



**THE MADURA COLLEGE (AUTONOMOUS)**  
(Affiliated to Madurai Kamaraj University, Reaccredited (4<sup>th</sup> cycle) with “A” Grade by NAAC)  
TPK Road, Madurai – 625 011, Tamil Nadu  
[www.maduracollege.edu.in](http://www.maduracollege.edu.in)

# ACADEMIC COUNCIL

## 12.10.2023



ESTD : 1889

*Learning Shines with Righteousness*

**BOOK 3 of 3**

*(Syllabi Pages : 1363-1878)*





## **THE MADURA COLLEGE (AUTONOMOUS)**

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### **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**

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Date:  
21.09.2023

#### **NOTICE**

An ordinary meeting of the Academic Council will be held on **12<sup>th</sup> 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](mailto: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





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**ACADEMIC COUNCIL**

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**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.
<b>I.</b>	CONFIRMATION OF THE MINUTES OF THE PREVIOUS ACADEMIC COUNCIL MEETING HELD ON 17.06.2021	i-ix
<b>II.</b>	BUSINESS BROUGHT FORWARD BY THE CHAIRMAN	x
<b>III.</b>	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	
<b>IV.</b>	ANY OTHER SUBJECTS BROUGHT FORWARD BY THE CHAIRMAN	xxiii
	<b>BOOK – I</b>	
<b>V.</b>	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
	<b>BOOK – II</b>	
	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

<b>BOOK – III</b>		
	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 (3<sup>rd</sup> 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, 20<sup>th</sup> 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           | 88) Dr. S. Dinakaran           |
| 70) Dr. M. Malarvizhi          | 89) Dr. L.D. Devasree          |
| 71) Dr. S.V. Karthikeyan       | 90) Dr. B. Latha               |
| 72) Prof. S. Vidhyasankar      | 91) Dr. C. Selvakumar          |
| 73) Dr. R. Ramachandran        | 92) Dr. P. Sivakumar           |
| 74) Prof. S. Selvakumar        | 93) Er. J. Rajendran           |
| 75) Dr. P. Prasanna            | 94) Prof. R. Umasankari        |
| 76) Dr. M. Boominathan         | 95) Dr. T. SreeRamkumar        |
| 77) Dr. M. HasmathFarzana      | 96) Dr. K. Kathirvelpandian    |
| 78) Dr. J. Shanmugapriya       | 97) Prof. C. Hema              |
| 79) Prof. S. ChellaPandian     | 98) Dr. N. Paneerselvam        |
| 80) Dr. P. Kannan              | 99) Prof. K. Rajasaravanakumar |
| 81) Dr. S. Karuppusamay        | 100) Dr. R. Chitra             |
| 82) Dr. S. GnaanaSaraswathi    | 101) Prof. G. Sreedevi         |
| 83) Prof. V. MeenakshiSundaram | 102) Dr. P. Pandi              |
| 84) Dr. N. Janakiraman         | 103) Dr. R. Karthikeyan        |
| 85) Dr. P. Jansi Rani          | 104) Prof. J. Premkumar        |
| 86) Dr. M. Karpagajothi        | 105) Prof. S. Selvaulaganathan |
| 87) Dr. S. Saravanan           | 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 addon 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.Sivaramakrisnan 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 (21PICME2) 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 departmant 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 departmant 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 (Acdecemics) 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 plaaning in designing the curriculam. 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 TANSICHE 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 TANSICHE (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 TANSICHE 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 Disipline 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 1<sup>st</sup> 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 TANSICHE 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 (ACDEMIC)**

**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 BOTANY**

**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. Botany)**

**Allied Courses**

**I and II semesters (M.Sc. Botany)**



**THE MADURA COLLEGE**  
**An Autonomous Institution affiliated to Madurai Kamaraj University**  
**Re-accredited (3<sup>rd</sup> cycle) with 'A' grade by NAAC**  
**Vidya Nagar, T.P.K. Road, Madurai – 625 011**

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**UG-BOTANY**

**Vision**

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

**Mission**

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

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

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

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

**Programme Specific Outcomes (PSOs) will be achieved by**

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

## PROGRAMME STRUCTURE – B.Sc. BOTANY

### Semester – I

Part	Course description	Course code	Hours	Credits
I	Language - I Tamil / Hindi / Sanskrit	23U1TLAN1	6	3
		23U1HLAN1		
		23U1SLAN1		
II	Language - II English	23U1NENG1	6	3
III	Core Course - Plant Diversity I – Algae	23U1BCCT1	5	5
	Core Practical – I	23U1BCCP1	3	3
	Generic Elective – 1 Allied Zoology	23U1ZGET1	4	4
	Generic Elective -1 Allied Zoology Practical	23U1ZGEP1	2	1
IV	Skill Enhancement Course (SEC-1) – Organic farming	23U1BSED1	2	2
	Foundation course (FC)	23U1BFCT1	2	2
	Total		<b>30</b>	<b>23</b>

