistry for Physical: sciences - II	Chemistry Practical for Physical and Biological sciences - II	SEC – 2	SEC-3
GRADUATE ATTRIBUTES	PO–1 Disciplinary Knowledge	3	3	3	3	3	3	3
	PO–2 Critical Thinking	2	2	2	2	2	2	2
	PO–3 Problem Solving	2	2	2	2	3	2	2
	PO–4 Analytical Reasoning	2	3	2	2	3	2	2
	PO–5 Scientific Reasoning	2	3	2	2	3	2	2
	PO–6 Self-directed & Lifelong Learning	2	2	2	2	2	2	2

Title of the Course		GENERAL CHEMISTRY-I					
TANSICHE Course type		CC1					
Course Category		Core (T1)					
Nature of Course		Skill Development					
Category	Core	Year	1	Credits	5	Course Code	23U1CCCT1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester			Total
		25		75			100
Pre-requisite(s)		Higher secondary chemistry					
Objectives of the Course		The course aims at giving an overall view of the • various atomic models and atomic structure • wave particle duality of matter • periodic table, periodicity in properties and its application in explaining the chemical behaviour • nature of chemical bonding, and • fundamental concepts of organic chemistry					
Course Outline		UNIT I Atomic structure and Periodic trends History of atom (J.J. Thomson, Rutherford); Moseley’s Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck’s quantum theory - Bohr’s model of atom; The Franck-Hertz Experiment; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength- Davisson and Germer experiment Heisenberg’s Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund’s rule, Pauli’s exclusion principle and Aufbau principle; Numerical problems involving the core concepts.					
		Unit II Introduction to Quantum mechanics Classical mechanics, Wave mechanical model of atom, Postulates of quantum mechanics; probability interpretation of wavefunctions, Formulation of Schrodinger wave equation - Probability density and significance of Ψ and Ψ^2 .					
		Modern Periodic Table Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity. Problems involving the core concepts.					

	UNIT-III: Structure and bonding - I Ionic bond Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarisation– polarising power and polarizability; Fajans’ rules - effects of polarisation on properties of compounds; problems involving the core concepts. Covalent bond Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency -hybridization; VSEPR theory - shapes of molecules of the type AB₂, AB₃, AB₄, AB₅, AB₆ and AB₇ Partial ionic character of covalent bond-dipole moment, application to molecules of the type A₂, AB, AB₂, AB₃, AB₄; percentage ionic character-numerical problems based on calculation of percentage ionic character. UNIT-IV: Structure and bonding - II VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO₂, NO₂, CO₃²⁻, NO₃⁻ ; limitations of VBT; MO theory - bonding, anti-bonding and nonbonding orbitals, bond order; MO diagrams of H₂, C₂, O₂, O₂⁺, O₂⁻, O₂²⁻, N₂, CO; magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of NH₄⁺, BF₄⁻, H₃O⁺ properties Metallic bond-electron sea model, VB model; Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boilingpoints.

	UNIT-V: Basic concepts in Organic Chemistry and Electronic effects Types of bond cleavage – heterolytic and homolytic; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes and nitrenes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects. Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and freeradicals, reactivity of vinyl chloride, bond lengths; steric inhibition to resonance. Hyperconjugation - stability of alkenes, bond length, orienting effect of methylgroup, Types of organic reactions-addition, substitution, elimination and rearrangements.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course enhances the better understanding of atomic models, electronic configuration, periodic properties; enable to explore structure and bonding in ionic as well as covalent bonding, VB & MO theory; bring out the reaction mechanism from various reaction intermediates.
Text Book(s)	1. Madan, R. D. and Sathya Prakash, <i>Modern Inorganic Chemistry</i>, 2nded.; S.Chand and Company: New Delhi, 2003. 2. Rao, C.N. R. <i>University General Chemistry</i>, Macmillan Publication: NewDelhi, 2000. 3. M.K. Jain and S. C. Sharma, <i>Modern Organic Chemistry</i>, Visal Publishing Co, 2015.
Reference Book(s)	1. Puri, B. R. and Sharma, L. R. <i>Principles of Physical Chemistry</i>, 38thed.; Vishal Publishing Company: Jalandhar, 2002. 2. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4th ed.; ELBS WilliamHeinemann: London,1991. 3. R. T. Morrison, R. N. Boyd and S.K. Bhattacharjee, <i>Organic chemistry</i>, 7thedn, Pearson Education Asia,2010

Websites and e-Learning resources	1. https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding 2. https://www.khanacademy.org/science/chemistry/chemical-bonds/types-chemical-bonds/v/ionic-bonds-and-coulombs-law?modal=1 3. https://nptel.ac.in/courses/104106119/

COURSE OUTCOMES:

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

CO1	Explain atomic models and use rules for writing electronic configuration	K2
CO2	Organize basic concepts of quantum mechanics and to develop concept of trends in periodic properties	K3
CO3	Apply knowledge about the common themes running through ionic and covalent bonding	K3
CO4	Develop the structure and types of bond in inorganic molecules using VB and MO theories.	K4
CO5	Bring out the reaction mechanism using various reaction intermediates	K3

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	1	3	2	1	2	1	3	3	1	2	3	2
CO2	1	2	1	1	2	1	3	2	1	2	3	3
CO3	1	2	3	1	2	1	3	3	2	2	3	2
CO4	1	2	3	1	2	1	3	3	2	3	3	2
CO5	1	3	3	1	2	1	3	3	2	3	3	2

Blueprint for Semester Examination

S. No.	COs	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	CO 1	Up to K 2	2	K1 &K2	1	K1	2 (K1&K1)	1(K2)
2	CO 2	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
3	CO 3	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
4	CO 4	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
5	CO 5	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

Distribution of Section-wise Marks with K Levels

K Levels	Section A& B (No Choice)	Section C (Either / or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	9	10	--	19	15.83	42%
K2	11	10	10	31	25.83	
K3	-	20	30	50	41.67	42%
K4	-	10	10	20	16.67	16%
Total marks	20	50	50	120	100.00	100%

Name of the Course Designer

Dr. M. Hasmath Farzana		Title of the Course Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations					
TANSICHE Course type		CC2					
Course Category		Core (P1)					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	3	Course Code	23U1CCCP1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		-	-	3		3	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher secondary chemistry					
Objectives of the Course		• This course aims • To know the laboratory safety and handling glasswares • To prepare the solutions based on their concentrations • To understand the basic principle of volumetric analysis • To demonstrate the different volumetric estimation like permanganometry, dichrometry, iodometry, argentimetry and complexometry • To explain the preparation of inorganic compounds					
Course Outline		Unit I Chemical Laboratory Safety in Academic Institutions Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal. Common Apparatus Used in Quantitative Estimation (Volumetric) Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand. Principle of quantitative estimation(Volumetric) Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality, preparation of standard solutions. Theories of acid-base, redox, complexometric, iodometric and argentometric titrations. Indicators-Types, Theory of acid-base, redox, Metal ion & adsorption indicators, Choice of indicators.					

	Unit II Quantitative Estimation (Volumetric) Preparation of standard solution, dilution from stock solution Permanganometry Estimation of sodium oxalate using standard ferrous ammonium sulphate Dichrometry Estimation of ferric alum using standard dichromate (external indicator) Estimation of ferric alum using standard dichromate (internal indicator) Iodometry Estimation of copper in copper sulphate using standard dichromate Argentimetry Estimation of chloride in barium chloride using standard sodium chloride/ Estimation of chloride in sodium chloride (Volhard's method) Complexometry Estimation of hardness of water using EDTA Estimations Estimation of iron in iron tablets Estimation of ascorbic acid. Preparation of Inorganic compounds- Potash alum Tetraammine copper (II) sulphate Hexamminecobalt (III) chloride Mohr's Salt
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on volumetric analysis and develops the students approach towards accurate measurement of concentration, molecular mass and stoichiometry of a chemical equation which involves titration techniques and they know how to calculate the yield of different inorganic preparations and thus it brings employability.
Text Book(s)	1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand & Sons: New Delhi, 1997. 2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; An advanced course in Practical Chemistry, 3rd ed.; New Central Book Agency: Kolkata, 2007.

Reference Book(s)	1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; Vogel's Textbook of Quantitative Chemical Analysis, 6th ed.; Pearson Education Ltd: New Delhi, 2000.
Websites and e-Learning resources	1. http://www.federica.unina.it/agraria/analytical-chemistry/volumetricanalysis 2. https://chemdictionary.org/titration-indicator/ 3. https://unacademy.com/content/jee/study-material/chemistry/inorganic-compounds-mohrs-salt-potash-alum/ 4. https://byjus.com/chemistry/preparation-of-potash-alum/ 5. https://www.creative-chemistry.org.uk/documents/N-ch5-08.pdf

COURSE OUTCOMES:

On successful completion of the course the students should be able to:

	CO Statement	K-level
CO1	Explain the basic principles involved in titrimetric analysis	K2
CO2	Illustrate the different volumetric estimation like permanganometry, dichrometry, iodometry, argentimetry and complexometry	K4
CO3	Calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.	K3
CO4	Identify the end point of various titrations.	K3
CO5	Examine the yield of different inorganic preparations	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	2	2	2	3	2	3	2	2	3	2	2
CO2	3	2	2	2	3	2	3	2	2	3	2	2
CO3	3	2	2	2	3	2	3	2	2	3	2	2
CO4	3	2	2	2	3	2	3	2	2	3	2	2
CO5	2	2	2	2	2	2	3	2	2	3	2	2

Assessment Schema

Evaluation

Continuous Internal Assessment : 25 Marks

External Assessment : 75 Marks

Total : 100 Marks

Components of CIA

Component	Weight / Mark
Internal Test	10
Observation/Record	7.5
Continuous Class Assessment	7.5
Total	25

	CO Statement	K-level	Marks
CO1	Explain the basic principles involved in titrimetric analysis	K2	10
CO2	Illustrate the different volumetric estimation like permanganometry, dichrometry, iodometry, argentimetry and complexometry	K4	20
CO3	Calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.	K3	20
CO4	Identify the end point of various titrations.	K3	10
CO5	Examine the yield of different inorganic preparations	K4	15
	Total Marks		75

Summative Assessment:

Name of the course Designer

Dr. P. Prasanna

Title of the Course		Foundation Course FC					
TANSICHE Course type		FC					
Course Category		Core (T)					
Nature of Course		Skill Development					
Category	Core	Year	1	Credits	2	Course Code	23U1CFCT1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		2	-	-		2	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher secondary chemistry					
Objectives of the Course		The course aims at giving an overall view of the - historical development of atomic models - physical properties of compounds - Importance and purification of organic compounds - importance of analytical chemistry - Impact of pollution over the environment					
Course Outline		Unit I: Structure atom : Classical method History of atom- detection of electron -discharge tube experiments – essential constituent of atoms - determination of charge and mass of electron – Millikan’s oil drop experiment - positive rays and the proton - discovery of neutron					
		Unit III: Fundamental of chemistry Definition of organic chemistry - comparison of organic and inorganic compounds- importance of organic chemistry - source of organic compounds - Detection of elements carbon & nitrogen - estimation of elements carbon & nitrogen.					
		Unit II: Properties of compounds Definition of melting and boiling points - Determination of melting point and boiling points – calculation of empirical formula of compounds - calculation of molecular formula of compounds – physical methods of determination of molecular weight- Victor Mayer method- cryoscopic methods					
		Unit IV: Analytical Chemistry Role and importance of analytical chemistry – types of analytical methods - Principle of gravimetric analysis-condition for precipitation- specific and selective precipitant. use of sequestering agents					

	Unit V: Fundamentals of Biochemistry Definition - branch of biochemistry - historical resume - biochemistry living organisms - characteristics of the living matter - axioms of living matter - major compounds of living beings – biochemical Techniques - observations on tissues –Perfusion - Tissues slices - Homogenization
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course enhance the better understanding of basic of fundamental chemistry and help the understanding concept of chemistry thus it involved in imparting skill development
Text Book(s)	1. P.L.Soni, Mohan Katyal, Text Book Of Inorganic Chemistry 20th revised edition ; S.Chand and Company: New Delhi, 2010. 2. B S Bahl, Arun Bahl, A Textbook of Organic Chemistry, 20th revised edition ; S.Chand and Company: New Delhi, 2011 3. J.I. Jain, S.J .Jain, & N Jain, Fundamentals of Biochemistry 6th revised edition ; S.Chand and Company: New Delhi, 2005.
Reference Book(s)	1. Madan, R. D. and Sathya Prakash, Modern Inorganic Chemistry, 2nd ed.; S. Chand and Company: New Delhi, 2003. 2. Rao, C.N. R. University General Chemistry, Macmillan Publication: New Delhi, 2000. 3. Puri, B. R. and Sharma, L. R. Principles of Physical Chemistry, 38th ed.; Vishal Publishing Company: Jalandhar, 2002.
Websites and e-Learning resources	1. https://ncert.nic.in/textbook/pdf/kech102.pdf 2. https://study.com/academy/lesson/physical-chemical-properties-of-compounds-types-examples.html 3. https://byjus.com/chemistry/organic-chemistry-class-11/

COURSE OUTCOMES:

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

CO	CO Statement	K-level
CO1	Describe the classical methods for deriving structure of atom	K2
CO2	Identify methods for determining physical properties of compounds	K3
CO3	Analyse the samples using various analytical methods	K4
CO4	Inspect the type of purifications of compounds and detection of elements in a compound	K3
CO5	Infer the history and biochemical techniques of biochemistry	K3

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	2	1	1	1	3	3	2	2	2	1
CO2	3	3	2	1	1	1	3	3	2	2	2	1
CO3	3	3	2	1	1	1	3	3	2	2	2	1
CO4	3	3	2	1	1	1	3	3	2	2	2	1
CO5	3	3	2	1	1	1	3	3	2	2	2	1

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5
Total	25

Blueprint for Semester Examination
Articulation Mapping-K Levels with Courses Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K3	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K3	2	K3 & K3	1	K2	2 (K3 & K3)	1(K3)
5	CO 5	Up to K3	2	K2 & K3	1	K3	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, analysing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A& B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	8	20	30	36	30	30
K4		10	10	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

Dr. M. Boominathan

Title of the Course		General Chemistry-II					
TANSCHE Course type		CC III					
Course Category		Core (T2)					
Nature of Course		Employability					
Category	Core	Year	I	Credits	5	Course Code	23U2CCCT2
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester			Total
		25		75			100
Pre-requisite(s)		General Chemistry I					
Objectives of the Course		This course aims at providing an overall view of the • chemistry of acids, bases and ionic equilibrium • properties of s and p-block elements • chemistry of hydrocarbons • applications of acids and bases • compounds of main block elements and hydrocarbons					
Course Outline		Unit I: Acids, bases and Ionic equilibria Concepts of Acids and Bases - Arrhenius concept, Bronsted- Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators –action of phenolphthalein and methyl orange, - use of acid base indicators; Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation; Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product - determination and applications; numerical problems involving the core concepts.					

	Unit II: Chemistry of s - Block Elements Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, and Na₂CO₃. Anomalous behaviour of Be. Chemistry of p- Block Elements (Group 13 & 14) preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates. Unit III: Chemistry of p- Block Elements (Group 15-18) General characteristics of elements of Group 15; chemistry of H₂N-NH₂, NH₂OH, HN₃ and HNO₃. Chemistry of PH₃, PCl₃, PCl₅, POCl₃, P₂O₅ and oxy acids of phosphorous (H₃PO₃ and H₃PO₄). General properties of elements of group 16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides – oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids (HClO₄). Inter-halogen compounds (ICl, ClF₃, BrF₅ and IF₇), pseudo halogens [(CN)₂ and (SCN)₂] and basic nature of Iodine. Noble gases: Position in the periodic table. Preparation, properties and structure of XeF₂, XeF₄, XeF₆ and XeOF₄; uses of noble gases – clathrate compounds. Unit IV: Hydrocarbon Chemistry-I Alkenes-Nomenclature, general methods of preparation – Mechanism of β-elimination reactions – E1 and E2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions mechanisms – Markownikoff's rule, Kharascheffect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization. Alkadienes Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation. Cycloalkanes: Nomenclature, Preparation-Dieckmann-Wurtz reactions Relative stability of cycloalkanes, Bayer's strain theory and its limitations.

	Unit V: Hydrocarbon Chemistry – II Benzene: Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity. Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at < - position – reduction, oxidation – uses. Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will empower the students to grasp the basic concepts of acids and bases: to understand the periodic properties of s and p block elements and idea of organic chemistry, the preparation and properties of aliphatic as well as alicyclic compounds.
Text Book(s)	1. Madan R D, Sathya Prakash, (2019), Modern Inorganic Chemistry, Revised, S.Chand and Company, New Delhi. ISBN: 9789352837298, 9789352837298 2. Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2022), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi. ISBN: 9789355012753, 9789355012753 3. Bahl B S, Arul Bhal, (2019), Advanced Organic Chemistry, 22ed., S.Chand and Company, New Delhi. ISBN: 978-9352837304. 4. Tewari K S, Mehrotra S N and Vishnoi N K, (2017), Text book of Organic Chemistry, 4/e., Vikas Publishing House, New Delhi. 5. Puri B R, Sharma L R, (2012), Principles of Physical Chemistry, 46th ed., Vishal Publishing Company, Jalandhar.

Reference Book(s)	1. Maron S H and Prutton C P, (2018), Principles of Physical Chemistry, 4th ed., The Macmillan Company, Newyork. 2. Barrow G M, Physical Chemistry, 6th ed., Tata McGraw Hill, NewDelhi. 3. Lee J D, (1999), Concise Inorganic Chemistry, 5thed., ELBS William Heinemann, London. 4. Huheey J E, (1999), Inorganic Chemistry: Principles of Structure and Reactivity, 5th ed., Addison Wesley Publishing Company, India. 5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed.,Goel Publishing House, Meerut. ISBN: 9788182836679, 8182836670 6. Agarwal O P, (2019), Reactions and Reagents in Organic Chemistry,10thed., Goel Publishing House,Meerut.
Websites and e-Learning resources	1. https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/smbblack/chem1010/lecture_notes/4B.html 2. http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding 3. MOOC components http://nptel.ac.in/courses/104101090/ Lecture 1: Classification of elements and periodic properties http://nptel.ac.in/courses/104101090/

COURSE OUTCOMES:

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

No	Cos	K-level
CO1	Explain theories of acids, bases and assess the application of hard, soft acids indicators & buffer action	K3
CO2	Examine the properties s and p-block elements(Group 13 and 14)	K2
CO3	Illustrate the properties of p-block elements (Group 15-18)	K3
CO4	Describe the classification of hydrocarbons, types of reactions and discuss the preparation, reaction mechanism of alkanes, alkenes, alkadienes, alkynes and cycloalkanes	K3
CO5	Interpret preparation, properties and reaction mechanism of aromatic hydrocarbons	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	3	2	2	2	3	3	3	2	2	2
CO2	3	3	3	2	2	2	3	3	2	3	2	2
CO3	3	3	3	2	2	2	3	3	2	3	2	2
CO4	3	3	3	2	2	2	3	3	2	3	2	2
CO5	3	3	3	2	2	2	3	3	3	3	2	2

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Poster presentation	5
Quizzes/Objective tests	5

Blueprint for Semester Examination**Articulation Mapping-K Levels with Courses Learning Outcomes (COs)**

S. No.	COs	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	CO 1	Up to K3	2	K1 & K2	1	K2	2 (K2 & K2)	1(K3)
2	CO 2	Up to K2	2	K1 & K2	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K3	2	K1 & K2	1	K2	2 (K2 & K2)	1(K3)
4	CO 4	Up to K3	2	K1 & K2	1	K2	2 (K2 & K2)	1(K3)
5	CO 5	Up to K4	2	K1 & K2	1	K2	2 (K3 & K3)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

Distribution of Section-wise Marks with K Levels

K Levels	Section A & B (No Choice)	Section C (Either / or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	7	-	--	7	5.83	50%
K2	13	40	--	53	44.16	
K3	-	10	40	50	41.67	42%
K4	-	-	10	10	8.33	8%
Total marks	20	50	50	120	100.00	100%

Name of the course Designer

Dr.J.Shanmugapriya

Title of the Course		Qualitative Organic Analysis And Preparation Of Organic Compounds					
TANSCHÉ Course type		CC4A					
Course Category		Core (P2)					
Nature of Course		Employability & Skill Development					
Category	Core	Year	I	Credits	3	Course Code	23U2CCCP2
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		-	-	3		3	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		General Chemistry II					
Objectives of the Course		This course aims at providing knowledge on • Basic knowledge on safety measurements • Analysis of organic compounds • Preparation of organic compounds • Separation and purification of organic compounds					
Course Outline		Unit I Safety rules, symbols and first-aid in chemistry laboratory Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware –basis information and uses. Unit II Qualitative Organic Analysis Preliminary examination, detection of special elements nitrogen, sulphur and halogens Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests Confirmation of functional groups • monocarboxylic acid, dicarboxylic acid • monohydric phenol, polyhydric phenol • aldehyde, ketone, ester • carbohydrate (reducing and non-reducing sugars) • primary, secondary, tertiary amine • monoamide, diamide, thioamide • anilide, nitro compound • Preparation of derivatives for functional groups					

	Unit-III 1. Preparation of Organic Compounds - Nitration - picric acid from Phenol - Halogenation - p-bromo acetanilide from acetanilide - Oxidation - benzoic acid from Benzaldehyde - Microwave assisted reactions in water - Methyl benzoate to Benzoic acid - Salicylic acid from Methyl Salicylate - Rearrangement - Benzil to Benzilic Acid - Hydrolysis of benzamide to Benzoic Acid 2. Separation and Purification Techniques (Not for Examination) - Purification of organic compounds by crystallization (from water / alcohol) and distillation - Determination of melting and boiling points of organic compounds. Steam distillation - Extraction of essential oil from citrus fruits/eucalyptus leaves. Chromatography (any one) (Group experiment) - Separation of amino acids by Paper Chromatography - Thin Layer Chromatography - mixture of sugars / plant pigments /permanganate dichromate. - Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate. Electrophoresis – Separation of amino acids and proteins. (Demonstration) - Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5& 6–not for ESE)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course paper is used for systematic qualitative analysis of organic sample to find the saturation, unsaturation, aromatic, aliphatic nature o and find the functional group of the sample.