### Semester – II

Part	Course description	Course code	Hours	Credits
I	Language - I Tamil / Hindi / Sanskrit	23U2TLAN2	6	3
		23U2HLAN2		
		23U2SLAN2		
II	Language - II English	23U2NENG2	6	3
III	Core Course - Plant Diversity II	23U2BCCT2	5	5
	Core Course – Practical – II	23U2BCCP2	3	3
	Generic Elective - 2 Allied Zoology Theory	23U2ZGET2	4	4
	Generic Elective - 2 Allied Zoology Practical	23U2ZGEP2	2	1
IV	Skill Enhancement Course (SEC-2) – Mushroom cultivation	23U2BSED2	2	2
	SEC – Subject Specific (SEC-3) – Botanical gardening and landscaping	23U2BSED3	2	2
	Total		<b>30</b>	<b>23</b>

<b>Title of the Course</b>		<b>PLANT DIVERSITY I – ALGAE</b>					
<b>TANSCHÉ</b> <b>Course type</b>		<b>CORE COURSE</b>					
<b>Course Category</b>		<b>CORE COURSE– I</b>					
<b>Nature of Course</b>		<b>Employability</b> <input checked="" type="checkbox"/>		<b>Entrepreneurship</b> <input checked="" type="checkbox"/>		<b>Skill Development</b> <input checked="" type="checkbox"/>	
<b>Category</b>	<b>Core</b>	<b>Year</b>	1	<b>Credits</b>	5	<b>Course Code</b>	23U1BCCT1
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		5	-----		-----		5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Students should be familiar with the basics of different classes of algae.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To provide a comprehensive knowledge on the biology of algae.</li> <li>• To provide a basis for better understanding of classification of algae.</li> <li>• To understand benefits and economic importance of algae.</li> <li>• To evaluate the role of algae in environmental applications.</li> <li>• To understand the cultivation and harvesting methods of algae.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: General Characteristics of Algae:</b> Occurrence, Thallus organizations, Pigmentation, Reserve food materials, Flagellation, Reproduction and lifecycle patterns					
		<b>Unit II:</b> Classification (Fritsch-1935-1945), criteria for classification, Structure and lifecycle of <i>Anabaena</i> , <i>Chlorella</i> , <i>Volvox</i> , <i>Caulerpa</i> , <i>Oedogonium</i> , <i>Diatoms</i> , <i>Sargassum</i> and <i>Gracilaria</i> .					
		<b>Unit III:</b> Economic importance: Algae as food and fodder, as biofertilizer, seaweed liquid biofertilizer, Phycocolloids: Agar-agar, Carrageenan and alginic acid. SCP. Pharmaceutical applications and Biocolourants.					
		<b>Unit IV:</b> Diatomite. Resource potential of algae: Application of algae as fuel, Phycoremediation. Role of algae in CO <sub>2</sub> sequestration, algal bioinoculants, Bioluminescence, Algae as indicator of water pollution, algal bloom, cyanotoxins.					
		<b>Unit V:</b> Algal cultivation methods, Algal production systems; indoor cultivation methods and large-scale cultivation of algae, harvesting of algae.					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved.					

<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
<b>Justification for nature of course</b>	This course enhances the better understanding of classification, structure and reproduction, economic importance and cultivation of beneficial algae for supporting human lifestyle.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Kumar, H.D.1999. Introductory Phycology. Affiliated East-West Press, Delhi.</li> <li>2. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.</li> <li>3. Vashishta, P.C. 2014. S.Chand &amp; Company Ltd, New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani. ISBN: 978-9922-20-391-1.</li> <li>2. Chapman V.J. and Chapman D.J, 2013. The Algae. Alpha Numera.</li> <li>3. Lee, R.D. 2008. Phycology 4th Edition, Cambridge University Press, New York.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382">https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382</a></li> <li>2. <a href="https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678">https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678</a></li> <li>3. <a href="https://www.kobo.com/in/en/ebook/algae-biotechnology">https://www.kobo.com/in/en/ebook/algae-biotechnology</a></li> </ol>

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

<b>CO1</b>	Recall the general characteristics and thallus organizations in algae	<b>K1</b>
<b>CO2</b>	Review the classification of algae and understand the structure and lifecycle of selected algal genera.	<b>K2</b>
<b>CO3</b>	Apply the beneficial and economic aspects of algae	<b>K3</b>
<b>CO4</b>	Relate the eco-economic potential of algae	<b>K4</b>
<b>CO5</b>	Demonstrate the various methods of culture techniques in algae	<b>K5</b>

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes (PSOs) 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	1	3	2	3	1	2	2	1	2	2
CLO2	3	3	2	2	3	2	3	2	1	2	1	2
CLO3	2	2	1	1	2	1	2	1	3	1	1	1
CLO4	3	3	3	3	3	2	2	3	3	2	2	3
CLO5	3	3	2	3	2	1	3	3	3	2	1	2

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Continuous Internal Assessment Test	10 Marks
Assignments / Seminars	5 Marks
Quiz / Model making	5 Marks
Attendance/ Class participation	5 Marks
Total	<b>25 Marks</b>