Text Book(s)	1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012. 2. Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018.
Reference Book(s)	1. N.S. Gnanpragasam and G. Ramamurthy, Organic Chemistry Lab Manual, S.Viswanathan Pvt. Ltd 2. Gurtu, J. N; Kapoor, R. Advanced Experimental Chemistry (Organic), Sultan Chand: New Delhi, 1987. 3. Furniss, B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, 5th ed.; Pearson: India, 1989.
Websites and e-Learning resources	https://www.vlab.co.in/broad-area-chemical-sciences

COURSE OUTCOMES:

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

No	Cos	K-Level	Marks
CO1	Observe the physical state, odour, colour and solubility of the given organic compound.	K2	5
CO2	Identify the presence of special elements and Nature of compound (Saturation/Unsaturation/Aromatic/Aliphatic)	K3	10
CO3	Identify the presence of functional group in an unknown organic compound performing a systematic analysis. Characterisation of functional group analysis	K4	25
CO4	Exhibit a solid derivative with respect to the identified functional group.	K4	10
CO5	Prepare organic compounds quantitatively	K4	25

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

MAPPING 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	6
CLO1	3	3	3	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	3	3	3	3	3	3	3	3

Assessment Schema**Components of CIA**

Component	Weight / Mark
CIA	25
External Semester Exam	75

CIA Components	Marks
Internal Test	10
Observation/Record	5
Continuous class assessment	10

Name of the designer

Dr. J. Shanmugapriya

Title of the Course		Chemistry for Physical Sciences - I (For Mathematics)					
TANSCHHE Course type		EC1					
Course Category		Ancillary (T1)					
Nature of Course		Employability					
Category	Core	Year	I	Credits	4	Course Code	23U1CGET1 (M)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		4	-	-		4	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher secondary chemistry					
Objectives of the Course		- To know the basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry - To gain fundamental knowledge on nuclear chemistry and industrial chemistry - To study the concepts of thermodynamics and its applications. - To understand separation and purification techniques					
Course Outline		Unit I: Chemical Bonding and Nuclear Chemistry Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.					
		Unit II: Industrial Chemistry Fuels: Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate					

	Unit III: Fundamental Concepts in Organic Chemistry Hybridization: Orbital overlap hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆. Polar effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine
	Unit IV: Thermodynamics and Phase Equilibria Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. Phase Equilibria: Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).
	Unit V: Analytical Chemistry Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	The students will learn fundamental concept of chemistry like bonding, nuclear chemistry and understand advanced concept of fuels analytical chemistry etc

Text Book(s)	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Book(s)	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. 3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.
Websites and e-Learning resources	https://byjus.com/tn-board/class-11-chemistry-text-book/

COURSE OUTCOMES

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

CO	COs Statements	K-level
CO1	State the theories of chemical bonding, nuclear reactions and its applications.	K1
CO2	evaluate the efficiencies and uses of various fuels and fertilizers.	K2
CO3	explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.	K2
CO4	apply various thermodynamic principles, systems and phase rule.	K3
CO5	analyse various methods to identify an appropriate method for the separation of chemical components.	K3

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).

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	2	1	1	2	2	2	3	2	1	2
CO2	2	2	1	1	1	3	3	2	2	2	1	1
CO3	2	1	1	1	1	3	2	2	2	3	2	2
CO4	2	2	1	1	1	3	3	2	2	3	1	2
CO5	2	2	2	2	1	3	3	2	3	3	2	1

Blueprint for Semester Examination
Articulation Mapping-K Levels with Course Outcomes (COs)

S. No.	COs	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	CO 1	Up to K1	2	K1 & K1	1	K1	2 (K1 & K1)	1(K1)
2	CO 2	Up to K2	2	K1 & K2	1	K2	2 (K2 & K2)	1(K2)
3	CO 3	Up to K2	2	K2 & K2	1	K2	2 (K2 & K2)	1(K2)
4	CO 4	Up to K3	2	K1 & K1	1	K3	2 (K2 & K2)	1(K3)
5	CO 5	Up to K3	2	K1 & K2	1	K3	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 & B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	8	10	10	28	23.3	71.7
K2	8	30	20	58	48.4	
K3	4	10	20	34	28.3	28.3
K4	-	-	-	-	-	
Total marks	20	50	50	120	100	100

Name of the course Designer

Dr. R. Ramachandran

Title of the Course		Chemistry for Biological Sciences - I (For Zoology)					
TANSCHÉ Course type		EC1					
Course Category		Ancillary (T2)					
Nature of Course		Employability					
Category	Core	Year	I	Credits	4	Course Code	23U1CGET1 (Z)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		4	-	-		4	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher secondary chemistry					
Objectives of the Course		• To know basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry • To gain fundamental knowledge on nuclear chemistry and industrial chemistry • To know the basic ideas of importance of speciality drugs and • To understand separation and purification techniques					
Course Outline		Unit I: Chemical Bonding and Nuclear Chemistry Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.					
		Unit II: Industrial Chemistry Fuels: Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate					

	Unit III: Fundamental Concepts in Organic Chemistry Hybridization: Orbital overlap hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆. Polar effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine
	Unit IV: Drugs and Speciality Chemicals Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.
	Unit V: Analytical Chemistry Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	The students will learn fundamental concept of chemistry like bonding, nuclear chemistry and understand advanced concept of fuels analytical chemistry etc
Text Book(s)	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012. 4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Book(s)	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. 3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.
Websites and e-Learning resources	https://byjus.com/tn-board/class-11-chemistry-text-book/

COURSE OUTCOMES:

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

	COs Statements	K-level
CO1	State the theories of chemical bonding, nuclear reactions and its applications.	K1
CO2	Evaluate the efficiencies and uses of various fuels and fertilizers.	K2
CO3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.	K2
CO4	Application of antibiotics, anaesthetics, antipyretics and artificial sugars	K3
CO5	Analyse various methods to identify an appropriate method for the separation of chemical components.	K3

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	2	1	1	2	2	3	3	2	1	2
CO2	2	2	1	1	1	3	3	2	2	2	1	1
CO3	2	1	1	1	1	3	2	2	2	3	2	2
CO4	2	2	1	1	1	3	3	2	2	3	1	2
CO5	2	1	1	1	1	3	3	3	3	3	2	2

Blueprint for Semester Examination
Articulation Mapping-K Levels with Course Outcomes (COs)

S. No.	COs	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	CO 1	Up to K1	2	K1 & K1	1	K1	2 (K1 & K1)	1(K1)
2	CO 2	Up to K2	2	K1 & K2	1	K2	2 (K2 & K2)	1(K2)
3	CO 3	Up to K2	2	K2 & K2	1	K2	2 (K2 & K2)	1(K2)
4	CO 4	Up to K3	2	K1 & K1	1	K3	2 (K2 & K2)	1(K3)
5	CO 5	Up to K3	2	K1 & K2	1	K3	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 & B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	8	10	10	28	23.3	71.7
K2	8	30	20	58	48.4	
K3	4	10	20	34	28.3	28.3
K4	-	-	-	-	-	
Total marks	20	50	50	120	100	100

Name of the course Designer

Dr. R. Ramachandran

Title of the Course		Chemistry Practical For Physical and Biological Sciences - I (For Mathematics / Zoology)					
TANSCHÉ Course type		ECL1					
Course Category		Ancillary (P1)					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits 1		Course Code	23U1CGEP1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical			Total
		2	-	-			2
Marks		CIA		Semester			Total
		25		75			100
Pre-requisite(s)		Higher secondary chemistry					
Objectives of the Course		This course aims to provide knowledge on the • Basics of preparation of solutions. • Understanding of basic principles in volumetric analysis • Practical experience of volumetric analysis • Different types of volumetric analysis. • 5. Development of analytical analysis.					
Course Outline		VOLUMETRIC ANALYSIS 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate. 5. Estimation of potassium permanganate using standard NaOH. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using diphenyl amine as indicator.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC/Pollution control board and others to be solved (To be discussed during the Tutorial hours)					
Skills acquired from this course		Knowledge, Analytical ability in Titration process.					
Justification for nature of course		These courses enhance the better understanding of basic of fundamental practical knowledge in chemistry.					
Text Book(s)		1. A text-book of volumetric analysis-PETER Mc.Pherson2014 2. Practical Volumetric Analysis-Henry William Schimpf-1898					
Reference Book(s)		1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, 2. Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.					

COURSE OUTCOMES:

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

	CO Statement	K-Level
CO1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.	K2
CO2	Design, carry out, record and interpret the results of volumetric titration.	K4
CO3	Apply their skill in the analysis of water/hardness.	K3
CO4	Analyze the chemical constituents in allied chemical products	K3
CO5	Gain the analytical knowledge	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3	3
CO4	3	3	3	3	2	3	3	2	2	2	3	3
CO5	3	3	3	3	3	2	3	3	3	3	3	3

Assessment Schema

Continuous Internal Assessment : 25 Marks

External Assessment : 75 Marks

Total : 100 Marks

Blueprint for Semester Examination

	CO Statement	K-Level	Marks
CO1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.	K2	10
CO2	Design, carry out, record and interpret the results of volumetric titration.	K4	20
CO3	Apply their skill in the analysis of water/hardness.	K3	20
CO4	Analyze the chemical constituents in allied chemical products	K3	10
CO5	Gain the analytical knowledge	K4	5
Total			75

Name of the course Designer

Dr.S.SELVAKUMAR

Title of the Course		CHEMISTRY FOR PHYSICAL SCIENCES II (FOR MATHEMATICS)					
TANSCHÉ Course type		EC2					
Course Category		Ancillary (T4)					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23U2CGET2 (M)
		Semester	II				
Instructional Hours per week		Lecture	Tutoria l	Practical			Total
		4	-	-			4
Marks		CIA	Semester				Total
		25	75				100
Pre-requisite(s)		Chemistry for physical sciences -I					
Objectives of the Course		• This course aims at providing knowledge on the • Co-ordination Chemistry and Water Technology • Carbohydrates and Amino acids • Basics and applications of electrochemistry • Basics and applications of kinetics and catalysis • Various photochemical phenomenon					
Course Outline		Unit I: Co-ordination Chemistry and Water Technology Definition of terms-IUPAC Nomenclature -Werner’s theory - EAN rule - Pauling’s theory – Postulates -Applications to [Ni(CO) ₄], [Ni(CN) ₄] ²⁻ , [Co(CN) ₆] ³⁻ - Chelation- Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method--Purification techniques-BOD, COD.					
		Unit II: Carbohydrates and Amino acids Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose–fructose interconversion. Properties of starch and cellulose. Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).					

	Unit III: Electrochemistry Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications-electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.
	Unit IV: Kinetics and Catalysis Order and molecularity. Integrated rate expression for I and II (2A → Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction– Half-life period – Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber’s processes. Concept of energy of activation and Arrhenius equation.
	Unit V: Photochemistry Grothus-Draper’s law and Stark-Einstein’s law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on co-ordination Chemistry, water technology, carbohydrates, amino acids, electrochemistry, kinetics, catalysis and photochemistry and thus it brings employability.
Text Book(s)	V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Book(s)	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 3. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
Websites and e-Learning resources	1. https://byjus.com/jee/coordination-compounds/ 2. https://en.wikipedia.org/wiki/Carbohydrate 3. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Electrochemistry 4. https://www.pleiades.online/en/journal/kincat/main/ 5. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/photchem.htm

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	Develop the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology	K3
CO2	Explain the preparation and property of carbohydrate, amino acids and nucleic acids.	K2
CO3	Build the standard hydrogen electrode, electrochemical series, and explain electrochemistry principles in corrosion, electroplating and fuel cells.	K3
CO4	Identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.	K3
CO5	Illustrate the various type of photochemical process.	K2

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	2	2	2	3	2	3	3	2	2	3	2
CO2	3	2	2	2	3	2	3	3	2	2	3	2
CO3	3	3	3	3	3	2	3	3	3	3	3	2
CO4	3	2	2	2	3	2	3	3	2	2	3	2
CO5	3	2	2	2	3	2	3	3	3	3	3	2

Assessment Schema

Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Poster presentation	5
Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Course Outcomes (COs)

S. No.	COs	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	CO 1	Up to K3	2	K1 & K2	1	K2	2 (K2 & K2)	1(K3)
2	CO 2	Up to K2	2	K1 & K2	1	K1	2 (K2 & K2)	1(K2)
3	CO 3	Up to K3	2	K1 & K2	1	K2	2 (K2 & K2)	1(K3)
4	CO 4	Up to K3	2	K1 & K2	1	K2	2 (K2 & K2)	1(K3)
5	CO 5	Up to K2	2	K1 & K2	1	K2	2 (K2 & K2)	1(K2)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

Distribution of Section-wise Marks with K Levels

K Levels	Section A & B (No Choice)	Section C (Either / or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	7	-	--	7	5.83	75%
K2	13	50	20	83	69.17	
K3	-		30	30	25.00	25%
K4	-	-				
Total marks	20	50	50	120	100.00	100%

Name of the course Designer

Dr. P. Prasanna

Title of the Course		CHEMISTRY FOR BIOLOGICAL SCIENCES II (FOR ZOOLOGY)					
TANSCHÉ Course type		EC2					
Course Category		Ancillary (T5)					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23U2CGET2 (Z)
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		4	-	-		4	
Marks		CIA	Semester			Total	
		25	75			100	
Pre-requisite(s)		Chemistry for Biological sciences-I					
Objectives of the Course		This course aims to provide knowledge on Nomenclature of coordination compounds and carbohydrates. Amino Acids and Essential elements of biosystem understand the concepts of kinetics and catalysis provide fundamentals of electrochemistry and photochemistry					
Course Outline		Unit I: Co-ordination Chemistry and Water Technology Definition of terms-IUPAC Nomenclature -Werner’s theory - EAN rule - Pauling’s theory – Postulates -Applications to [Ni(CO)4], [Ni(CN)4]2-,[Co(CN)6]3- - Chelation- Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method--Purification techniques-BOD, COD.					
		Unit II: Carbohydrates Carbohydrates: Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose–fructose interconversion. Preparation and properties of sucrose, starch and cellulose.					
		Unit III: Amino Acids and Essential elements of biosystem Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method– Proteins classification– structure - Colour reactions – Biological functions –nucleosides –nucleotides– RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.					

	Unit IV: Electrochemistry Galvanic cells - Standard hydrogen electrode - calomel electrode -standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications-electroplating - Nickel and chrome plating - Types of cells -fuel cells-corrosion and its prevention.
	Unit V: Photochemistry Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on co-ordination Chemistry, water technology, carbohydrates, amino acids, electrochemistry and photochemistry and thus it brings employability.
Text Book(s)	V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Book(s)	1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007. 3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
Websites and e-Learning resources	1. https://byjus.com/jee/coordination-compounds/ 2. https://en.wikipedia.org/wiki/Carbohydrate 3. https://www.britannica.com/science/amino-acid/Standard-amino-acids 4. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Electrochemistry 5. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/photchem.htm

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	Develop the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology	K3
CO2	Explain the preparation and property of carbohydrate	K2
CO3	Plan the preparation and properties of amino acids, nucleic acids and enlighten the biological role of transition metals.	K3
CO4	Build the standard hydrogen electrode, electrochemical series and apply the electrochemistry principles in corrosion, electroplating and fuel cells.	K3
CO5	Illustrate the various type of photochemical process.	K2

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
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CO3	3	3	3	3	3	2	3	3	3	3	3	2
CO4	3	2	2	2	3	2	3	3	2	2	3	2
CO5	3	2	2	2	3	2	3	3	3	3	3	2

Assessment Schema

Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Poster presentation	5
Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Course Outcomes (COs)

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

Distribution of Section-wise Marks with K Levels

K Levels	Section A & B (No Choice)	Section C (Either / or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	7	-	--	7	5.83	75%
K2	13	50	20	83	69.17	
K3	-		30	30	25.00	25%
K4	-	-				
Total marks	20	50	50	120	100.00	100%

Name of the course Designer

Dr. P. Prasanna

Title of the Course		Chemistry Practical For Physical and Biological Sciences -II (For Mathematics / Zoology)						
TANSCHÉ Course type		ECL2						
Course Category		Ancillary (P3)						
Nature of Course		Skill Development						
Category	Core	Year	I	Credits 1		Course Code	23U2CGEP2	
		Semester	II					
Instructional Hours per week		Lecture	Tutorial	Practical		Total		
			-	2		2		
Marks		CIA		Semester		Total		
		25		75		100		
Pre-requisite(s)		Higher secondary chemistry						
Objectives of the Course		This course aims to provide knowledge on • Basics of organic qualitative analysis • Determination of elements in organic compounds • Identification of organic functional groups • Differentiate the aromatic and aliphatic compounds • Different types of organic compounds with respect to their properties.						
Course Outline		SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS The analysis must be carried out as follows: a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose]. b) Detection of elements (N, S, Halogens). c) To distinguish between aliphatic and aromatic compounds. d) (d) To distinguish – Saturated and unsaturated compounds.						
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)						
Skills acquired from this course		Knowledge, Analytical ability, organic compounds						
Justification for nature of course		This course enhances the better understanding of basic of organic chemistry.						
Text Books		1. N.S. Gnanapragasam and G. Ramamurthy, Organic chemistry – Lab manual, S. Viswanathan Co. Pvt. Ltd., 1998. 2. 2. J.N. Gurtu and R. Kapoor, Advanced Experimental Chemistry(Organic), S. Chand and Co., 1987.						
Reference Book(s)		1. Practical book V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, 2. Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.						

COURSE OUTCOMES:

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

	CO Statement	K-Level
CO1	Gain an understanding of the use of organic compounds	K2
CO2	Design, carry out, record and interpret the results of organic analysis.	K4
CO3	Apply their skill in the analysis of S and N elements.	K3
CO4	Analyze the kinds of functional groups	K3
CO5	Identify the saturated and unsaturated group of compounds	K2

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	3	3	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3
CO3	3	2	3	3	3	2	3	2	3	3	2	3
CO4	3	3	2	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	2	3	3

Assessment Schema

Continuous Internal Assessment: 25Marks

External Assessment: 75 marks

Total: 100 Marks

Blueprint for Test component of CIA

Component	Weight / Mark
Internal test	10
Observation /Record	5
Continuous class assessment	5
Short Procedure	5
Total	25

Blueprint for Semester Examination

Component	Weight / Mark
Experiment 1. Aromatic/Aliphatic (5Marks) 2. Saturated/ Unsaturated (5 Marks) 3. Elements (10 Marks) 4. Functional group (20 Marks)	40
Observation /Record	10
Procedure	15
Derivative preparation	10
Total	75

Name of the course Designer

DR. S.SELVAKUMAR

Title of the Course		Food Chemistry					
TANSICHE Course type		SEC1					
Course Category		Elective					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23U1CSED1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		2	-	-		2	
Marks		CIA	Semester			Total	
		25	75			100	
Pre-requisite(s)		Higher secondary Chemistry					
Objectives of the Course		- To understand food adulteration - To find the food poison - To get knowledge on food additives - To know about beverages and alcohol addiction - To understand the chemistry of oils and fats					
Course Outline		UNIT I: Food Adulteration: Sources of food, types, advantages and disadvantages. Food adulteration - contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals -Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques					
		UNIT-II: Food Poison: Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) -Chemical poisons - First aid for poison consumed victims					
		UNIT-III: Food Additives: Food additives -artificial sweeteners – Saccharin - Cyclamate and Aspartate Food flavours -esters, aldehydes and heterocyclic compounds – Food colours – Emulsifying agents – preservatives -leavening agents. Baking powder – yeast – tastemakers – MSG - vinegar.					
		UNIT-IV: Beverages: Beverages-softdrinks-soda-fruitjuices-alcoholicbeverages-examples. Carbonation-addictionto alcohol– diseases ofliver andsocial problems.					

	UNIT-V: Edible Oils: Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases - determination of iodine value, RM value, saponification values and their significance.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE / TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable the students to enrich their knowledge on food adulteration, food poison, food additives, beverages, oil & fats and thus it brings employability and entrepreneurship.
Text Book(s)	1. H. K. Chopra, P. S. Panesar, Food chemistry, 1st ed., Narosa publishing house, 2010. 2. J. Ghosh, Fundamental Concepts of Applied Chemistry, 1st ed., S. Chand & Company, 2010. 3. G. Subbulakshmi, S. A. Udipti, P. S. Ghugre, Food processing and preservation, 2nd ed., New age international publishers, 2021.
Reference Book(s)	1. M. Swaminathan, Food Science and Experimental Foods, Ganesh Publishers, 1979. 2. H. D. Belitz, W. Grosch, P. Schieberle, Food Chemistry, 4th ed., Springer, 2009. 3. J. M. deMan, J. W. Finley, W. J. Hurst, C. Y. Lee, Principles of food chemistry, 4th ed., Springer, 2018.
Websites and e-Learning resources	1. https://www.vedantu.com/biology/food-adulteration 2. https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/food-additives 3. https://thepharmapedia.com/tgs-properties/pharmacy-notes/ 4. https://thepharmapedia.com/tgs-properties/pharmacy-notes/ 5. https://www.saffola.in/blogs/mufas-pufas-why-you-should-have-fats-in-your-diet

COURSE LEARNING OUTCOMES:

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

	CO Statement	K-level
CLO1	To show the nature of adulteration in foods	K2
CLO2	To indicate food poison and its first aid.	K2
CLO3	To site the added additives in food products	K2
CLO4	To illustrate type of beverages	K2
CLO5	To describe the properties of oils and fats	K2

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	6
CLO1	3	3	3	3	2	3	2	3	2	3	3	2
CLO2	3	3	3	3	2	3	2	3	2	3	3	2
CLO3	3	3	3	3	2	3	2	3	2	3	3	2
CLO4	3	3	3	3	2	3	2	3	2	3	3	2
CLO5	3	3	3	3	2	3	2	3	2	3	3	2

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5
Total	25

Blueprint for Semester Examination
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 K3	2	K1& K1	1	K1	2 (K3& K3)	1(K2)
2	CLO 2	Up to K3	2	K2& K3	1	K2	2 (K1 & K1)	1(K3)
3	CLO 3	Up to K4	2	K3& K4	1	K1	2 (K4 & K4)	1(K4)
4	CLO 4	Up to K4	2	K3& K4	1	K3	2 (K4& K4)	1(K4)
5	CLO 5	Up to K3	2	K2& K3	1	K2	2 (K2 & K2)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3- 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%

Name of the course Designer

Dr. S. V. Karthikeyan

Title of the Course	Dairy Chemistry						
TANSCHE Course type	SEC-2						
Course Category	Skill Enhancement						
Nature of Course	Employability / Entrepreneurship / Skill Development						
Category	Core	Year	I	Credits	2	Course Code	23U2CSED2
		Semester	II				
Instructional hours per week	Lecture	Tutorial		Practice		Total	
	2	-		-		2	
Marks	CIA	Semester				Total	
	25	75				100	
Prerequisites	Higher secondary chemistry						
Objectives ofthe course	- To get knowledge on the chemistry of milk and milk products - To know about processing of milk - To get knowledge about preservation and formation of milk products. - To familiarize the estimation of fat in various milk products. - To get the idea about Fermented milk.						
Course Outline	UNIT I Composition of Milk Milk-definition-general composition of milk- constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity -Factors affecting the composition of milk - adulterants, preservatives with neutralizer- examples and their detection- estimation of fat, acidity and total solids in milk.						
	UNIT II Processing of Milk Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing - boiling, pasteurization – types of pasteurization -Bottle, Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.						

	UNIT III Major Milk Products Butter - definition -composition - theory of churning – desi butter - salted butter, estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity- definition - prevention - antioxidants and synergists - natural and synthetic.
	UNIT IV Special Milk Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk -condensed milk - definition, composition and nutritive value.
	UNIT V Fermented and other Milk Products Fermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - Bulgarious milk - acidophilous milk – Yoheer Indigeneous products- khoa and chhena definition - Ice cream -definition-percentagecomposition-types-ingredients-manufacture of ice-cream, stabilizers-emulsifiers and their role-milk powder-definition-need for making milk powder- drying process-types of drying.
	Questions related to the above topics, from various competitive examinations UPSC/ TRB/NET/UGC-CSIR/GATE/TNPSC others to be solved. (To be discussed during the tutorial hours)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable the students to enrich their knowledge on cosmetics and personal grooming and brings employability and entrepreneurship.
Text Book(s)	1. S. Ravi Kumar and B M Manjunatha, Text book of Dairy Engineering , Astral International Pvt Ltd. 2022. 2. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition,2006. 3. M.P. Mathur, D. Datta Roy, P. Dinakar, Text book of dairy chemistry, Indian Council of Agricultural Research, 1 st edition, 2008. 4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition,2013. 5. P. L. Choudhary, Text book of dairy chemistry, Bio-Green book publishers,2021.

ReferenceBook(s)	1. P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016. 2. F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006. 3. Eiri Board, Hand book of Milk Processing Dairy Products and Packaging Technology, Engineers India Research Institute 2008. 4. John W. Fuquay, Paul L.H. ,McSweeney, Patrick F. Fox, Encyclopedia of Dairy Sciences, Academic Press, Second edition, 2011.
Website and e-learning source	1. https://www.britannica.com/topic/dairy-product/Ripening 2. https://www.jliedu.com/blog/milk-processing-pasteurization/ 3. https://www.studocu.com/in/document/kerala-veterinary-and-animal-sciences-university/btech-dairy-technology/physico-chemical-changes-takes-place-during-manufacture-of-condensed-milk/22573601 4. https://www.slideshare.net/KamleshDhawal1/different-types-of-milk-75385497 5. https://www.yourarticlelibrary.com/dairy-farm-management/indigenous-dairy-products-manufactured-from-whole-milk/89376

COURSE LEARNING OUTCOMES:

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

	CO Statement	K-level
CO1	Understand about general composition of milk – constituents and its physical properties.	K2
CO2	Acquire knowledge about pasteurization of Milk and various types of pasteurization.	K2
CO3	Learn about Cream and Butter their composition and how to estimate fat in cream and Ghee.	K2
CO4	Explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.	K2
CO5	Have an idea about how to make milk powder and its drying process.	K2

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	3	2	3	3	3	2	2	3
CO2	2	2	1	1	2	3	3	3	2	3	2	3
CO3	2	2	1	1	2	3	3	3	2	3	2	3
CO4	2	2	1	1	3	3	3	3	2	3	2	3
CO5	2	2	1	1	2	3	3	3	3	3	2	3

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination
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 K3	2	K1& K1	1	K1	2 (K3& K3)	1(K2)
2	CLO 2	Up to K3	2	K2& K3	1	K2	2 (K1 & K1)	1(K3)
3	CLO 3	Up to K4	2	K3& K4	1	K1	2 (K4 & K4)	1(K4)
4	CLO 4	Up to K4	2	K3& K4	1	K3	2 (K4& K4)	1(K4)
5	CLO 5	Up to K3	2	K2& K3	1	K2	2 (K2 & K2)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3- 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%

Name of the course Designer

Dr. A.Xavier

Title of the Course		Cosmetics and Personal Grooming					
TANSCHÉ Course type		SEC3					
Course Category		Skill Enhancement Course					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23U2CSED3
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2	-		-		2
Marks		CIA		Semester			Total
		25		75			100
Pre-requisite(s)		Higher secondary Chemistry					
Objectives of the Course		- To familiarizing the students formulations of various types of - To cosmetics and their significance - To get knowledge on hair, skin and dental care - To know about makeup preparations - To get knowledge on personal grooming.					
Course Outline		Unit I Skin Care Nutrition of the skin, skin care and cleansing of the skin; face powder – ingredients; creams and lotions – cleansing, moisturizing all purpose, shaving- and sunscreen (formulation only); Gels – formulation and advantages;astringent and skin tonics – key ingredients, skin lightness, depilatories					
		Unit II Hair care Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner –types – ingredients Dental care Tooth pastes – ingredients – mouth wash					
		Unit III Make up Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge					
		Unit IV Perfumes Classification - Natural – plant origin – parts of the plant used, chief constituents; animal origin – amber gries from whale, civetone from civet cat,musk from musk deer; synthetic – classification emphasizing characteristics –esters – alcohols – aldehydes – ketones					
		Unit V Beauty Treatments Facials - types – advantages – disadvantages; face masks – types; bleach - types – advantages– disadvantages; shaping the brows; eyelash tinting; perming— types; hair colouring and dyeing ; permanent waving – hair straightening; wax— types – waxing; pedicure, manicure - advantages – disadvantages					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/ TRB/NET/UGC-CSIR/GATE/TNPSC others to be solved. (To be discussed during the tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable the students to enrich their knowledge on cosmetics and personal grooming and brings employability and entrepreneurship.
Text Book(s)	1. Thankamma Jacob, (1997) Foods, drugs and cosmetics – A consumer guide, Macmillan publication, London.
Reference Book(s)	1. Wilkinson J B E and Moore R J, (1997) Harry's cosmetology, 7th ed., Chemical Publishers, London. 2. George Howard, (1987) Principles and practice of perfumes and cosmetics, Stanley Theron, Chettnham
Websites and e-Learning resources	1. http://www.khake.com/page75.html 2. Net.foxsm/list/284

COURSE LEARNING OUTCOMES:

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

	CO Statement	K-level
CO1	know about the composition of various cosmetic products	K2
CO2	understand chemical aspects and applications of hair care and dental care and skincare products.	K2
CO3	understand chemical aspects and applications of perfumes and skin care products	K2
CO4	to understand the methods of beauty treatments their advantages and disadvantage	K2
CO5	understand the hazards of cosmetic products and personal grooming.	K2

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	3	2	3	3	3	2	2	3
CO2	2	2	1	1	2	3	3	3	2	3	2	3
CO3	2	2	1	1	2	3	3	3	2	3	2	3
CO4	2	2	1	1	3	3	3	3	2	3	2	3
CO5	2	2	1	1	2	3	3	3	3	3	2	3

Assessment Schema Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination
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 K3	2	K1& K1	1	K1	2 (K3& K3)	1(K2)
2	CLO 2	Up to K3	2	K2& K3	1	K2	2 (K1 & K1)	1(K3)
3	CLO 3	Up to K4	2	K3& K4	1	K1	2 (K4 & K4)	1(K4)
4	CLO 4	Up to K4	2	K3& K4	1	K3	2 (K4& K4)	1(K4)
5	CLO 5	Up to K3	2	K2& K3	1	K2	2 (K2 & K2)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers

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

K3- 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%

Name of the course Designer

Dr. M. Malarvizhi

Title of the Course		BIOLOGICAL CHEMISTRY (For Biotechnology)					
TANSCHÉ Course type		23U1CGET3					
Course Category		Ancillary (T3)					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23U1CGET1 (L)
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		2	2	-		4	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic knowledge of Biological chemistry					
Objectives of the Course		• To understand the models of an atom, electronic configuration and periodic trends of elements shapes of orbitals, the classification of organic compounds importance and types of organic reactions. To recognize the modern concepts of acids and bases • To understand the concept of acids & bases • To explain the concept of water in biological chemistry and the types of monosaccharides and polysaccharides • To study the classification of lipids and their properties • Discuss on the conformations of proteins and amino acids					
Course Outline		UNIT I: Atomic theory & Basic Organic Chemistry Atomic theory, formation of molecules, electronic configuration of atoms- s & p shapes of atomic orbitals. Periodic table, periodic classification, valency. Types of chemical bonds. Classification of organic compounds -. Hybridization in methane, ethane, acetylene, and benzene. Definition with examples- electrophiles, nucleophiles and free radicals. Types of reactions with an example: addition, substitution, elimination, condensation and polymerization. Electrophilic substitution reaction in benzene, nitration and sulphonation.					
		UNIT II: Acids & Bases Acids & Bases properties and differences, Concepts of acids and bases- Arrhenius, Lowry-Bronsted and Lewis. Concentration of solution, ways of expressing concentrations of solutions – per cent by weight, normality, molarity, molality, mole fraction. pH of solution, pH scale, measurement of pH. Buffer solutions, properties of buffers, Henderson-Hasselbalch equation, mechanism of buffer action of acidic buffer and basic buffer.					

	UNIT III: Water & Carbohydrates Importance to Biochemistry-the chemical foundation of life. Water: its unique properties, ionization of water, buffering action in biological system, properties and characteristics of water. Classification of carbohydrates. Properties of carbohydrates. Ring structure of sugars and conformations of sugars. Metabolism of Carbohydrates – Glycogenesis, Glycogenolysis, Cori's cycle, Glycolysis, TCA cycle, bioenergetics of carbohydrate metabolism.
	UNIT IV: Lipids & Nucleic acids Classification of Lipids. Characteristics, Properties and Biological importance of lipids. triglycerides, phospholipids, cholesterol. Classification of nucleic acids. Purine and Pyrimidine bases. Classification of DNA & RNA. Metabolism of Nucleic acids, Salvage pathway.
	UNIT V: Amino acids, Proteins & Hormones Classification and structure of amino acids. Structural conformation of proteins. Classification of proteins. Properties and biological importance of amino acids and proteins. Degradation of Amino acids and Urea Cycle. Vitamins and Hormones. Role of hormones in metabolism. ATP production. Oxidative phosphorylation, Electron transport chain and Photophosphorylation.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on various types of acids and bases, organic reaction mechanisms and the ways to convert into other molecules by employing suitable reagents and thus it brings employability.

Text Book(s)	1. P.L. Soni , A Text-book of Inorganic Chemistry, 11th Edition, S. Chand & Sonspublication 2. Abhilasha Shourie, Shilpa S, Chapadgoankar& Anamika Singh (2020) Textbook ofBiochemistry 1st Edition 3. J.L. Jain, 2016, Fundamentals of Biochemistry, S. Chand publication, 7th edition. 4. A.C. Deb, 2016, Fundamentals of Biochemistry, New central book agencies, 7th edition. 5. Satyanarayana .U, 2016, Biochemistry, MJ publishers 3rd edition (2006)
Reference Book(s)	1. Lehninger (2013) Principles of Biochemistrty 4 th edition WH Freeman and CompanyNY 2. Murray et al., (2003) Harper’s biochemistry 26 th edition Appleton and Lange PublishersFlorida USA 3. Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, 1995, Principles ofBiochemistry, W.C. Brown Publishers, 1995, 3rd edition. 4. LubertStryer (2007) Biochemistry –Stanford University 5 th Edition-W H Freemann andcompany San Francisco 5. Bahl Arun, Bahl B. S. (2016), A Textbook of Organic Chemistry, 22nd Edition, S. Chand& Sons publications
Websites and e-Learning resources	1. http://dwb4.unl.edu/chem869p/chem869plinks/s 2. www.longwood.edu/staff/buckalewdw/C3%20Biomolecules.pp 3. https://www.britannica.com/science/biochemistry 4. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences 5. https://biochemistry.org/education/careers/becoming-a-bioscientist > w..

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	To discuss the structure of atoms and the gradation of periodic properties of elements, differentiate the properties of various forms of Chemical substances.	K2
CO2	Characteristics of chemical reactions and to calculate the stoichiometry rate	K3
CO3	To indicate the Structure, Classification, Chemistry and Properties of Carbohydrates.	K3
CO4	To explain the Structure, Classification, Chemistry and Properties of Lipids, triglycerides, phospholipids, cholesterol	K4
CO5	To describe the Structure, Classification, Chemistry and Properties of proteins aminoacids. Identify and explain nutrients in foods and the specific functions in maintaining health.	K3

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	2	2	3	3	3	2	2	2
CO2	2	2	3	3	2	1	3	3	2	3	2	2
CO3	2	2	3	3	2	1	3	3	2	3	2	2
CO4	2	2	3	2	2	1	3	3	2	3	2	2
CO5	2	2	1	2	1	1	3	3	3	3	2	2

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Test component of CIA

CIA	COs	K-Level	Section A (Short Answer)	Section B (Either/or)	Section C (Open choice)
I	CO 1	Up to K2	2 (K1 & K2)	2 (K2 & K2)	1 (K2)
	CO 2	Up to K3	3 (K1, K2 & K2)	2 (K2 & K2)	2 (K3)
II	CO 3	Up to K4	2 (K1 & K2)	2 (K3 & K3)	1 (K3)
	CO 4	Up to K4	3 (K1, K2 & K2)	2 (K3 & K3)	2 (K3 & K4)
No. of Questions to be asked			5	4	3
No. of Questions to be answered			5	2	2
Marks for each question			2	5	10
Total Marks for each section			10	10	20

Distribution of Marks with K Level CIA I & CIA II

CIA	K Levels	Section A (Short Answer)	Section B (Either/or)	Section C (Open choice)	Total Marks	% of Marks without choice	Consolidated %
I	K1	4	-	--	4	6.67	66.67
	K2	6	20	10	36	60	
	K3	-		20	20	33.33	33.33
	K4	-	-	-	-	-	
	Marks	10	20	30	60	100	100
II	K1	4	-	--	4	6.67	33.3
	K2	6	10	-	16	26.67	
	K3	-	20	10	30	50	50
	K4	-	-	10	10	16.67	16.7
	Marks	10	30	20	60	100	100

Blueprint for Semester Examination
Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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& B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. S. SUJARANI
- Dr.R.SAKTHIVADIVEL
- Dr.R.SATHYA

Title of the Course		BIOINSTRUMENTATION (for Biotechnology)					
TANSICHE Course type		23U2CGET6					
Course Category		Ancillary (T6)					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23U2CGET2 (L)
		Semester	II				
Instructional Hours per week		Lecture		Tutorial		Practical	Total
		2		2			4
Marks		CIA	Semester				Total
		25	75				100
Pre-requisite(s)		Higher secondary chemistry					
Objectives of the Course		- To Understand the concept of pH & buffer solution and principle and applications of Microscopy - To gain knowledge about principles of spectroscopy - To the concept of Chromatography and electrophoresis - To understand the principle of radioactivity and used in medical diagnosis - To gain the knowledge of centrifugation process and its types					
Course Outline		Unit I: Basic instruments: pH – Definition – pH meter. Measurement of pH and calibration of pH meter - Buffers – Preparation of Buffers. Microscopy: Principle and applications of Compound, Bright field, Phase contrast and Fluorescence Microscope.					
		Unit II: SpectroscopicTechniques: Spectra – Absorption and Emission Spectra – Beer Lambert’s law – Colorimeter, UV-Visible Spectrophotometer. Mass spectroscopy - Atomic absorption spectrometer (AAS) - Nuclear magnetic resonance spectrometer (NMR).					
		Unit III: Chromatographic and Electrophoresis Techniques: Chromatography - Principles – Paper Chromatography, TLC, Gel filtration, Ion-Exchange, Affinity Chromatography Gas Liquid Chromatography and HPLC. Electrophoresis: Principle, Paper Electrophoresis – Cellulose Acetate Electrophoresis - Agarose Gel Electrophoresis – SDS- PAGE and Iso-electric focusing					
		Unit IV: Radiation based techniques : Radioactivity – Isotopes – Clinically important isotopes – Measurement of Radioactivity – GM Counters, Scintillation Counters – Autoradiography – Applications. SOPs for Radioactive materials.					

	Unit V: Centrifugation techniques: Centrifugation – Principles - RCF, Sedimentation concept - - Different types of centrifuge – Types of rotors – Centrifugation types: Differential and Density gradient centrifugation – Ultra Centrifuge.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours).
Skills acquired from this course	Students will gain in-depth knowledge about analytical techniques and principles. They will gain expertise in handling instruments and understand their applications.
Justification for nature of course	This course will enable the students to enrich their knowledge on cosmetics and personal grooming and brings employability and entrepreneurship.
Text Book(s)	1. Jayaraman J (2011). Laboratory Manual in Biochemistry, 2nd Edition. Wiley Eastern Ltd., New Delhi . 2. Ponmurugan.P and GangatharaPB(2012). Biotechniques.1st Edition. MJP publishers. 3. Veerakumari, L (2009).Bioinstrumentation- 5th Edition -.MJP publishers. 4. Upadhyay, Upadhyay and Nath (2002). Biophysical chemistry – Principles and techniques 3rd Edition. Himalaya publishing home. 5. Chatwal G and Anand (1989). Instrumental Methods of Chemical Analysis. S.Himalaya Publishing House, Mumbai.
Reference Book(s)	1. Webster, J.G. (2004). Bioinstrumentation- 4th Edition - John Wiley & Sons (Asia) Pvt. Ltd, Singapore. 2. Keith Wilson, John Walker,(2010). Principles and techniques of Biochemistry and Molecular Biology”(7th edition).Cambridge University Press. 3. David L.Nelson, Michael M Cox.Lehninger(2008).”Principles of Biochemistry”,Fifth edition W.H.Freeman,Newyork. 4. Khandpur R S, 2014. Handbook of Biomedical Instrumentation, 3rd edition, McGraw Hill Education (India). 5. Sharma B K, 2005. Instrumental Methods of Chemical Analysis, 24th Edition, GOEL Publishing House.

Websites and e-Learning resources	1. http://www.biologydiscussion.com/biochemistry/centrifugation/centrifuge-introduction- types- uses-and-other-details-with-diagram/12489 . 2. https://study.com/academy/lesson/what-is-chromatography-definition-typesuses.html . 3. http://www.rsc.org/learnchemistry/collections/spectroscopy/introduction

COURSE OUTCOMES:

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

CO1	Explain the experiment and apply the basic instruments in the laboratory.	K-level
CO2	Interpret the functionality of Beer – Lambert’s law in identifying and quantifying a biomolecule.	K1
CO3	Compare the separation techniques for separating bio molecules based on chromatography and electrophoresis techniques.	K2
CO4	Show the clinical important of isotopes and their detection of isotopes.	K2
CO5	Utilize the separation techniques for separating biomolecules by centrifugation	K3

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	3	3	2	2	3	3	3	2	3	3
CO2	3	3	2	3	2	3	3	2	3	3	3	2
CO3	3	3	3	2	3	3	3	3	3	2	3	3
CO4	3	3	3	3	2	3	3	2	3	3	2	3
CO5	3	3	3	2	3	2	3	3	2	3	3	2

Assessment Schema

Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination
Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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& B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. R.Sakthivadivel,
- Dr. R.Sathya
- Dr. Sujarani

Title of the Course		Chemistry practical for Biotechnology – Biological Chemistry - I					
TANSCHÉ Course type		23U1CGEP2					
Course Category		Ancillary (P2)					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	1	Course Code	23U1CGEP1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
			-	2		2	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher secondary chemistry					
Objectives of the Course		This course aims to provide knowledge on the 1. Basics of preparation of solutions. 2. Understanding of basic principles in volumetric analysis 3. Practical experience of volumetric analysis 4. Different types of volumetric analysis for biomolecules 5. Development of analytical analysis.					
Course Outline		VOLUMETRIC ANALYSIS 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Determination of Ascorbic acid – DCIPIP method.Estimation of ferrous sulphate using standard Mohr's salt. 3. Estimation of Glycine – Formal Titration. Colorimetric analysis 1. Estimation of glucose. 2. Estimation of proteins – Bradford’s method Chromatography technique Chromatography analysis of sugar, amino acids, lipids by paper chromatography. Chromatography analysis of sugar, amino acids, lipids by thin layer chromatography.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC/Pollution control board and others to be solved (To be discussed during the Tutorial hours)					
Skills acquired from this course		Knowledge, Analytical ability in Titration process.					
Justification for nature of course		These courses enhance the better understanding of basic of fundamental practical knowledge in chemistry.					

Text Book(s)	1. A text-book of volumetric analysis-PETER Mc.Pherson 2014 2. Practical Volumetric Analysis-Henry William Schimpf-1898
Reference Book(s)	1. V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, 2. Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

COURSE OUTCOMES:

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

	CO Statement	K-Level
CO1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.	K2
CO2	Design, carry out, record and interpret the results of volumetric titration.	K4
CO3	Apply their skill in the estimation of biomolecules.	K3
CO4	Analyze the chemical constituents in allied chemical products	K3
CO5	Gain the analytical knowledge	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3	3
CO4	3	3	3	3	2	3	3	2	2	2	3	3
CO5	3	3	3	3	3	2	3	3	3	3	3	3

Assessment Schema

Continuous Internal Assessment: 25 Marks

External Assessment : 75 marks

Total: 100 Marks

Blueprint for Test component of CIA

Component	Weight / Mark
Internal test	10
Observation /Record	5
Short procedure in experiment	5
Continuous class assessment	5

Blueprint for Semester Examination

Component	Weight / Mark
Internal test	45
Observation /Record	15
Short procedure in experiment	15

Name of the course Designer

- Dr.R.Sathya
- Dr.R.Sakthivadivel
- Dr.S.Sujarani

Title of the Course		Chemistry Practical for Biotechnology - Bioinstrumentation - II					
TANSCHÉ Course type		23U2CGEP4					
Course Category		Ancillary (P4)					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	1	Course Code	23U2CGEP2 (L)
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
			-	2		2	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher secondary chemistry					
Objectives of the Course		This course aims to provide knowledge on 1. Basics of organic qualitative analysis 2. Determination of elements in organic compounds 3. Identification of organic functional groups 4. Differentiate the aromatic and aliphatic compounds 5. Different types of organic compounds with respect to their properties.					
Course Outline		SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS The analysis must be carried out as follows: a) Functional group tests [Carboxylic acids (Benzoic acid, phthalic acid), phenol, urea, Aniline. b) Detection of elements (N, Halogens). c) To distinguish between aliphatic and aromatic compounds. d) To distinguish – Saturated and unsaturated compounds. e) Preparation of Buffer (Phosphate Buffer) f) Determination of pH of biological samples using pH meter. g) Fractionation of biological material into its various components by centrifuge.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)		Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)					
Skills acquired from this course		Knowledge, Analytical ability, organic compounds					
Justification for nature of course		This course enhances the better understanding of basic of organic chemistry.					

Text Books :	1. N.S. Gnanapragasam and G. Ramamurthy, Organic chemistry – Lab manual, S. Viswanathan Co. Pvt. Ltd., 1998. 2. J.N. Gurtu and R. Kapoor, Advanced Experimental Chemistry(Organic), S. Chand and Co., 1987.
Reference Book(s)	1. Practical book V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, 2.Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

COURSE OUTCOMES

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

	CO Statement	K-Level
CO1	Gain an understanding of the use of organic compounds	K2
CO2	Design, carry out, record and interpret the results of organic analysis.	K4
CO3	Apply their skill in the analysis of S and N elements.	K3
CO4	Analyze the kinds of functional groups	K3
CO5	Identify the saturated and unsaturated group of compounds	K2

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	3	3	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3
CO3	3	2	3	3	3	2	3	2	3	3	2	3
CO4	3	3	2	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	2	3	3

Assessment Schema

Continuous Internal Assessment : **25Marks**

External Assessment: **75 marks**

Total : **100 Marks**

Blueprint for Test component of CIA

Component	Weight / Mark
Internal test	15
Observation /Record	5
Continuous class assessment	5

Blueprint for Semester Examination

Component	Weight / Mark
Experiment 5. Aromatic/Aliphatic (10Marks) 6. Saturated/ Unsaturated (10 Marks) 7. Elements (10 Marks) 8. Functional group (15 Marks)	45
Observation /Record	15
Write a procedure	15

Name of the course Designer

- Dr.S.Sujarani
- Dr.R.Sathya
- Dr.R.Sakthivadivel

THE MADURA COLLEGE (AUTONOMOUS), MADURAI – 625 011
DEPARTMENT OF CHEMISTRY

VISION & MISSION OF THE DEPARTMENT

Vision

To produce disciplined and committed students through effective teaching-learning for the professional growth and research aimed at a greener environment and healthier living of humankind.

Mission

- To ensure the quality and knowledgeable chemistry graduates capable of creating new developments for the society and applicable in daily life to become entrepreneurs.
- Inspiring students to fulfil the expectations of local, national and global needs.
- Motivate the students to pursue higher studies and research to cater the need of industries.

PROGRAMME OUTCOMES (DEFINED BY TANSCHÉ):

PO1: Problem Solving Skill

Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.

PO2: Decision Making Skill

Foster analytical and critical thinking abilities for data-based decision-making.

PO3: Ethical and Moral Value

Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities and Ability to embrace moral/ethical values in conducting one's life.

PO4: Communication Skill and Multicultural competence

Ability to develop communication, managerial and interpersonal skills, Possess knowledge of the values and beliefs of multiple cultures and a global perspective.

PO5: Individual and Team Leadership Skill

Capability to lead themselves and the team to achieve organizational goals and contribute significantly to society

PO6: Employability Skill and : Entrepreneurial Skill

Inculcate contemporary business practices to enhance employability skills in the competitive environment and Equip with skills and competencies to become an entrepreneur.

PROGRAMME SPECIFIC OUTCOMES (DEFINED BY TANSCHÉ)

PSO1 – Placement

To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

PSO2 - Entrepreneur

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

PSO3 – Research and Development

Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.

PSO4 – Contribution to Business World

To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO5 – Contribution to the Society

To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

PSO6 – Contribution to the Multicultural Competence

To exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities and exhibit competence in educational, industrial and research pursuits

Qualification for Admission

Pass in B. Sc. Chemistry

Duration of the Course

The students shall undergo prescribed course of study for the period of two academic years.

Medium of Instruction: English

Nature of the Course

Courses are classified according to the following nature

- Skill Oriented
- Employability Oriented
- Entrepreneurship Oriented

Teaching & Evaluation Pattern

- As Per TANSCH

This curriculum is designed based on Tamilnadu State Council for Higher Education (TANSCH) State Integrated Board of Studies & UGC.

Evaluation

Formative (Continuous Internal Assessment (CIA))	: 25 marks
Summative (External)	: 75 marks
Total	: 100 marks

Formative Examination (CIA) : 25 Marks

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Question Paper Pattern for Summative Examination

Section	Question pattern	Marks
A	Multiple choice (10 x 1 marks)	10
B	Short answer (5 x 2 marks)	10
C	Either / or type (5 x 5 marks)	25
D	Open choice type (3 out of 5 x 10 marks)	30
Total		75

In respect of external examinations passing minimum is 45% for PG Courses and in total, aggregate of 50%. The curriculum is revised to suit the changing trends by propagation of ideas ensuring professional growth through innovative method of teaching.

Question Paper Pattern for Internal Test

Section	Question pattern	Marks
A	Short answer (2 x 2.5 marks)	5
B	Either / or type (2 x 5 marks)	10
C	Open choice type (1 out of 2 x 10 marks)	10
Total		25

- Centralized system of two internal assessment test
- Duration of internal test will be 1 hour
- Students shall write retest on the genuine grounds if they are absent in either Test-I or Test-II with the approval of HoD and the Principal
- For the purpose of Formative assessment (CIA), the course teacher may decide the CO for the two tests as per the following conditions.
- Any two COs shall be considered for the first test.
- Two COs (other than those already considered for the first test) shall be considered for the second test.
- The remaining CO may be considered for assignment

Blueprint for Test component of CIA

Sl. No	COs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)	Total
			Short Answers				
			No. of Questions	K- Level			
1	COx Up to K2/K3/ K4	K2	1	K1	K2 & K2	K2	
		K3	1	K2	K3& K3	K3	
		K4	1	K2	K3& K3	K4	
2	COy Up to K2/K3/ K4	K2	1	K1	K2 & K2	K2	
		K3	1	K2	K3& K3	K3	
		K4	1	K2	K3& K3	K4	
S			2		4	2	8
No. of Questions to be answered			2		2	1	5
Marks for each question			2.5		5	10	
Total Marks for each section			5		10	10	25

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

EVALUATION PATTERN FOR PRACTICAL PAPERS

Continuous Internal Assessment : 25 Marks

External Assessment : 75 Marks

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	- Choose - Define - Find - How - Label - List - Match - Name - Omit - Recall - Relate - Select - Show - Spell - Tell - What - When - Where - Which - Who - Why	- Classify - Compare - Contrast - Demonstrate - Explain - Extend - Illustrate - Infer - Interpret - Outline - Relate - Rephrase - Show - Summarize - Translate	- Apply - Build - Choose - Construct - Develop - Experiment with - Identify - Interview - Make use of - Model - Organize - Plan - Select - Solve - Utilize	- Analyze - Assume - Categorize - Classify - Compare - Conclusion - Contrast - Discover - Dissect - Distinguish - Divide - Examine - Function - Inference - Inspect - List - Motive - Relationships - Simplify - Survey - Take part in - Test for - Theme	- Agree - Appraise - Assess - Award - Choose - Compare - Conclude - Criteria - Criticize - Decide - Deduct - Defend - Determine - Disprove - Estimate - Evaluate - Explain - Importance - Influence - Interpret - Judge - Justify - Mark - Measure - Opinion - Perceive - Prioritize - Prove - Rate - Recommend - Rule on - Select - Support - Value	- Adapt - Build - Change - Choose - Combine - Compile - Compose - Construct - Create - Delete - Design - Develop - Discuss - Elaborate - Estimate - Formulate - Happen - Imagine - Improve - Invent - Make up - Maximize - Minimize - Modify - Original - Originate - Plan - Predict - Propose - Solution - Solve - Suppose - Test - Theory

Assessment Rubrics

TEST

#	Timeline
1	36 th day
2	72 nd day
Retest	On genuine reasons / medical grounds (with prior permission)

Assessment Strategy

- Objective.
- Subjective.

Assessment of the learning level attained by the students against mapped course / Programmes Outcomes.

Rubrics:

Section A (Objective)

Criteria	Performance Marks
	1
Assessment	The answer is correct

Section B (Short Answer)

Criteria	Performance Marks	
	2 / 2.5 (CIA)	1
Assessment	The answer is relevant, correct and complete	The answer is irrelevant but incomplete

Section C (Paragraph Answer)

Criteria	Performance Marks				
	5	4	3	2	1
Assessment	The answer is relevant, answered at the appropriate K-level, conclusion or result drawn correctly.	The answer is relevant, answered at the appropriate K-level, arguments are correct but conclusion / result is inconclusive or incorrect.	The answer is relevant, answered at the appropriate K-level, arguments are correct but incomplete and inconclusive	The answer is relevant with few correct and few incorrect and inconclusive arguments	The answer is relevant but arguments are incorrect and inconclusive.

Section D

Criteria	Performance Marks					
	10	8-9	6-7	4-5	2-3	1
Assessment	The answer is correct and conclusive. The result is drawn correctly	The answer is correct and complete. The result is incorrect or inconclusive	The answer is mostly correct, most key points are correct but the result is incorrect or inconclusive	The answer is partly correct. A few key points are correct. Inference is drawn incorrectly or inconclusively	The answer is incomplete. Most key points are incorrect.	The answer is irrelevant

Question paper pattern for test component of Internal Assessment (Duration 1 hour)

Pattern	No. of questions	Marks per question	Total marks
Part A (Short answer type - no choice)	2	2.5	5
Part B (Paragraph answer type - Either-or)	2	5	10
Part C (Essay type - openchoice – one question to be answered out of 2 question asked)	1/2	10	10
Total marks			25

Blueprint for test component of CIA

Pattern	Part A (Short answer type)	Part B (Either-or)	Part C (Essay type - open choice)
CO X	1*	1*	1*
CO Y	1*	1*	1*

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

Assessment methodology and weight:

Weight: 10 marks. **Calculated metric** = Average of two tests.

SEMINAR

Timeline
Spread over the entire semester from days 20 to 80

Assessment Strategy

Rubric:

Criteria	Performance Marks		
	3	2	1
Preparation	-	Content is illustrated with good usage of narrative techniques.	Content is not prepared with adequate usage of narrative techniques.
Presentation	-	The content is presented well with clarity.	The content is presented without clarity.
Content	-	-	The question asked by the evaluators are answered.

Weight: 5 marks

Poster/chart presentation

Timeline
Spread over the entire semester from days 20 to 80

Assessment Strategy

Rubric:

Criteria	Performance Marks		
	3	2	1
Presentation	-	Presentation was done with ICT tools and the tools were appropriate for the content.	Usage of ICT tools is inadequate.
Content	Content is presented clearly and concisely, key points were answered well and arguments were established very well.	Content is relevant, key points were presented but inferences were ineffectively drawn or questions answered inadequately.	Content is presented but key points were not articulated effectively

Weight: 5 marks

ASSIGNMENT NT

#	Timeline
1	30 th day
2	70 th day

Assessment Strategy

Rubric:

Criteria	Performance Marks		
	3	2	1
Timely submission	-	-	The assignment is submitted on time
Content	-	-	Content is relevant and complete in all respects
Originality	-	-	Content is written in own words with paraphrasing
Library and Information resources usage	-	Library and N-list resources are used and the resources used are cited appropriately and adequately	Information resource usage (or) usage of other resources are inadequate or not properly referenced

Weight: 5 marks

Assessment methodology and weight**Assessment outcome:** Best one score to be considered.

#	Timeline	<u>Quiz</u>	#	Timeline
1	18 th day		1	40 th day
2	48 th day		2	80 th day
3	78 th day			

(Or)**Assessment strategy**

➤ Objective

Assessment methodology and weight **Weight:** 5 Marks.**Assessment outcome:** Average of best 2 out of 3 quizzes (or) best one of 2 quizzes.

#	Timeline
1	40 th day
2	80 th day

Assessment strategy

➤ Objective

Assessment methodology and weight**Weight:** 5 Marks.**Assessment outcome:** Average of best 2 out of 3 quizzes (or) best one of 2 quizzes.**Attendance**

#	Timeline*
1	33 rd day
2	63 rd day
3	83 rd day

Attendance to be verified by students at the intervals specified.*Assessment Strategy Rubric:**

Criteria	Performance Marks				
	5	4	3	2	1
Attendance	>90%	80-89%	70-79%	60-69%	<59%

Weight: 5 Marks.***Attendance to be verified by students at the intervals specified.**

Assessment StrategyRubric:

Template for P.G., Programmes (Science with Practicals)

Semester-I	Credit	Hours	Semester-II	Credit	Hours	Semester-III	Credit	Hours	Semester-IV	Credit	Hours
1.1. Core-I	5	6	2.1. Core-IV	5	6	3.1. Core-VII	5	6	4.1. Core-XI	5	6
1.2 Core-II	5	6	2.2 Core-V	5	6	3.2 Core-VIII	5	6	4.2 Core-XII (Practicals)	4	6
1.3 Core – III (Practicals)	4	6	2.3 Core – VI (Practicals)	4	6	3.3 Core – IX (Practicals)	4	6	4.3 Project with viva voce	8	8
1.4 Discipline Centric Elective -I	3	5	2.4 Discipline Centric Elective – III	3	5	3.4 Core – X (Core industry module)	3	5	4.4 Elective – VI (Industry / Entrepreneurship) 20% Theory 80% Practical	3	6
1.5 Generic Elective-II:	3	5	2.5 Generic Elective -IV:	3	5	3.5 Discipline Centric Elective - V	3	5	4.5 Skill Enhancement course / Professional Competency Skill	2	4
SEC	2	2	2.6 NME I	2	2	3.6 NME II	2	2	4.6 Extension Activity	1	
						3.7 Internship/ Industrial Activity	2	-			
	22	30		22	30		24	30		23	30
Total Credit Points -91											

Credit Distribution for PG Programme in Chemistry-M. Sc. Chemistry (I and II Semester)

Category	Course code	Title of the Paper	Credits	No of Hours	Marks (Max 100)	
					CIA	Semester Exam
Semester –I						
1.1 Core I	23P1CCCT1	Organic Reaction Mechanism-I	5	6	25	75
1.2 Core II	23P1CCCT2	Structure and Bonding in Inorganic Compounds	5	6	25	75
1.3 Core III	23P1CCCP1	Organic Practicals	4	6	25	75
1.4 Discipline Centric Elective I	23P1CECT1(A)	Nano materials and Nano technology	3	5	25	75
	23P1CECT1(B)	Pharmaceutical Chemistry				
1.5 Generic Elective II	23P1CECT2(A)	Molecular Spectroscopy	3	5	25	75
	23P1CECT2(B)	Electrochemistry				
SEC-Skill Enhancement Course	23P1CSED1	Preparation of Consumer Products	2	2	25	75
Total hours and credits			22	30		

Semester –II						
2.1Core IV	23P2CCCT3	Organic Reaction Mechanism-II	5	6	25	75
2.2Core V	23P2CCCT4	Physical Chemistry - I	5	6	25	75
2.3Core VI	23P2CCCP2	Inorganic Practicals	4	6	25	75
2.4 Discipline Centric Elective III	23P2CECT3(A)	Green Chemistry	3	5	25	75
	23P2CECT3(B)	Medicinal Chemistry				
2.5Generic Elective IV	23P2CECT4(A)	Bioinorganic Chemistry	3	5	25	75
	23P2CECT4(B)	Material Science				
2.6NME I	23P2CSEN1	Environmental Chemistry	2	2	25	75
Total hours and credits			22	30		

Elective Courses

Courses are grouped (Group A to Group F) so as to include topics from Pure Chemistry (PC), Applied Chemistry (AC) and Industrial Components (IC) like pharmaceutical industries, Polymer labs courses for flexibility of choice by the stakeholders / institutions.

Semester I: Elective I and Elective II

Elective I to be chosen from Group A and Elective II to be chosen from Group B

Group A: (PC/AC/IC)

1. Pharmaceutical Chemistry
2. Nanomaterials and Nanotechnology

Group B:(PC/AC/IC)

1. Electrochemistry
2. Molecular Spectroscopy

Semester II: Elective III & Elective IV

Elective III to be chosen from Group C and Elective IV to be chosen from Group D

Group C:(PC/AC/IC)

1. Medicinal Chemistry
2. Green Chemistry

Group D :(PC/AC/IC)

1. Bioinorganic Chemistry
2. Material Science

Semester III: Elective V

Elective V to be chosen from Group E.

Group E: (PC/AC/IC)

1. Pharmacognosy and Phytochemistry
2. Biomolecules and Heterocyclic compounds

Semester IV: Elective VI

Elective VI to be chosen from Group F.

Group F:(PC/AC/IC)

1. Chemistry of Natural products
2. Polymer Chemistry

Skill Enhancement Courses

Skill Enhancement Courses are chosen to keep in pace with the latest developments in the academic / industrial front and provides flexibility of choice by the stakeholders / institutions.

Group G (Skill Enhancement Courses) SEC:(Practical based paper)

- Computational Chemistry
- 3D printing in Chemistry
- Preparation of Consumer products
- Chemistry in everyday life
- Cosmetic Chemistry
- Origin lab
- Industrial Chemistry
- Research Tools and Techniques

Extra Disciplinary Courses for other Departments (not for Mathematics students)

Students from other Departments may also choose any one of the following as Extra Disciplinary Course.

ED-I: Chemistry for Life Sciences

ED-II: Chemical conservation

ED-III: Chemistry in food preservation

ED-IV: Chemistry for Social studies

ED-V: Chemistry in consumer products

Semester wise mapping of courses with Programme specific outcomes (PSOs)

Semester-I

	Programme learning outcomes	CC1 Organic Reaction Mechanism-I	CC2 Structure and Bonding in Inorganic Compounds	CC3 Organic Practicals	EC1		EC2		SEC1 Preparation of Consumer Products
					Nano materials and Nano technology	Pharmaceutical Chemistry	Molecular Spectroscopy	Electro chemistry	
GRADUATE ATTRIBUTES	PSO-1 <i>Placement</i>	3	3	3	3	2	2	3	2
	PSO-2 <i>Entrepreneur</i>					3	3		2
	PSO-3 <i>Research and Development</i>	3	3	3	3	3	3	3	
	PSO-4 <i>Contribution to Business World</i>	2	2	2	1	1	1	3	3
	PSO-5 <i>Contribution to the Society</i>	2	2	2	2	2	2	1	3
	PSO-6 <i>Contribution to the Multicultural Competence</i>	1	1	1	2	2	2	2	2
	3- Advance Application 2- Intermediate Level 1- Basic Level								

Semester wise mapping of courses with Programme specific outcomes (PSOs)

Semester-II

	Programme learning outcomes	CC4 Organic Reaction Mechanism-II	CC5 Physical Chemistry	CC6 Inorganic Practicals	EC3		EC4		NME1 Environmental Chemistry
					Green Chemistry	Medicinal Chemistry	Bio-inorganic chemistry	Material Science	
GRADUATE ATTRIBUTES	PSO-1 <i>Placement</i>	3	3	3	3	2	2	3	1
	PSO-2 <i>Entrepreneur</i>				1	1		1	1
	PSO-3 <i>Research and Development</i>	2	2	2	3	3	3	3	2
	PSO-4 <i>Contribution to Business World</i>	2	2	2	1	1	1	3	3
	PSO-5 <i>Contribution to the Society</i>	2	2	2	2	2	2	1	3
	PSO-6 <i>Contribution to the Multicultural Competence</i>	1	1	1	2	2	2	2	2
	3- Advance Application 2- Intermediate Level 1- Basic Level								

Title of the Course		ORGANIC REACTION MECHANISM-I						
TANSICHE Course type		CC1						
Course Category		Core						
Nature of Course		Employability / Entrepreneurship / Skill Development						
Category	Core	Year	I	Credits	5	Course Code	23P1CCCT1	
		Semester	I					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		5		1		-		6
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Basic knowledge of organic chemistry						
Objectives of the Course		1. To understand the feasibility and the mechanism of various organic reactions and comprehend the techniques in the determination of reaction mechanisms 2. To correlate and appreciate the differences involved in the various types of organic reaction mechanisms. 3. To design feasible synthetic routes for the preparation of organic compounds.. 4. To understand the concept of stereochemistry involved in organic compounds. 5. To analyze and assign conformations of various molecules and the applications						
Course Outline		Unit-I: Methods of Determination of Reaction Mechanism: (18 Hrs) Reaction intermediates, The transition state, Reaction coordinate diagrams, Thermodynamic and kinetic requirements of reactions: Hammond postulate. Methods of determining mechanism: non-kinetic methods - product analysis, determination of intermediates-isolation, detection, and trapping. Cross-over experiments, isotopic labelling, isotope effects and stereo chemical evidences. Kinetic methods - relation of rate and mechanism. Effect of structure on reactivity: Hammett and Taft equations. Linear free energy relationship, partial rate factor, substituent and reaction constants.						
		Unit-II: Aromatic and Aliphatic Electrophilic Substitution: (18 Hrs) Aromaticity: Aromaticity in benzenoid, non-benzenoid, heterocyclic compounds and annulenes. Aromatic electrophilic substitution: Orientation and reactivity of di- and polysubstituted phenol, nitrobenzene and halobenzene. Reactions involving nitrogen electrophiles: nitration, nitrosation and diazonium coupling; Sulphur electrophiles: sulphonation; Halogen electrophiles: chlorination and bromination; Carbon electrophiles: Friedel-Crafts alkylation, acylation and arylation reactions. Aliphatic electrophilic substitution Mechanisms: SE ₂ and SE _i , SE ₁ - Mechanism and evidences.						

	Unit-III: Aromatic and Aliphatic Nucleophilic Substitution: (18 Hrs) Aromatic nucleophilic substitution: Mechanisms - S_NAr, S_N1 and Benzyne mechanisms - Evidences - Reactivity, Effect of structure, leaving group and attacking nucleophile. Reactions: Oxygen and Sulphur-nucleophiles, Bucherer and Rosenmund reactions, von Richter, Sommelet- Hauser and Smiles rearrangements. S_N1, ion pair, S_N2 mechanisms and evidences. Aliphatic nucleophilic substitutions at an allylic carbon, S_N1, S_N2, S_Ni mechanism - Ambident nucleophiles. Unit-IV: Stereochemistry-I: (18 Hrs) Introduction to molecular symmetry and chirality – axis, plane, center, alternating axis of symmetry. Optical isomerism due to asymmetric and dissymmetric molecules with C, N, S based chiral centers. Optical purity, prochirality, enantiotopic and diastereotopic atoms, groups, faces, axial and planar chirality, chirality due to helical shape, methods of determining the configuration. Racemic modifications: Racemization by thermal, anion, cation, reversible formation, epimerization, mutarotation. D, L system, asymmetric synthesis-Cram's and Prelog's rules: R, S-notations, proR, proS, side phase and re phase Cahn-Ingold-Prelog rules, axial and planar chirality-allenes, spiranes, biphenyls, cyclooctene-Topicity and prostereoisomerism, Stereoselective and stereospecific synthesis. Unit-V: Stereochemistry-II: (18 Hrs) Conformation and reactivity of acyclic systems, intramolecular rearrangements, neighbouring group participation, chemical consequence of conformational equilibrium - Curtin-Hammett Principle. Stability of five and six-membered rings: mono-, di- and polysubstituted cyclohexanes, conformation and reactivity in cyclohexane systems. Fused and bridged rings: bicyclic, poly cyclic systems, decalins and Brett's rule. Optical rotation and optical rotatory dispersion, conformational asymmetry, ORD curves, octant rule, configuration and conformation, Cotton effect, axial haloketone rule and determination of configuration.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on various types of reactions, their mechanisms, stereochemistry and the ways to convert into other molecules by employing suitable reagents and thus it brings employability.

Text Book(s)	1. J. March and M. Smith, Advanced Organic Chemistry, 5th edition, John-Wiley and Sons.2001. 2. E. S. Gould, Mechanism and Structure in Organic Chemistry, Holt, Rinehart and Winston Inc., 1959. 3. P.S.Kalsi, Stereochemistry of carbon compounds, 8th edition, New Age International Publishers, 2015. 4. P. Y. Bruice, Organic Chemistry, 7th edn, Prentice Hall, 2013. 5. J.Clayden, N. Greeves, S. Warren, Organic Compounds, 2nd edition, Oxford University Press, 2014.
Reference Book(s)	1. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry Part-A and B, 5th edition, Kluwer Academic / Plenum Publishers, 2007. 2. D. G. Morris, Stereochemistry, RSC Tutorial Chemistry Text 1, 2001. 3. N.S. Isaacs, Physical Organic Chemistry, ELBS, Longman, UK, 1987. 4. E. L. Eliel, Stereochemistry of Carbon Compounds, Tata-McGraw Hill, 2000. 5. I. L. Finar, Organic chemistry, Vol-1 & 2, 6th edition, Pearson Education Asia, 2004.
Websites and e-Learning resources	1. https://sites.google.com/site/chemistrybookscollection02/home/organic-chemistry/organic 2. https://www.organic-chemistry.org/

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	Recall the basic principles of organic chemistry. Apply the principles of kinetic and non-kinetic methods to determine the mechanism of reactions	K2
CO2	Understand the formation and detection of reaction intermediates of organic reactions.	K3
CO3	Predict the reaction mechanism of organic reactions and stereochemistry of organic compounds.	K4
CO4	Design and synthesize new organic compounds by correlating the stereochemistry of organic compounds	K4
CO5	Propose and construct new organic compounds by applying the stereochemistry principles.	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	1	2	3	3	3	2	2	2
CO2	2	2	1	1	1	3	3	3	2	3	2	2
CO3	2	2	1	1	1	3	3	3	2	3	2	2
CO4	2	2	1	1	1	3	3	3	2	3	2	2
CO5	2	2	1	1	1	3	3	3	3	3	2	2

Assessment Scheme**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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 & B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr.M.Karpagavalli

Title of the Course		STRUCTURE AND BONDING IN INORGANIC COMPOUNDS					
TANSCHÉ Course type		CC2					
Course Category		Core					
Nature of Course		Employability/Skill Oriented					
Category	Core	Year	I	Credits	5	Course Code	23P1CCCT2
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5	1		-		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic concepts of Inorganic Chemistry					
Objectives of the Course		1. To determine the structural properties of main group compounds and clusters. 2. To gain fundamental knowledge on the structural aspects of ionic crystals. 3. To familiarize various diffraction and microscopic techniques. 4. To study the effect of point defects and line defects in ionic crystals. 5. To evaluate the structural aspects of solids.					
Course Outline		Unit I: Structure of main group compounds and clusters: (18 Hrs) VB theory – Effect of lone pair and electronegativity of atoms (Bent’s rule) on the geometry of the molecules; Structure of silicates – applications of Paulings rule of electrovalence - isomorphous replacements in silicates – ortho, meta and pyro silicates – one dimensional, two dimensional and three-dimensional silicates. Structure of silicones, Structural and bonding features of B-N, S-N and P-N compounds; Polyacids – types, examples and structures; Borane cluster: Structural features of closo, nido, arachano and klado; carboranes, hetero and metalloboranes; Wade’s rule to predict the structure of borane cluster;					
		Unit II: Solid state chemistry – I: (18 Hrs) Ionic crystals: Packing of ions in simple, hexagonal and cubic close packing, voids in crystal lattice, Radius ratio, Crystal systems and Bravis lattices, Symmetry operations in crystals, glide planes and screw axis; point group and space group; Solid state energetics: Lattice energy – Born-Lande equation - Kapustinski equation, Madelung constant.					

	Unit III: Solid state chemistry – II: (18 Hrs) Structural features of the crystal systems: Rock salt, zinc blende & wurtzite, fluorite and anti-fluorite, rutile and anatase, cadmium iodide and nickel arsenide; Spinels –normal and inverse types and perovskite structures. Crystal Growth methods: From melt and solution (hydrothermal, sol-gel methods) – principles and examples.
	Unit IV: Techniques in solid state chemistry: (18 Hrs) X-ray diffraction technique: Bragg's law, Powder diffraction method – Principle and Instrumentation; Interpretation of XRD data – es, Phase purity, Scherrer formula, lattice constants calculation; Systematic absence of reflections; Electron diffraction technique – principle, instrumentation and application. Electron microscopy – difference between optical and electron microscopy, theory, principle, instrumentation, sampling methods and applications of SEM and TEM
	Unit V: Band theory and defects in solids (18 Hrs) Band theory – features and its application of conductors, insulators and semiconductors, Intrinsic and extrinsic semiconductors; Defects in crystals – point defects (Schottky, Frenkel, metal excess and metal deficient) and their effect on the electrical and optical property, laser and phosphors; Linear defects and its effects due to dislocations
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will useful to the students to learn fundamental aspects of structure of inorganic molecules and bonding feature of various type of molecules and basic aspects of solid state.
Text Book(s)	1. A R West, Solid state Chemistry and its applications, 2ndEdition (Students Edition), John Wiley & Sons Ltd., 2014. 2. A K Bhagi and G R Chatwal, A textbook of inorganic polymers, Himalaya Publishing House, 2001. 3. L Smart, E Moore, Solid State Chemistry – An Introduction, 4th Edition, CRC Press, 2012. 4. K. F. Purcell and J. C. Kotz, Inorganic Chemistry; W.B. Saunders company: Philadelphia, 2008. 5. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry; 4th ed.; Harper and Row: NewYork, 2006.

Reference Book(s)	1. D. E. Douglas, D.H. McDaniel and J. J. Alexander, Concepts and Models in Inorganic Chemistry, 3rd Ed, 2006. 2. R J D Tilley, Understanding Solids - The Science of Materials, 2nd edition, Wiley Publication, 2013. 3. C N R Rao and J Gopalakrishnan, New Directions in Solid State Chemistry, 2nd Edition, Cambridge University Press, 2000. 4. T. Moeller, Inorganic Chemistry, A Modern Introduction; John Wiley: New York, 1982. 5. D. F. Shriver, P. W. Atkins and C.H. Langford; Inorganic Chemistry; 3rd ed.; Oxford University Press: London, 2001.
Websites and e-Learning resources	1. https://ocw.mit.edu/courses/3-091-introduction-to-solid-state-chemistry-fall-2018/video_galleries/lecture-videos/

COURSE OUTCOMES:

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

COs	COs Statements	K-level
CO1	Predict the geometry of main group compounds and clusters.	K2
CO2	Apply Born-Landé equation and Kapustinski equation	K3
CO3	Understand the various types of ionic crystal systems and analyze their structural features.	K4
CO4	Explain the crystal growth methods	K4
CO5	Understand the principles of diffraction techniques and microscopic techniques	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	2	1	1	2	3	3	3	2	1	2
CO2	2	2	1	1	1	3	3	3	2	3	1	1
CO3	2	1	1	1	1	3	3	3	2	3	2	2
CO4	2	2	1	1	1	3	3	3	2	3	2	2
CO5	2	1	1	1	1	3	3	3	3	3	2	2

Assessment Scheme
Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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 & B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. P. Gajendran

Title of the Course		Organic Practicals					
TANSCHÉ Course type		CC3					
Course Category		Core					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23P1CCC P1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
			1		5		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic concepts of organic chemistry					
Objectives of the Course		1. Understand the concept of separation, qualitative analysis and preparation of organic compounds. 2. Develop analytical skill in the handling of chemical reagents for separation of binary and ternary organic mixtures. 3. Analyze the separated organic components systematically and derivative them suitably. 4. Construct suitable experimental setup for the organic preparations involving two stages. 5. Experiment different purification and drying techniques for the compound processing.					
Course Outline		Separation and analysis: A. Two component mixtures. B. Three component mixtures.					
		Estimations: a) Estimation of Phenol (bromination) b) Estimation of Aniline (bromination) c) Estimation of Ethyl methyl ketone (iodimetry) d) Estimation of Glucose (redox) e) Estimation of Ascorbic acid (iodimetry) f) Estimation of Aromatic nitro groups (reduction) g) Estimation of Glycine (acidimetry) h) Estimation of Formalin (iodimetry) i) Estimation of Acetyl group in ester (alkalimetry) j) Estimation of Hydroxyl group (acetylation) k) Estimation of Amino group (acetylation))					

	Two stage preparations: <i>p</i>-Bromoacetanilide from aniline <i>p</i>-Nitroaniline from acetanilide 1,3,5-Tribromobenzene from aniline - Acetyl salicylic acid from methyl salicylate - Benzilic acid from benzoin <i>m</i>-Nitroaniline from nitrobenzene <i>m</i>-Nitrobenzoic acid from methyl benzoate
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	Students acquire their new skills for synthesis of organic compounds and their analytical skills and can help in their employability and entrepreneurship
Text Book(s)	N. S. Gnanaprakasam and G. Ramamurthy, Organic Chemistry Lab Manual; S. V. Printers, 1987. A. I. Vogel, A. R. Tatchell, B. S. Furnis, A. J. Hannaford and P. W. G. Smith, Vogel's Textbook of Practical Organic Chemistry; 5th Ed., Prentice Hall, 1989
Reference Book(s)	J. Mohan, Organic Analytical Chemistry, Theory and Practice; Narosa, 2003. V. K. Ahluwalia, P. Bhagat and R. Agarwal, Laboratory Techniques in Organic Chemistry; I. K. International, 2005 - Dey and Sitaraman, "Laboratory Manual of Organic Chemistry", Allied Publishers, 1992.
Websites and e-Learning resources	https://www.youtube.com/watch?v=o3h6TpFA1CE https://www.youtube.com/watch?v=Y4NMpO1xI8U https://www.youtube.com/watch?v=mtPBIHu0EZM https://nptel.ac.in/courses/104/106/104106131/ https://nptel.ac.in/courses/104/101/104101127/

COURSE OUTCOMES:

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

	CO Statement	K-level	Marks
CO1	Recall the basic principles of organic separation, qualitative analysis and preparation.	K2	15
CO2	Explain the method of separation and analysis of separated organic mixtures and convert them as derivatives by suitable preparation method.	K3	15
CO3	Determine the characteristics of separation of organic compounds by various chemical reactions.	K4	15
CO4	Develop strategies to separate, analyze and prepare organic compounds.	K4	15
CO5	Formulate a method of separation, analysis of organic mixtures and design suitable procedure for organic preparations.	K4	15

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	1	2	3	3	3	2	2	2
CO2	2	2	1	1	1	3	3	3	2	3	2	2
CO3	2	2	1	1	1	3	3	3	2	3	2	2
CO4	2	2	1	1	1	3	3	3	2	3	2	2
CO5	2	2	1	1	1	3	3	3	3	3	2	2

Assessment Scheme**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Valuation	5
Review	5
Viva-voce	5

Name of the course Designer

- Dr.P.S.Harikrishnan
- Dr.M.Karpagavalli

Title of the Course		NANO MATERIALS AND NANO TECHNOLOGY					
TANSCHÉ Course type		EC1					
Course Category		Elective (Discipline Centric)					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core Elective	Year	I	Credits	3	Course Code	23P1CECT1
		Semest er	I				
Instructional Hours per week		Lect ure	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic knowledge of crystallography and material science					
Objectives of the Course		1. To understand the concept of nano materials and nano technology. 2. To understand the various types of nano materials and their properties. 3. To understand the applications of synthetically important nano materials. 4. To correlate the characteristics of various nano materials synthesized by new technologies. 5. To design synthetic routes for synthetically used new nano materials.					
Course Outline		Unit I: Introduction of nanomaterials and nanotechnologies (15 Hrs) Introduction of nanomaterials and nanotechnologies, -, classification-0D, 1D, 2D, 3D. Synthesis-Bottom–Up, Top–Down. Techniques of synthesis of nanomaterials, Applications of nanomaterials and technologies.					
		Unit II: Bonding and structure of the nanomaterials (15 Hrs) Predicting the Type of Bonding in a Substance crystal structure. Metallic nanoparticles, Surfaces of Materials, Nanoparticle Size and Properties. Synthesis- Physical and chemical methods, arc discharge, laser ablation, sol-gel, solvothermal -CVD-types, plasma enhanced, and low-pressure CVD. Microwave assisted synthesis.					
		Unit III: Mechanical properties (15 Hrs) Mechanical properties of materials, theories relevant to mechanical properties. Techniques to study mechanical properties of nanomaterials, adhesion and friction, thermal properties of nanomaterials Nanoparticles: gold and silver, metal oxides: silica, iron oxide and alumina - synthesis and properties.					

	Unit IV: Electrical properties (15 Hrs) Electrical properties, Conductivity and Resistivity, Classification of Materials based on Conductivity, magnetic properties, electronic properties of materials. Semiconductor materials – classification-Ge, Si, GaAs, SiC, GaN, GaP, CdS, PbS. Identification of materials as p and n-type semiconductor-Hall effect -. Applications of semiconductors: p-n junction as transistors and rectifiers, photovoltaic and photogalvanic cell.
	Unit V: Characterization and Applications (15 Hrs) Nano thin films, nanocomposites-Application of nanoparticles in different fields. Core-shell nanoparticles - types, synthesis, and properties. Nanocomposites - metal-, ceramic- and polymer-matrix composites-applications. Characterization – SEM, TEM and AFM - principle, instrumentation and applications.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on concept of nano materials and nano technology, various types of nano materials and their properties, applications of synthetically important nano materials, characteristics of various nano materials synthesized by new technologies and synthetic routes for synthetically used new nano materials and thus it brings employability.
Text Book(s)	1. S.Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016. 2. Arumugam, Materials Science, Anuradha Publications,2007. 3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010
Reference Book(s)	1. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012. 2. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6th ed., PEARSON Press, 2007

Websites and e-Learning resources	1. https://www.agc.ac.in/resources/Introduction_to_Nanomaterials_and_Nanotechnology.pdf 2. https://ion2.upm.edu.my/article/introduction_to_nanomaterials-68574 3. https://news.umich.edu/nanotechnology-theory-predicts-new-type-of-bond-that-assembles-nanoparticle-crystals/ 4. https://www.degruyter.com/document/doi/10.1515/ntrev-2020-0021/html?lang=en 5. https://www.hindawi.com/journals/jnm/2015/892542/

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	Discuss the features, background of nanostructures and techniques of synthesis of nanomaterials.	K2
CO2	Find the bonding, structure of the nanomaterials and organize its physical and chemical synthetic methods.	K3
CO3	Illustrate the mechanical and thermal properties of nanomaterials	K4
CO4	Classify the materials based on Conductivity, magnetic properties, electronic properties of materials and applications of semiconductors.	K4
CO5	Analyse the nano thin films, nanocomposites and application of nanoparticles in different fields.	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	2	2	3	3	3	2	2	3
CO2	2	2	1	1	2	3	3	3	2	3	2	3
CO3	2	2	1	1	2	3	3	3	2	3	2	3
CO4	2	2	1	1	2	3	3	3	2	3	2	3
CO5	2	2	1	1	2	3	3	3	3	3	2	3

Assessment Schema

Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Course Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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& B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. P. Prasanna

Title of the Course		PHARMACEUTICAL CHEMISTRY					
TANSCHÉ Course type		ECI					
Course Category		Elective (Discipline Centric)					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core Elective	Year	I	Credits	3	Course Code	23P1CECT1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic knowledge of organic chemistry					
Objectives of the Course		1. To understand the advanced concepts of pharmaceutical chemistry. 2. To recall the principle and biological functions of various drugs. 3. To train the students to know the importance as well the Consequences of various drugs. 4. To have knowledge on the various analysis and techniques. 5. To familiarize on the drug dosage and its structural activities					
Course Outline		Unit-I: Physical properties in Pharmaceuticals: (15 Hrs) Physical properties of drug molecule: physical properties. Refractive index- Definition, explanation, formula, importance, determination, specific & molar refraction. Optical activity\rotation- monochromatic & polychromatic light, optical activity, angle of rotation, specific rotation examples, measurement of optical activity. Dielectric constant & Induced Polarization- Dielectric constant explanation & determination. Rheology of pharmaceutical systems: Introduction, Definition, Applications, concept of viscosity, Newton’s law of flow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity. Newtonian system, non-Newtonian system- Plastic flow, Pseudoplastic flow, Dilatent flow. Viscosity measurements- selection of viscometer for Newtonian and non-Newtonian system.					
		Unit-II: Isotopic Dilution analysis: (15 Hrs) Principle and applications, Neutron activation analysis: Principle, advantages and limitations, Scintillation counters: Body scanning. Introduction to radiopharmaceuticals. Properties of various types of radiopharmaceuticals, Radiopharmaceuticals as diagnostics, as therapeutics, for research and sterilization. Physico Chemical Properties and drug action. Physico chemical properties of drugs (a) Partition coefficient, (b) solubility (c) surface activity, (d) degree of ionization.					
		Unit-III: Drug dosage and product development: (15 Hrs) Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products,					

	need for a dosage form, classification of dosage forms. Drug dosage and product development. Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms.
	Unit-IV: Development of new drugs: (15 Hrs) Introduction, procedure followed in drug design, the research for lead compounds, molecular modification of lead compounds. Structure-Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect, isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups, theories of drug activity, occupancy theory, rate theory, induced-fit theory, 4.3 Quantitative structure activity relationship (QSAR): Development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables.
	Unit-V: Computers in Pharmaceutical Chemistry: (15 Hrs) Need of computers for chemistry. Computers for Analytical Chemists- Introduction to computers: Organization of computers, CPU, Computer memory, I/O devices, information storage, software components. Application of computers in chemistry: Programming in high level language (C+) to handle various numerical methods in chemistry – least square fit, solution to simultaneous equations, interpolation, extrapolation, data smoothing, numerical differentiation and integrations.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on various types of drugs, their SAR and the ways to computerize molecules for drug actions applications and designing new drugs.
Text Book(s)	1. Physical Chemistry- Bahl and Tuli. 2. Text Book of Physical Pharmaceutics, IInd edition, Vallabh Prakashan-. C.V.S. Subramanyam. 3. Medicinal Chemistry (Organic Pharmaceutical Chemistry), G.R Chatwal, Himalaya Publishing house.

	- Instrumental method of Analysis: Hubert H, Willard, 7th edition. - Textbook of Pharmaceutical Chemistry by, Jayshree Ghosh, S. Chand & company Ltd. Pharmaceutical Chemistry by Dr. S. Lakshmi, Sultan chand & Sons.
Reference Book(s)	- Computers in chemistry, K.V. Raman, Tata Mc.Graw-Hill, 1993. - Computers for Chemists, S.K Pundir, Anshu bansal, A pragate prakashan., 2 nd edition, New age international (P) limited, New Delhi. - Physical Pharmacy and Pharmaceutical Sciences by Martins, Patrick J. Sinko, Lippincott. William and Wilkins. - Cooper and Gunn's Tutorial Pharmacy ,6th edition by S.J. Carter, CBS Publisher Ltd. - Ansels pharmaceutical Dosage forms and Drug Delivery System by Allen Popvich and Ansel, Indian edition-B.I. Publication Pvt. Ltd.
Websites and e-Learning resources	https://sites.google.com/site/chemistryebookscollection02/home/organic-chemistry/organic https://www.organic-chemistry.org/

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	Identify the suitable drugs for various diseases.	K2
CO2	Apply the principles of various drug action and drug design.	K3
CO3	Acquire the knowledge on product development based on SAR.	K4
CO4	Apply the knowledge on applications of computers in chemistry.	K4
CO5	Synthesize new drugs after understanding the concepts SAR.	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	1	2	3	3	3	2	2	2
CO2	2	2	1	1	1	3	3	3	2	3	2	2
CO3	2	2	1	1	1	3	3	3	2	3	2	2
CO4	2	2	1	1	1	3	3	3	2	3	2	2
CO5	2	2	1	1	1	3	3	3	3	3	2	2

Assessment Scheme**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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 & B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr.M.Karpagavalli

Title of the Course		MOLECULAR SPECTROSCOPY					
TANSCHÉ Course type		ECII					
Course Category		Elective (Generic Elective)					
Nature of Course		Skill Development					
Category	Core Elective	Year	I	Credits	3	Course Code	23P1CECT2
		Semester	I				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		4	1	-		5	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic knowledge of spectroscopy					
Objectives of the Course		1. To understand the influence of rotation and vibrations on the spectra of the polyatomic molecules. 2. To study the principle of Raman spectroscopy, ESR spectroscopy, EPR spectroscopy and fragmentation patterns in Mass spectroscopy. 3. To highlight the significance of Franck-Condon principle to interpret the selection rule, intensity and types of electronic transitions and the principl, applications of XPS and LASER. 4. To interpret the first and second order NMR spectra in terms of splitting and coupling patterns using correlation techniques such as COSY, HETCOR, NOESY. 5. To study the principle of Mass, EPR and Mossbauer Spectroscopy, and carry out the structural elucidation of molecules using different spectral techniques.					
		Unit-I: Rotational and Raman Spectroscopy: (15 Hrs) Rotational spectra of diatomic and polyatomic molecules. Intensities of rotational spectral lines, effect of isotopic substitution. Non-rigid rotators. Classical theory of the Raman effect, polarizability as a tensor, quantum theory of the Raman effect, Pure rotational Raman spectra of linear and asymmetric top molecules, Stokes and anti-Stokes lines. Vibrational Raman spectra, Raman activity of vibrations, rule of mutual exclusion, rotational fine structure-O and S branches, Polarization of Raman scattered photons.					
		Unit-II: Vibrational Spectroscopy: (15 Hrs) Vibrations of molecules, harmonic and anharmonic oscillators- vibrational energy expression, energy level diagram, vibrational wave functions and their symmetry, selection rules, expression for the energies of spectral lines, hot bands, effect of isotopic substitution. Diatomic vibrating rotor, vibrational-rotational spectra of diatomic molecules, P, R branches, breakdown of the Born-Oppenheimer approximation. Vibrations of polyatomic molecules – symmetry properties, overtone and combination frequencies. Influence of rotation on vibrational spectra of polyatomic molecule, P, Q, R branches					

	Unit-III: Electronic spectroscopy: (15 Hrs) Electronic Spectroscopy: Electronic spectroscopy of diatomic molecules, Frank-Condon principle, dissociation and predissociation spectra. $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$ transitions and their selection rules. Photoelectron Spectroscopy: Basic principles, photoelectron spectra of simple molecules, X-ray photoelectron spectroscopy (XPS). Lasers: Laser action, population inversion, properties of laser radiation, examples of simple laser systems.
	Unit-IV: NMR and ESR spectroscopy: (15 Hrs) Chemical shift, Factors influencing chemical shifts: electronegativity and electrostatic effects; Mechanism of shielding and deshielding. Spin-spin interactions: Homonuclear coupling interactions - AX, AX₂, AB types. Vicinal, germinal and long-range coupling-spin decoupling. Nuclear Overhauser effect (NOE), Factors influencing coupling constants and Relative intensities. ¹³CNMR and structural correlations, Brief introduction to 2D NMR – COSY, NOESY. ESR spectroscopy: Characteristic features of ESR spectra, line shapes and line widths; ESR spectrometer. The g value and the hyperfine coupling parameter (A), origin of hyperfine interaction. Interpretation of ESR spectra and structure elucidation of organic radicals using ESR spectroscopy; Spin orbit coupling and significance of g-tensors, zero/non-zero field splitting, Kramer's degeneracy.
	UNIT-V: Mass Spectrometry and Mossbauer Spectroscopy: (15 Hrs) Ionization techniques- Electron ionization (EI), chemical ionization (CI), electrospray ionization (ESI), isotope abundance, molecular ion, fragmentation processes of organic molecules, deduction of structure through mass spectral fragmentation, high resolution. Effect of isotopes on the appearance of mass spectrum. Principle of Mossbauer spectroscopy: Doppler shift, recoil energy. Isomer shift, quadrupole splitting, magnetic interactions. Applications: Mossbauer spectra of high and low-spin Fe and Sn compounds.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	To improve the Analytical skill and spectral interpretation of data for structural elucidation

Text Book(s)	1. C. N. Banwell and E. M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, 4th Ed., Tata McGraw Hill, New Delhi, 2000. 2. R. M. Silverstein and F. X. Webster, <i>Spectroscopic Identification of Organic Compounds</i>, 6th Ed., John Wiley & Sons, New York, 2003. 3. W. Kemp, <i>Applications of Spectroscopy</i>, English Language Book Society, 1987. 4. D. H. Williams and I. Fleming, <i>Spectroscopic Methods in Organic Chemistry</i>, 4th Ed., Tata McGraw-Hill Publishing Company, New Delhi, 1988. 5. R. S. Drago, <i>Physical Methods in Chemistry</i>; Saunders: Philadelphia, 1992.
Reference Book(s)	1. P.W. Atkins and J. de Paula, <i>Physical Chemistry</i>, 7th Ed., Oxford University Press, Oxford, 2002. 2. I. N. Levine, <i>Molecular Spectroscopy</i>, John Wiley & Sons, New York, 1974. 3. A. Rahman, <i>Nuclear Magnetic Resonance-Basic Principles</i>, Springer-Verlag, New York, 1986. 4. K. Nakamoto, <i>Infrared and Raman Spectra of Inorganic and coordination Compounds</i>, PartB: 5th ed., John Wiley& Sons Inc., New York, 1997. 5. J. A. Weil, J. R. Bolton and J. E. Wertz, <i>Electron Paramagnetic Resonance</i>; Wiley Interscience, 1994.
Websites and e-learning resources	1. https://onlinecourses.nptel.ac.in/noc20_cy08/preview 2. https://www.digimat.in/nptel/courses/video/104106122/L14.html

COURSE OUTCOMES:

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

CO1	Understand the importance of rotational and Raman spectroscopy.	K2
CO2	Apply the vibrational spectroscopic techniques to diatomic and polyatomic molecules.	K3
CO3	Evaluate different electronic spectra of simple molecules using electronic spectroscopy and understand the principle of XPS and LASER.	K4
CO4	Analyse the NMR, ¹³ C NMR, 2D NMR – COSY, NOESY, ³¹ P, ¹⁹ F NMR and ESR spectroscopic techniques.	K4
CO5	Inspect structure of simple molecules using Mass Spectrometry, and Mossbauer spectroscopy techniques.	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	1	2	3	3	3	3	3	2
CO2	2	2	1	2	1	2	3	3	3	3	2	2
CO3	2	2	1	2	1	2	3	3	2	3	2	2
CO4	3	2	1	1	1	3	3	3	2	3	3	2
CO5	2	2	1	1	1	3	3	3	3	2	2	2

Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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 & B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

Dr. M. Malarvizhi

Title of the Course		ELECTROCHEMISTRY					
TANSCH Course type		ECII					
Course Category		Elective (Generic Elective)					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core Elective	Year	I	Credits	3	Course Code	23P1CECT2
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1		-		5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic knowledge of electrochemistry					
Objectives of the Course		1. To understand the behavior of electrolytes in terms of conductance, ionic atmosphere, interactions. 2. To familiarize the structure of the electrical double layer of different models. 3. To compare electrodes between current density and over potential. 4. To discuss the mechanism of electrochemical reactions. 5. To highlight the different types of over voltages and its applications in electroanalytical techniques					
Course Outline		Unit I: Ionics: (15 Hrs) Arrhenius theory -limitations, van't Hoff factor and its relation to colligative properties. Deviation from ideal behavior. Ionic activity, mean ionic activity and mean ionic activity coefficient-concept of ionic strength, Debye Huckel theory of strong electrolytes, activity coefficient of strong electrolytes Determination of activity coefficient ion solvent and ion-ion interactions. Born equation. Debye-Huckel Bjerrum model. Derivation of Debye-Huckel limiting law at appreciable concentration of electrolytes modifications and applications. Electrolytic conduction-Debye-Huckel Onsager treatment of strong electrolyte-qualitative and quantitative verification and limitations. Evidence for ionic atmosphere. Ion association and triple ion formations.					
		Unit II: Electrode-electrolyte interface: (15 Hrs) Interfacial phenomena -Evidences for electrical double layer, polarizable and non-polarizable interfaces, Electrocapillary phenomena - Lippmann equation electro capillary curves. Electro-kinetic phenomena electro-osmosis, electrophoresis, streaming and sedimentation potentials, colloidal and poly electrolytes. Structure of double layer: Helmholtz -Perrin, Guoy- Chapman and Stern models of electrical double layer. Zeta potential and potential at zero charge. Applications and limitations					

	Unit III: Electrodicts of Elementary Electrode Reactions: (15 Hrs) Behavior of electrodes: Standard electrodes and electrodes at equilibrium. Anodic and Cathodic currents, condition for the discharge of ions. Nernst equation, polarizable and non-polarizable electrodes. Model of three electrode system, over potential. Rate of electro chemical reactions: Rates of simple elementary reactions. Butler-Volmer equation-significance of exchange current density, net current density and symmetry factor. Low and high field approximations. symmetry factor and transfer coefficient Tafel equations and Tafel plots.
	Unit IV: Electrodicts of Multistep Multi Electron System: (15 Hrs) Rates of multi-step electrode reactions, Butler - Volmer equation for a multi-step reaction. Rate determining step, electrode polarization and depolarization. Transfer coefficients, its significance and determination, Stoichiometric number. Electro-chemical reaction mechanisms-rate expressions, order, and surface coverage. Reduction of I^{3-}, Fe^{2+}, and dissolution of Fe to Fe^{2+}. Overvoltage - Chemical and electro chemical, Phase, activation and concentration over potentials. Evolution of oxygen and hydrogen at different pH. Pourbiax and Evan's diagrams
	Unit V: Concentration Polarization, Batteries and Fuel cells: (15 Hrs) Modes of Transport of electro active species - Diffusion, migration and hydrodynamic modes. Role of supporting electrolytes. Polarography-principle and applications. Principle of square wave polarography. Cyclic voltammetry- anodic and cathodic stripping voltammetry and differential pulse voltammetry. Sodium and lithium-ion batteries and redox flow batteries. Mechanism of charge storage: conversion and alloying. Capacitors- mechanism of energy storage, charging at constant current and constant voltage. Energy production systems: FuelCells: classification, alkaline fuel cells, phosphoric acid fuel cells, high temperature fuel cells
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on electrochemistry, electrical double layer, electrokinetic phenomenon, battery and fuel cells.

Text Book(s)	1. D. R. Crow, Principles and applications of electrochemistry, 4th edition, Chapman & Hall/CRC, 2014. 2. J. Rajaram and J.C. Kuriakose, Kinetics and Mechanism of chemical transformations Macmillan India Ltd., New Delhi, 2011. 3. S. Glasstone, Electro chemistry, Affiliated East-West Press, Pvt., Ltd., New Delhi, 2008. 4. B. Viswanathan, S. Sundaram, R. Venkataraman, K. Rengarajan and P.S. Raghavan, Electrochemistry-Principles and applications, S. Viswanathan Printers, Chennai, 2007. 5. Joseph Wang, Analytical Electrochemistry, 2nd edition, Wiley, 2004.
Reference Book(s)	1. J.O.M. Bockris, A.K.N. Reddy and M.G. Aldeco Morden Electro chemistry, vol. 2A, Springer, Plenum Press, New York, 2008. 2. Philip H. Rieger, Electrochemistry, 2nd edition, Springer, New York, 2010. 3. L.I. Antropov, Theoretical electrochemistry, Mir Publishers, 1977. 4. K.L. Kapoor, A Text book of Physical chemistry, volume-3, Macmillan, 2001.
Websites and e-Learning resources	1. https://www.pdfdrive.com/modern-electrochemistry-e34333229.

COURSE OUTCOMES:

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

COs		K-level
CO1	Understand the behaviour of electrolytes in solution and compare the structures of electrical double layer of different models	K2
CO2	Predict the kinetics of electrode reactions applying Butler-Volmer and Tafel equations	K3
CO3	Study different thermodynamic mechanism of corrosion,	K4
CO4	Discuss the theories of electrolytes, electrical double layer, electrostatics and activity coefficient of electrolytes	K4
CO5	Have knowledge on storage devices and electrochemical reaction mechanism	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	2	1	1	2	3	3	3	2	2	2
CO2	2	2	1	1	1	3	3	3	2	3	2	2
CO3	2	1	1	1	1	3	3	3	2	3	2	2
CO4	2	2	1	1	1	3	3	3	2	3	2	2
CO5	2	1	1	1	1	3	3	3	3	3	1	1

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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& B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. R. Ramachandran

Title of the Course		PREPARATION OF CONSUMER PRODUCTS					
TANSCH Course type		SEC					
Course Category		Skill Enhancement Course					
Nature of Course		Skill Development					
Category	Core Elective	Year	I	Credits	2	Course Code	23P1CSED1
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2			-		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic knowledge of chemistry in consumer products					
Objectives of the Course		1. To understand the concepts of making soaps. 2. To understand the composition of various detergents 3. To recognize about preparation of shampoos 4. To learn the making face creams 5. To study the various cosmetics.					
		Unit-I :Soaps (6 Hrs) Saponification of oils and fats, Manufacture of soaps, Formulation of toilet soaps, Different ingredients used and their functions- Medicated soaps, Herbal soaps, Mechanism of action of soap, Soft soaps, Shaving soaps and creams,					
		Unit-II: Detergents (6 Hrs) Anionic detergents: Manufacture of LAB (linear alkyl benzene), Sulphonation of LAB– preparation of acid slurry, different ingredients in the formulation of detergent powders and soaps, Liquid detergents. Cationic detergents: Manufacture and applications. Non–ionic detergents with examples and manufacture of ethylene oxide condensate. Mechanism of action of detergents, Comparison of soaps and detergents, Biodegradation–environmental effects,					
		Unit-III: Shampoos (6 Hrs) Manufacture of Sodium lauryl sulphate (SLS), Ingredients, Functions. Different kinds of shampoos : anti– dandruff, anti–lice, herbal and baby shampoos. Permanent colouring- Natural Organic dyes-Henna Shampoo-Henna Mixtures-Synthetic dyes-Amino dyes-Colour Shampoos.					
		Unit-IV : Skin Creams Preparation (6 Hrs) Shaving cream-Shaving soap and creams-Brushless shaving creams-solid shaving preparation-lather shaving cream- anti perspirants- liquid anti perspirants- anti perspirants creams-Formulas and Preparation-Deodorants-Formula and Preparation					

	Unit-V: Cosmetics (6 Hrs) Nail polish: preparation and its removers, Nail enamel-Nail polish powders and nail polish pastes- Lipsticks, eyebrow pencils, Mascara
Extended Professional Component (is a part of internal component only, Not to be included in the External examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge about consumer products and their utilities.
Justification for nature of course	This course will enable to the students to enrich their knowledge on various consumer products and their standard specifications.
Text Book(s)	1. Biswas, A.K., Frontiers in Applied Chemistry, Narosa publishing house, 1989 2. Vermain, O.P, Narula A.C., Applied chemistry theory and books.
Reference Book(s)	1. S. Gobala Rao, Outlines of Chemical Technology, Affiliated East West press, 1998. 2. Kafaro, Wasteless chemical processing, Mir publishers, 1995. 3. W. Sawyer, Experimental Cosmetics, Dover publishers, New York, 2000

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	Understand the concepts of making soaps.	K2
CO2	Associate the composition of various detergents	K2
CO3	Recognize about preparation of shampoos	K2
CO4	Express to learn the making face creams	K2
CO5	Generalise to study the various cosmetics	K2

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	2	1	3	3	3	2	3	3	3	1
CO2	3	3	2	2	3	3	3	2	3	1	1	1
CO3	3	2	1	2	3	3	3	3	2	3	1	3
CO4	3	1	1	3	3	3	3	3	3	2	3	3
CO5	2	3	3	3	3	3	3	3	1	3	2	2

Assessment Schema

Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination**Articulation Mapping-K Levels with Courses Learning Outcomes (COs)**

S. No.	COs	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	CO1	Up to K2	1	K1	1	2 (K2& K2)	1(K1)
2	CO2	Up to K2	1	K1	1	2 (K2 & K2)	1 (K1)
3	CO3	Up to K2	1	K1	1	2 (K2 & K2)	1 (K1)
4	CO4	Up to K2	1	K1	1	2 (K2 & K2)	1 (K1)
5	CO5	Up to K2	1	K1	1	2 (K2 & K2)	1 (K1)
No. of Questions to be asked			5		5		5
No. of Questions to be answered			5		5		3
Marks for each question			2		7		10
Total Marks for each section			10		35		30

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 without choice	Consolidated %
K1	10	-	50	60	46	46
K2	-	70		70	54	54
Total Marks	10	70	50	130	100	100

Name of the course Designer

Dr.S.Selvakumar

Title of the Course		ORGANIC REACTION MECHANISM-II						
TANSCHÉ Course type		CC4						
Course Category		Core						
Nature of Course		Employability / Entrepreneurship / Skill Development						
Category	Core	Year	I	Credits	5	Course Code	23P2CCCT3	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		5		1		-		6
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Basic knowledge of organic chemistry						
Objectives of the Course		1. To understand the concepts of elimination and free radical reactions. 2. To understand various oxidation and reduction of organic molecules with variety of reagents, conditions, etc. 3. To recognize about rearrangement reactions and its synthetic applications. 4. To explain the various addition reactions such as Carbon-Carbon multiple bonds and Carbon-heteroatom multiple bonds with mechanism and stereochemical aspects. 5. To understand the applications of synthetically important reagents for novel synthetic routes.						
Course Outline		Unit I: Elimination and Free Radical Reactions: (18 Hrs) Mechanisms: E2, E1, and E1cB mechanisms. Syn- and anti-eliminations. Orientation of the double bond: Hoffmann and Saytzeff rules. Reactivity: Effect of substrate, attacking bases, leaving group and medium. Stereochemistry of eliminations in acyclic and cyclic systems, pyrolytic elimination. Long lived and short-lived radicals – Production of radicals by thermal and photochemical reactions, Detection and stability of radicals, characteristics of free radical- reactions of radicals; polymerization, addition, halogenations, aromatic substitutions, rearrangements. Reactivity: Reactivity on aliphatic, aromatic substrates, reactivity in the attacking radical, effect of solvent.						

	Unit II: Oxidation and Reduction Reactions (18 Hrs) Mechanisms: Direct electron transfer, hydride transfer, hydrogen transfer, displacement, addition-elimination, oxidative and reductive coupling reactions. Mechanism of oxidation reactions: Dehydrogenation by quinones, selenium dioxides, ferricyanide, mercuric acetate lead tetraacetate, permanganate, manganese dioxide, osmium tetroxide, oxidation of saturated hydrocarbons, alkyl groups, alcohols, halides and amines. Reactions involving cleavage of C-C bonds - cleavage of double bonds, oxidative decarboxylation, allylic oxidation, oxidation by chromium trioxide-pyridine, DMSO-Oxalyl chloride (Swern oxidation) and Corey-Kim oxidation, dimethyl sulphoxide- dicyclohexyl carbodiimide (DMSO-DCC). Mechanism of reduction reactions: Wolff-Kishner, Clemmenson, Rosenmund, reduction with Trialkyl and triphenyltin hydrides, McFadyen-Steven's reduction, Homogeneous hydrogenation, Hydroboration with cyclic systems, MPV and Bouveault-Blanc reduction. Unit III: Rearrangements: (18 Hrs) Rearrangements to electron deficient carbon: Pinacol-pinacolone and semi-pinacolone rearrangements -applications and stereochemistry, Wagner-Meerwein, Demjanov, Dienone-phenol, Baker-Venkataraman, Benzilic acid and Wolff rearrangements. Rearrangements to electron deficient nitrogen: Hofmann, Curtius, Schmidt, Lossen, Beckmann Rearrangements to electron deficient oxygen: Baeyer-Villiger oxidation and Dakin rearrangements. Rearrangements to electron rich atom: Favorskii, Quasi-Favorskii, Stevens, Wittig rearrangements. Fries and Photo Fries rearrangement. Intramolecular rearrangements – Claisen, Cope, oxy-Cope Benzidine rearrangements. Unit IV: Addition to Carbon Multiple Bonds: (18 Hrs) Mechanisms: (a) Addition to carbon-carbon multiple bonds- Addition reactions involving electrophiles, nucleophiles, free radicals, carbenes and cyclic mechanisms-Orientation and reactivity, hydrogenation of double and triple bonds, Michael reaction, addition of oxygen and Nitrogen; (b) Addition to carbon-hetero atom multiple bonds: Mannich reaction, acids, esters, nitrites, addition of Grignard reagents, Wittig reaction, Prins reaction. Stereochemical aspects of addition reactions. Addition to Carbon-Hetero atom multiple bonds: Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Mechanism of condensation reactions involving enolates – Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

	Unit V: Reagents and Modern Synthetic Reactions: (18 Hrs) Lithium diisopropylamine (LDA), Azobisisobutyronitrile (AIBN), Sodium cyanoborohydride (NaBH_3CN), <i>meta</i> -Chloroperbenzoic acid (<i>m</i> -CPBA), Dimethyl aminopyridine (DMAP), $\text{n-Bu}_3\text{SnD}$, Diazobicyclo[5.4.0]undec-7-ene (DBU), Diisopropyl-azodicarboxylate (DIAD), Diethylazodicarboxylate (DEAD), <i>N</i> -bromo-succinimide (NBS), Tetramethyl piperidyl-1-oxyl (TEMPO), Phenyltrimethyl-ammonium tribromide (PTAB). Diazomethane and Zn-Cu, Diethyl maleate (DEM), Pyridinium chlorochromate (PCC), Pyridinium dichromate (PDC), Meisenheimer complex. Suzuki coupling, Heck reaction, Negishi reaction, Baylis-Hillman reaction.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on various types of reactions, their mechanisms and the ways to convert into other molecules by employing suitable reagents and thus it brings employability.
Text Book(s)	1. M. B. Smith, March's Advanced Organic Chemistry: Reactions, Mechanism and structure, 7th ed., Wiley student edition 2015. 2. R.O.C. Norman and J. M. Coxon, Principles of Organic Synthesis, 3rd ed., CRC Press, 1993. 3. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd ed., Oxford University Press, 2012.
Reference Book(s)	1. J. J. Li, Name Reactions: A Collection of Detailed Mechanisms and Synthetic Applications, 5th ed., Springer, 2014. 2. P. S. Kalsi, Stereochemistry Confirmation and Mechanism, 11th ed., New Age International Publishers, 2022.
Websites and e-Learning resources	1. https://www.organic-chemistry.org/ 2. https://onlinecourses.nptel.ac.in/noc23_cy54/preview 3. https://onlinecourses.nptel.ac.in/noc23_cy57/preview

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	Describe the mechanism of elimination and free radical reactions on various substrate.	K2
CO2	Identify suitable oxidising and reducing agent for given conversion.	K3
CO3	Inspect the type of rearrangements involved for the given conversion of molecules.	K4
CO4	Analyse new routes to synthesis organic compounds via addition to Carbon multiple bonds.	K4
CO5	Examine the suitable reagents for the conversion of selective organic compounds.	K4

MAPPING WITH PROGRAMME OUTCOMES

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	1	2	3	3	3	2	2	2
CO2	2	2	1	1	1	3	3	3	2	3	2	2
CO3	2	2	1	1	1	3	3	3	2	3	2	2
CO4	2	2	1	1	1	3	3	3	2	3	2	2
CO5	2	2	1	1	1	3	3	3	3	3	2	2

Assessment Schema

Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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& B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. S. V. Karthikeyan

Title of the Course		PHYSICAL CHEMISTRY-I						
TANSCHÉ Course type		CC5						
Course Category		Core						
Nature of Course		Employability / Skill Development						
Category	Core	Year	I	Credits	5	Course Code	23P2CCCT4	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		5		1		-		6
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Basic knowledge of Physical chemistry						
Objectives of the Course		1. To recall the fundamentals of thermodynamics and the composition of partial molar quantities. 2. To understand the classical and statistical approach of the functions 3. To compare the significance of Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein 4. To correlate the theories of reaction rates for the evaluation of thermodynamic parameters. 5. To study the mechanism and kinetics of reactions						
Course Outline		Unit I: Classical Thermodynamics: (18 Hrs) Partial molar properties-Chemical potential, Gibb’s- Duhem equation-binary systems. Determination of partial molar quantities. Thermodynamics of real gases - Fugacity- determination of fugacity by graphical and equation of state methods-dependence of temperature, pressure and composition. Thermodynamics of ideal and non-ideal binary mixtures, Duhem - Margulus equation applications of ideal and non-ideal mixtures. Activity and activity coefficients-standard states - determination-vapour pressure, EMF and freezing point methods.						
		Unit II: Statistical thermodynamics: (18 Hrs) Introduction of statistical thermodynamics concepts of thermodynamic and mathematical probabilities-distribution of distinguishable and non-distinguishable particles. Assemblies, ensembles, canonical particles. Maxwell - Boltzmann, Fermi Dirac & Bose-Einstein Statistics- comparison Partition functions-evaluation of translational, vibrational and rotational partition functions for monoatomic, diatomic and polyatomic ideal gases. Thermodynamic functions in terms of partition functions-calculation of equilibrium constants. Statistical approach to Thermodynamic properties: pressure, internal energy, entropy, enthalpy, Gibb’s function, Helmholtz function residual entropy, equilibrium constants. Heat capacity of mono and di atomic gases. Heat capacity of solids-Einstein and Debye models.						

	Unit III: Irreversible Thermodynamics: (18 Hrs) Theories of conservation of mass and energy entropy production in open systems by heat, matter and current flow, force and flux concepts. Onsager theory-validity and verification- Onsager reciprocal relationships. Electro kinetic and thermo mechanical effects-Application of irreversible thermodynamics to biological systems. Unit IV: Kinetics of Reactions: (18 Hrs) Theories of reactions-effect of temperature on reaction rates, collision theory of reaction rates, Unimolecular reactions -Lindeman and Christiansen hypothesis- molecular beams, collision cross sections, effectiveness of collisions, Potential energy surfaces. Transition state theory-evaluation of thermodynamic parameters of activation-applications of ARRT to reactions between atoms and molecules, time and true order-kinetic parameter evaluation. Factors determine the reaction rates in solution - primary salt effect and secondary salt effect, Homogeneous catalysis- acid- base catalysis-mechanism of acid base catalyzed reactions- Bronsted catalysis law, enzyme catalysis-Michelis-Menton catalysis Unit V Kinetics of complex and fast reactions: (18 Hrs) Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions. Chain reactions- kinetics of $H_2 - Cl_2$ & $H_2 - Br_2$ reactions (Thermal and Photochemical reactions) - Rice Herzfeld mechanism. Study of fast reactions-relaxation methods- temperature and pressure jump methods -stopped flow flash photolysis methods and pulse radiolysis. Kinetics of polymerization-free radical, cationic, anionic polymerization - Polycondensation.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on classical thermodynamics, statistical thermodynamics, study of kinetics and fact reactions

Text Book(s)	1. J. Rajaram and J.C. Kuriacose, Thermodynamics for Students of Chemistry, 2nd edition, S.L.N. Chand and Co., Jalandhar, 2003. 2. I.M. Klotz and R.M. Rosenberg, Chemical thermodynamics, 6th edition, W.A. Benjamin Publishers, California, 1977. 3. M.C. Gupta, Statistical Thermodynamics, New Age International, Pvt. Ltd., New Delhi, 2001. 4. K.J. Laidler, Chemical Kinetics, 3rd edition, Pearson, Reprint - 2013.
Reference Book(s)	1. D.A. Mcquarrie And J.D. Simon, Physical Chemistry - A Molecular Approach, Viva Books Pvt. Ltd., New Delhi, 2001. 2. R.P. Rastogi and R.R. Misra, Classical Thermodynamics, Vikas Publishing, Pvt. Ltd., New Delhi, 2005. 3. S.H. Maron and J.B. Lando, Fundamentals of Physical Chemistry, Macmillan Publishers, New York, 2003 4. K.B. Ytziimiriski, "Kinetic Methods of Analysis", Pergamon Press, 2000. 5. Gurdeep Raj, Phase rule, Goel Publishing House, 2011.
Websites and e-Learning resources	1. https://nptel.ac.in/courses/104/103/104103112/ 2. https://bit.ly/3tL3GdN

COURSE OUTCOMES:

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

COs	COs Statement	K-level
CO1	Explain the classical and statistical concepts of thermodynamics.	K2
CO2	Apply the concepts of thermodynamics to study the kinetics of chemical reactions.	K3
CO3	Discuss the various thermodynamic and kinetic determination	K4
CO4	Evaluate the thermodynamic methods for real gases and mixtures	K4
CO5	Compare the theories of reactions rates and fast reactions.	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	1	2	3	3	3	2	2	2
CO2	2	2	1	1	1	3	3	3	2	3	2	2
CO3	2	2	1	1	1	3	3	3	2	3	2	2
CO4	2	2	1	1	1	3	3	3	2	3	2	2
CO5	2	2	1	1	1	3	3	3	3	3	2	2

Assessment Schema

Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S.No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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 & B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. R. Ramachandran

Title of the Course		INORGANIC CHEMISTRY PRACTICAL					
TANSCHÉ Course type		CC6					
Course Category		Core					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23P2CCCP2
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
			1		5		6
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic principles of quantitative analysis and complexometric analysis					
Objectives of the Course		1. To understand and enhance the visual observation as an analytical tool for the quantitative estimation of ions. 2. To recall the principle and theory in preparing standard solutions. 3. To train the students for improving their skill in estimating the amount of ion accurately present in the solution 4. To estimate metal ions, present in the given solution accurately without using instruments. 5. To determine the amount of ions, present in a binary mixture accurately					
Course Outline		Analysis of mixture of cations: Analysis of a mixture of four cations containing two common cations and two rare cations. Cations to be tested. Group-I: W, Tl and Pb. Group-II : Se, Te, Mo, Cu, Bi and Cd. Group-III : Tl, Ce, Th, Zr, V, Cr, Fe, Ti and U. Group-IV : Zn, Ni, Co and Mn. Group-V : Ca, Ba and Sr. Group-VI : Li and Mg. Preparation of metal complexes: Preparation of inorganic complexes: a. Preparation of trithiourea copper(I) sulphate b. Preparation of potassium trioxalatochromate(III) c. Preparation of tetramminecopper(II) sulphate d. Preparation of Reineck's salt e. Preparation of hexathiourea copper(I) chloridedihydrate f. Preparation of <i>cis</i>-Potassium tri oxalato diaquachromate(III) g. Preparation of sodium trioxalato ferrate(III) h. Preparation of hexathiourea lead(II) nitrate					

	Complexometric Titration: 1. Estimation of zinc, nickel, magnesium, and calcium. 2. Estimation of mixture of metal ions-pH control, masking and demasking agents. 3. Determination of calcium and lead in a mixture (pH control). 4. Determination of manganese in the presence of iron. 5. Determination of nickel in the presence of iron.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable the students to comprehend the basic knowledge of inorganic estimations through volumetric analysis using EDTA and complex preparation. They will acquire skills through titrimetric methods by connecting the principles of inorganic synthesis
Text Book(s)	1. O.P. Pandey, N. Bajpai, S. Giri, "Practical Chemistry" S. Chand and Co Ltd., ISBN: 9788121908122, 9788121908122, 2010. 2. Henry W. Schimpf "A text book of volumetric analysis", Biolife Publishers, ISBN: 9781117262451, 1117262456, 2009. 3. V. Venkateswaran, R. Veeraswamy, A.R. Kulandaivelu, Basic Principles of Practical Chemistry, S. Chand & Co., New Delhi, 1997.
Reference Book(s)	1. G. Pass, and H. Sutcliffe, Practical Inorganic Chemistry; Chapman Hall, 1965. 2. W. G. Palmer, Experimental Inorganic Chemistry; Cambridge University Press, 1954.
Websites and e-Learning resources	1. http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis/ 2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cy02/ 3. https://chem.hbcse.tifr.res.in/synthesis-and-analysis-of-an-inorganic-complex/

COURSE OUTCOMES:

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

CO	CO Statement	K-level	Weight / Mark
CO1	Apply the preparative knowledge of inorganic complex	K3	10
CO2	Demonstrate the basic laboratory techniques of volumetric analysis of given samples.	K2	15
CO3	Estimate the amount of metal ions in the given solution by complexometric method.	K3	20
CO4	Interpret analytical data	K4	25
CO5	Communicate the finding	K3	5

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	3	1	1	1	2	1	1	2	3	1	1
CO2	2	3	1	1	1	2	1	1	2	3	1	1
CO3	2	3	1	1	1	2	1	1	2	3	1	1
CO4	2	3	1	1	1	2	1	1	2	3	1	1
CO5	2	3	1	1	1	2	1	1	2	3	1	1

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	15
Observation/Record	5
Continuous class assessment	5
Total Marks	25

Name of the course Designer

- Dr. M. Boominathan

Title of the Course		Green chemistry						
TANSCHE Course type		ECIII						
Course Category		Elective (Discipline Centric)						
Nature of Course		Employability / Entrepreneurship / Skill Development						
Category	Core Elective	Year	I	Credits	3	Course Code	23P2CECT3	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		4		1		-		5
Marks		CIA			Semester		Total	
		25			75		100	
Pre-requisite(s)		Basic knowledge of general chemistry and organic synthesis						
Objectives of the Course		1. To discuss the principles of green chemistry. 2. To propose green solutions for chemical energy storage and conversion. 3. To explain green solutions for industrial production of petrochemicals, drug molecules and agro compounds. 4. To recognise solutions for pollution prevention in industrial chemical and fuel production, automotive industry and shipping industries. 5. To identify green solutions for industrial production of surfactants, and inorganic materials.						
Course Outline		Unit I: Introduction to Green Chemistry: (15 Hrs) Need for Green Chemistry. Goals of Green Chemistry. Limitations/ of Green Chemistry. Chemical accidents, terminologies, International green chemistry organizations and Twelve principles of Green Chemistry with examples.						
		Unit II: Green synthesis: (15 Hrs) Choice of starting materials, reagents, catalysts and solvents in detail, Green chemistry in day today life. Designing green synthesis-green reagents: dimethyl carbonate. Green solvents: Water, Ionic liquids-criteria, general methods of preparation, effect on organic reaction. Supercritical carbon dioxide - properties, advantages, drawbacks and a few examples of organic reactions in scCO ₂ . Green synthesis-adipic acid and catechol.						
		Unit III: Green catalysts-I: (15 Hrs) Environmental pollution, Green Catalysis-Acid catalysts, Oxidation catalysts, Basic catalysts, Polymer supported catalysts-Poly styrene aluminum chloride, polymeric super acid catalysts, Poly supported photosensitizers.						

	Unit IV: Green catalysts-II: (15 Hrs) Phase transfer catalysis in green synthesis-oxidation using hydrogen peroxide, crown ethers-esterification, saponification, anhydride formation, Elimination reaction, Displacement reaction. Applications in organic synthesis.
	Unit V: Green Techniques: (15 Hrs) Micro wave induced green synthesis-Introduction, Instrumentation, Principle and applications. Sonochemistry – Instrumentation, Cavitation theory - Ultra sound assisted green synthesis and Applications.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable the students to enrich their skills on synthetic chemistry in a green manner and thus it brings employability.
Text Book(s)	1. R. Sanghi, M. M. Srivatsava, Green Chemistry: Environment friendly alternatives, 1st ed., Narosa publishing house, 2003. 2. V. K. Ahluwalia, M. Kidwai, New Trends in Green Chemistry, 1st ed., Kluwer academic publishers, 2012. 3. P. T. Anastas, J. C. Warner, Green Chemistry: Theory and Practice, 1st ed., University oxford press, 2005
Reference Book(s)	1. V. K. Ahluwalia and R. Aggarwal, Organic Synthesis: Special Techniques, Narosa Publishing House, New Delhi, 2006. 2. M. Lancaster, Green Chemistry: An Introductory Text, 3rd ed., Royal Society of Chemistry, 2016. 3. F. A. Etzkorn, Green Chemistry: Principles and case studies, 1st ed., Royal Society of Chemistry, 2019.
Websites and e-Learning resources	1. https://www.epa.gov/greenchemistry 2. https://ehs.mit.edu/green-chemistry/ 3. https://greenchemistry.yale.edu/about/history-green-chemistry

COURSE LEARNING OUTCOMES:

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

	CO Statement	K-level
CO1	Summarize the basic principles need and limitations of green chemistry.	K2
CO2	Develop organic synthesis using green chemistry principles and methods.	K3
CO3	Analyse the usage of polymer supported catalysts	K4
CO4	Examine the applications of PTC and crown ethers for various conversions.	K4
CO5	Compare the advantages of organic reactions assisted by microwaves, ultrasound and sonication methods.	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	2	2	2	2	3	3	3	2	2	3
CO2	3	3	3	3	3	3	3	3	2	3	2	3
CO3	3	3	3	3	3	3	3	3	2	3	2	3
CO4	3	3	3	3	3	3	3	3	2	3	2	3
CO5	3	3	3	3	3	3	3	3	3	3	2	3

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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& B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. S. V. Karthikeyan

Title of the Course		Medicinal chemistry						
TANSICHE Course type		EC III						
Course Category		Elective (Discipline Centric)						
Nature of Course		Employability						
Category	Core Elective	Year	I	Credits	3	Course Code	23P2CECT3	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		4		1		-		5
Marks		CIA			Semester			Total
		25			75			100
Pre-requisite(s)		Basic knowledge of medicinal chemistry						
Objectives of the Course		1. To study the chemistry behind the development of pharmaceutical materials. 2. To gain knowledge on mechanism and action of drugs. 3. To understand the need of antibiotics and usage of drugs. 4. To familiarize with the mode of action of diabetic agents and treatment of diabetes. 5. To identify and apply the action of various antibiotics.						
Course Outline		Unit I: Introduction to receptors: (15 Hrs) Introduction,targets, Agonist, antagonist, partial agonist. Receptors,Receptor types, Theories of Drug – receptor interaction, Drug synergism, Drug resistance, physicochemical factors influencing drug action.						
		Unit II: Antibiotics: (15 Hrs) Introduction, Targets of antibiotics action, classification of antibiotics, enzyme-based mechanism of action, SAR of penicllins and tetracyclins, clinical application of penicillins, cephalosporin. Current trends in antibiotic therapy.						
		Unit-III: Antihypertensive agents and diuretics: (15 Hrs) Classification of cardiovascular agents, introduction to hypertension, etiology, types, classification of antihypertensive agents, classification and mechanism of action of diuretics, Furosemide, Hydrochlorothiazide, Amiloride.						
		Unit-IV: Antidiabetic Agents: (15 Hrs) Medicinal Chemistry of Antidiabetic Agents Introduction, Types of diabetics, Drugs used for the treatment, chemical classification, Mechanism of action, Treatment of diabetic mellitus. Chemistry of insulin, sulfonyl urea.						

	Unit-V: Analgesics, Antipyretics and Anti-inflammatory Drugs: (15 Hrs) Introduction, Mechanism of inflammation, classification and mechanism of action and paracetamol, Ibuprofen, Diclofenac, naproxen, indomethacin, phenylbutazone and meperidine.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable the students to comprehend the basic concepts of medicinal chemistry, to study the nature of drugs and mechanism of action of various drugs like antibiotics, antibacterials, Antihypertensive agents and diuretics and diabetic agents, analgesics, antipyretics and Anti-inflammatory Drugs.
Text Book(s)	1. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry, 2. Wilson, Charles Owens: Beale, John Marlowe; Block, John H, Lipincott William, 12th edition, 2011. 3. Graham L. Patrick, An Introduction to Medicinal Chemistry, 5th edition, Oxford University Press, 2013. Jayashree Ghosh, A text book of Pharmaceutical Chemistry, S. Chand and Co. Ltd, 1999, 1999 edn. 4. O. LeRoy, Natural and synthetic organic medicinal compounds, Ealemi, 2015. 5. S. Ashutosh Kar, Medicinal Chemistry, Wiley Eastern Limited, New Delhi, 1993, New edn.

Reference Book(s)	1. Foye's Principles of Medicinal Chemistry, Lipincott Williams, Seventh Edition, 2012 2. Burger's Medicinal Chemistry, Drug Discovery and Development, Donald J. Abraham, David P. Rotella, Alfred Burger, Academic press, 2010. 3. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, John M. Beale Jr and John M. Block, Wolters Kluwer, 2011, 12th edn. 4. P. Parimoo, A Textbook of Medical Chemistry, New Delhi: CBS Publishers.1995. 5. S. Ramakrishnan, K. G. Prasannan and R. Rajan, Textbook of Medical Biochemistry, Hyderabad: Orient Longman. 3rd edition, 2001.
Websites and e-Learning resources	1. https://www.ncbi.nlm.nih.gov/books/NBK482447/ 2. https://training.seer.cancer.gov/treatment/chemotherapy/types.html 3. https://www.classcentral.com/course/swayam-medicinal-chemistry-12908

COURSE OUTCOMES:

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

		K-level
CO1	Outline the importance of receptors	K2
CO2	Classify different types antibiotics and its mode of action	K3
CO3	Classify and study mechanism of action of antihypertensive agents and diuretics	K4
CO4	Familiarize with the mode of action of diabetic agents and treatment of diabetes.	K4
CO5	Know the mechanism and action of Analgesics, Antipyretics and Anti inflammatory Drugs	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

Assessment Schema

Components of CIA

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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& B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. J.Shanmugapriya

Title of the Course		BIO-INORGANIC CHEMISTRY					
TANSCHÉ Course type		ECIV					
Course Category		Elective (Generic Elective)					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core Elective	Year	I	Credits	3	Course Code	23P2CECT4
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		4	1				5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Basic Knowledge of Inorganic chemistry					
Objectives of the Course		1. To understand the role of trace elements. 2. To understand the biological significance of iron, sulphur. 3. To study the toxicity of metals in medicines. 4. To have knowledge on diagnostic agents. 5. To discuss on various metalloenzymes properties					
Course Outline		Unit-I: Essential trace elements: (15 Hrs) Selective transport and storage of metal ions: Ferritin, Transferrin and siderophores; Sodium and potassium transport, Calcium signalling proteins. Metalloenzymes: Zinc enzymes–carboxypeptidase and carbonic anhydrase. Iron enzymes–catalase, peroxidase. Copper enzymes – superoxide dismutase, Plastocyanin, Ceruloplasmin, Tyrosinase. Coenzymes - Vitamin-B12 coenzymes.					
		Unit-II: Transport Proteins: (15 Hrs) Oxygen carriers -Hemoglobin and myoglobin - Structure and oxygenation Bohr Effect. Binding of CO, NO, CN– to Myoglobin and Hemoglobin. Biological redox system: Cytochromes-Classification, cytochrome a, b and c. Cytochrome P-450. Non-heme oxygen carriers-Hemerythrin and hemocyanin. Iron-sulphur proteins- Rubredoxin and Ferredoxin- Structure and classification.					
		Unit-III: Nitrogen fixation (15 Hrs) Introduction, types of nitrogen fixing microorganisms. Nitrogenase enzyme - Metal clusters in nitrogenase- redox property - Dinitrogen complexes transition metal complexes of dinitrogen - nitrogen fixation via nitride formation and reduction of dinitrogen to ammonia. Photosynthesis: photosystem-I and photosystem-II-chlorophylls structure and function.					

	Unit-IV: Metals in medicine: (15 Hrs) Metal Toxicity of Hg, Cd, Zn, Pb, As, Sb. Therapeutic Compounds: Vanadium-Based Diabetes Drugs; Platinum-Containing Anticancer Agents. Chelation therapy; Cancer treatment. Diagnostic Agents: Technetium Imaging Agents; Gadolinium MRI Imaging Agents. Temperature and critical magnetic Field.
	Unit-V: Enzymes (15 Hrs) Introduction and properties -nomenclature and classification. Enzyme kinetics, free energy of activation and the effects of catalysis. Michelis - Menton equation - Effect of pH, temperature on enzyme reactions. Factors contributing to the efficiency of enzyme.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable to the students to enrich their knowledge on various area of bioinorganic chemistry and the ways to develop their skill thus it brings employability Skill Development.
Text Book(s)	1. Williams,D.R. –Introduction to Bioinorganic chemistry. 2. F.M. Fiabre and D.R. Williams– The Principles of Bioinorganic Chemistry,RoyolSoceity of Chemistry, Monograph for Teachers-31 3. K.F. Purcell and Kotz., InorganiBOc chemistry, WB Saunders Co., USA.G.N. Mugherjea
Reference Book(s)	1. M.Satake and Y.Mido, Bioinorganic Chemistry- Discovery Publishing House, New Delhi (1996) 2. M.N. Hughes, 1982, The Inorganic Chemistry of Biological processes, II Edition, Wiley London. 3. R. W. Hay, Bio Inorganic Chemistry, Ellis Horwood, 1987.
Websites and e-Learning resources	1. https://www.pdfdrive.com/instant-notes-in-inorganic-chemistry-the-instant-notes-chemistry-series-d162097454.html 2. https://www.pdfdrive.com/shriver-and-atkins-inorganic-chemistry-5th-edition-d161563417.html

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	Describe the role of various trace elements in biological system	K2
CO2	Explain the various biological redox systems in biochemical reactions	K3
CO3	Examine the redox centers involved in nitrogen fixation and photosynthesis	K4
CO4	Analyzing the toxicity of heavy metals and finding the suitable drugs.	K4
CO5	Inferring the catalytic and kinetic mechanism of enzymes	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	1	2	3	3	3	2	2	2
CO2	2	2	1	1	1	3	3	3	2	3	2	2
CO3	2	2	1	1	1	3	3	3	2	3	2	2
CO4	2	2	1	1	1	3	3	3	2	3	2	2
CO5	2	2	1	1	1	3	3	3	3	3	2	2

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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 & B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. M.Boominathan

Title of the Course		MATERIAL SCIENCE						
TANSCHÉ Course type		EC IV						
Course Category		Elective (Generic Elective)						
Nature of Course		Employability / Entrepreneurship / Skill Development						
Category	Core Elective	Year	I	Credits	3	Course Code	23P2CECT4	
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Practical		Total
		4		1		-		5
Marks		CIA			Semester		Total	
		25			75		100	
Pre-requisite(s)		Basic knowledge of solid-state chemistry						
Objectives of the Course		1. To understand the crystal structure, growth methods and X-ray scattering. 2. To explain the optical, dielectric and diffusion properties of crystals 3. To recognize the basis of semiconductors, superconductivity materials and magnets 4. To study the synthesis, classification and applications of nanomaterials 5. To study the synthesis, classification and applications of nanomaterials						
Course Outline		Unit I: Crystallography: (15 Hrs) Symmetry - Unit cell and Miller indices -crystal systems - Bravais lattices - point groups and space groups - X-ray diffraction-Laue equations-Bragg's law-reciprocal lattice and its application to geometrical crystallography. Crystal structure–powder and single crystal applications. Electron charge density maps, neutron diffraction-method and applications.						
		Unit II: Crystal growth methods: (15 Hrs) Nucleation–equilibrium stability and metastable state. Single crystal –Low and high temperature, solution growth– Gel and sol-gel. Crystal growth methods- nucleation– equilibrium stability and metastable state. Single crystal–Low and high temperature, solution growth– Gel and sol-gel. Melt growth - Bridgeman-Stockbarger, Czochralski methods. Flux technique, physical and chemical vapour transport. Lorentz and polarization factor - primary and secondary extinctions.						

	Unit III: Properties of crystals: (15 Hrs) Optical studies - Electromagnetic spectrum (qualitative) refractive index – reflectance – transparency, translucency and opacity. Types of luminescence – photo-, electro-, and injection luminescence, LEDs – organic, Inorganic and polymer LED materials - Applications. Dielectric studies- Polarisation - electronic, ionic, orientation, and space charge polarisation. Effect of temperature. dielectric constant, dielectric loss. Types of dielectric breakdown–intrinsic, thermal, discharge, electrochemical and defect breakdown
	Unit IV: Special Materials: (15 Hrs) Superconductivity: Meissner effect, Critical temperature and critical magnetic Field, Type I and II superconductors, BCS theory-Cooper pair, Applications. Soft and hard magnets – Domain theory Hysteresis Loop-Applications. Magneto and giant magneto resistance. Ferro, ferri and antiferromagnetic materials-applications, magnetic parameters for recording applications. Ferro-, Piezo-, and pyro electric materials – properties and applications. Shape memory Alloys-characteristics and applications, Non-linear optics-Second Harmonic Generators, mixing of Laser wavelengths by quartz, ruby and LiNbO₃.
	Unit V: Materials for Renewable Energy Conversion: (15 Hrs) Solar Cells: Organic, bilayer, bulk heterojunction, polymer, perovskite based. Solar energy conversion: lamellar solids and thin films, dye-sensitized photo voltaic cells, coordination compounds anchored onto semiconductor surfaces - Ru(II) and Os(II) polypyridyl complexes. Photochemical activation and splitting of water, CO₂ and N₂. Manganese based photo systems for water-splitting. Complexes of Rh, Ru, Pd and Pt - photochemical generation of hydrogen from alcohol.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Justification for nature of course	This course will enable the students to gain advanced knowledge of solid state chemistry and materials useful for technological applications.

Text Book(s)	1. S. Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016. 2. Arumugam, Materials Science, Anuradha Publications, 2007. 3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010 4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012. 5. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6th ed., PEARSON Press, 2007.
Reference Book(s)	1. M.G. Arora, Solid State Chemistry, Anmol Publications, New Delhi, 2001. 2. R.K. Puri and V.K. Babbar, Solid State Physics, S Chand and Company Ltd, 2001. 3. C. Kittel, Solid State Physics, John-Wiley and sons, NY, 1966. 4. H.P. Meyers, Introductory Solid State Physics, Viva Books Private Limited, 1998. 5. A.R. West, Solid State Chemistry and Applications, John-Wiley and sons, 1987.
Websites and e-Learning resources	1. http://xrayweb.chem.ou.edu/notes/symmetry.html. 2. http://www.uptti.ac.in/classroocontent/data/Unit%20cell.pdf. 3. https://bit.ly/3QyVg2R

COURSE OUTCOMES:

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

	CO Statements	K-level
CO1	Understand and recall the synthesis and characteristics of crystal structures, semiconductors, magnets, nanomaterials and renewable energy materials	K2
CO2	Integrate and assess the structure of different materials and their properties.	K3
CO3	Analyse and identify new materials for energy applications.	K4
CO4	Explain the importance of crystal structures, piezoelectric and pyroelectric materials, nanomaterials, hard and soft magnets, superconductors, solar cells, electrodes, LED uses, structures and synthesis.	K4
CO5	Design and develop new materials with improved property for energy applications.	K4

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	2	1	1	1	2	3	3	3	2	2	2
CO2	2	2	1	1	1	3	3	3	2	3	2	2
CO3	2	2	1	1	1	3	3	3	2	3	2	2
CO4	2	2	1	1	1	3	3	3	2	3	2	2
CO5	2	2	1	1	1	3	3	3	3	3	2	2

Assessment Scheme**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination

Articulation Mapping-K Levels with Courses Learning Outcomes (COs)

S. No.	COs	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	CO 1	Up to K2	2	K1 & K1	1	K1	2 (K1 & K1)	1(K2)
2	CO 2	Up to K3	2	K2 & K3	1	K1	2 (K2 & K2)	1(K3)
3	CO 3	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
4	CO 4	Up to K4	2	K3 & K4	1	K2	2 (K4 & K4)	1(K4)
5	CO 5	Up to K4	2	K2 & K3	1	K3	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 & B (No Choice)	Section C (Either /or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	10	-	16	13.3	35
K2	6	10	10	26	21.7	
K3	6	10	20	36	30	30
K4	2	20	20	42	35	35
Total marks	20	50	50	120	100	100

Name of the course Designer

- Dr. P. Gajendran

Title of the Course		ENVIRONMENTAL CHEMISTRY					
TANSCHÉ Course type		NME 1					
Course Category		Elective					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core Elective	Year	I	Credits	2	Course Code	23P2CSEN1
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2	-		-		2
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Higher secondary Chemistry					
Objectives of the Course		1. To understand the concepts of environment. 2. To understand the composition of atmosphere. 3. To recognize about water pollution. 4. To learn the aquatic chemistry. 5. To study the various secondary pollution.					
Course Outline		Unit-1 : Environment (6 Hrs) Composition of atmosphere-Temperature variation of earth atmospheric system-Biogeochemical cycles of C, N, P, S and O system.					
		Unit –II: Atmosphere (6 Hrs) Chemical composition of atmosphere-chemical and photochemical reaction in atmosphere-smog formation- Oxides of N, C, O and their effects -Air pollution and its control.					
		Unit-III: Aquatic chemistry (6 Hrs) Water and its sources - various water quality parameters Dissolved oxygen, Biological oxygen demand, Chemical oxygen demand and its determination-Industrial and waste water treatment process-solid waste treatment					
		Unit IV: Water pollution (6 Hrs) Ground and surface water contamination-sources-ocean pollution-Eutrophication-Acid mine drains- And agro pesticides and fertilizer pollution.					
		Unit-V: Air Pollution (6 Hrs) Climate change due to CFC, Greenhouse effect-Acid rain and Ozone layer depletion- Issues and possible solutions.					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge about environmental chemistry
Justification for nature of course	This course will enable to the students to enrich their knowledge on various environmental aspects and their standard specifications.
Text Book(s)	1. Subramanian V.A Textbook of environmental chemistry I K international publishing House, 2011 2. Ajay kumar B and chatwal G.K Environmental chemistry Himalaya Publishing House. 3. Peter o Neill, Environmental chemistry , CRC PRESS 3rd edition- 1998
Reference Book(s)	1. Balram P , Textbook of environmental chemistry, New Delhi, I K International 2007 2. Gillber M , Introduction to environmental engineering& science , New Delhi 2004

COURSE OUTCOMES:

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

	CO Statement	K-level
CO1	Understand the environmental segments	K2
CO2	Associate to atmosphere and its photochemistry	K2
CO3	Recognize water pollution	K2
CO4	Express to learn aquatic chemistry and water parameters	K2
CO5	Generalise to study the various environmental pollution	K2

MAPPING WITH PROGRAMME OUTCOMES:

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

CO	POs						PSOs					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	3	2	2	1	2	3	2	2	1	2	3	1
CO2	3	3	2	2	1	3	3	2	3	1	1	1
CO3	3	2	1	2	3	3	2	3	3	2	1	3
CO4	3	1	1	3	3	3	2	3	3	2	3	3
CO5	2	3	3	3	3	3	2	3	1	3	2	2

Assessment Schema**Components of CIA**

Component	Weight / Mark
Internal Test	10
Periodical Assignments	5
Seminar/Article review	5
Paper/poster presentation/Quizzes/Objective tests	5

Blueprint for Semester Examination**Articulation Mapping-K Levels with Courses Learning Outcomes (COs)****Blueprint for Semester Examination****Articulation Mapping-K Levels with Courses Learning Outcomes (COs)**

S. No.	COs	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	CO 1	Up to K2	1	K1	1	2 (K2 & K2)	1(K1)
2	CO 2	Up to K2	1	K1	1	2 (K2 & K2)	1 (K1)
3	CO 3	Up to K2	1	K1	1	2 (K2 & K2)	1 (K1)
4	CO 4	Up to K2	1	K1	1	2 (K2 & K2)	1 (K1)
5	CO 5	Up to K2	1	K1	1	2 (K2 & K2)	1 (K1)
No. of Questions to be asked			5		5		5
No. of Questions to be answered			5		5		3
Marks for each question			2		7		10
Total Marks for each section			10		35		30

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 without choice	Consolidated %
K1	10	-	50	60	46	46
K2	-	70		70	54	54
Total Marks	10	70	50	130	100	100

Name of the course Designer

Dr. S. Selvakumar