#### Blue for Internal CIA Examination

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
<b>Total Marks for each section</b>			<b>5</b>	<b>10</b>	<b>10</b>

### Blueprint for Semester Examination

Sl.No	Cos	K -Level	Section –A		Section –B		Section C (Either/ Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K - Level		
1	CO1	Up to K2	2	K1or K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Up to K3	2	K1or K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Up to K3	2	K1or K2	1	K2	2(K3&K3)	1(K3)
4	CO4	Up to K4	2	K1or K2	1	K2	2(K4&K4)	1(K4)
5	CO5	Up to K3	2	K1or K2	1	K2	2(K3&K3)	1(K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark for each question			1		2		5	10
Total Marks for each section			10		10		25	30

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>PLANT DIVERSITY I – ALGAE</b>					
<b>TANSICHE Course type</b>		<b>CORE COURSE PRACTICAL</b>					
<b>Course Category</b>		<b>CORE PRACTICAL– I</b>					
<b>Nature of Course</b>		Employability <input checked="" type="checkbox"/> / Entrepreneurship <input checked="" type="checkbox"/> / Skill Development <input checked="" type="checkbox"/>					
<b>Category</b>	Core	<b>Year</b>	1	<b>Credits</b>	3	<b>Course Code</b>	23U1BCCP1
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		-----	-----	3		3	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Students should be familiar with the basics of algae.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To develop skills to identify algae based on habitat, thallus structure and the internal organization.</li> <li>• To identify microalgae at the genus level from the mixture.</li> <li>• To develop skills to prepare the microslides of algae.</li> <li>• To study the economic importance of algae.</li> <li>• To understand various methods of algal cultivation.</li> </ul>					
<b>Course Outline</b>		<b>PRACTICALS</b> <ol style="list-style-type: none"> <li>1. Micro-preparation of the Algal genera prescribed in the syllabus.</li> <li>2. Identifying the micro slides relevant to the syllabus.</li> <li>3. Identifying the algae genus from the algal mixture.</li> <li>4. Economic importance of Algae as: (i) Food (ii) Feed (iii) Biofertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar-Agar (viii) Alginate (ix) Diatomaceous earth.</li> <li>5. Field visit to study fresh water/marine water algal habitats.</li> <li>6. Visit to nearby industries engaged in algal technology and algal products.</li> </ol>					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/ others to be solved					
<b>Skills acquired from this course</b>		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
<b>Justification for nature of course</b>		This course will be enhanced the practical knowledge on algal identification through macro and micromorphological observation, economic potential of the algal resources and cultivation technology of the algae.					

<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Kumar, H.D.1999. Introductory Phycology. Affiliated East-West Press, Delhi.</li> <li>2. Bendre, M. Ashok and Ashok Kumar, A. 2020.Text Book of Practical Botany-1(10<sup>th</sup>ed). Rastogi Publications, Meerut.</li> <li>3. Round, FE. 1984.The Ecology of Algae. Cambridge University Press.</li> <li>4. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying</li> <li>2. Manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.</li> <li>3. Chapman, V.J and Chapaman, D.J. 1960.The Algae, ELBS &amp; MacMillan, London.</li> <li>4. Lee, R.D. 2008. Phycology 4th Edition, Cambridge University Press, New York.</li> <li>5. Dehradun. Edwardlee, R.2018. Phycology,5<sup>th</sup>Ed., Cambridge University Press, London.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://books.google.co.in/books/about/Practical_Manual_of_Algae.html?id=8d5">https://books.google.co.in/books/about/Practical_Manual_of_Algae.html?id=8d5</a></li> <li>2. <a href="https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-(PDF-21P).html">https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae-(PDF-21P).html</a></li> <li>3. <a href="https://www.ebooks.com/en-in/book/210152662/algae/sachin-kumar-mandotra/">https://www.ebooks.com/en-in/book/210152662/algae/sachin-kumar-mandotra/</a></li> <li>4. <a href="https://books.google.co.in/books/about/Algae.html?id=s1P855ZWc0kC&amp;redir_esc=y">https://books.google.co.in/books/about/Algae.html?id=s1P855ZWc0kC&amp;redir_esc=y</a></li> </ol>

### COURSE OUTCOMES:

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

<b>CO1</b>	Recall and identify algae using thallus structure and organization.	<b>K1</b>
<b>CO2</b>	Demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture.	<b>K2</b>
<b>CO3</b>	Describe the internal structure of algal genera prescribed in the syllabus by micro-preparation.	<b>K3</b>
<b>CO4</b>	Decipher the algal diversity in fresh/marine water and their economic significance.	<b>K4</b>
<b>CO5</b>	Evaluate the various techniques used to culture of algae for industrial purposes.	<b>K5</b>

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:

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

### Scheme of valuation

CIA Component	Weight / Mark
Continuous Internal Assessment of class practical/Attendance/experimental skill	10 Marks
Model practical examination	15 Marks
<b>Internal component</b>	<b>25 Marks</b>
End semester External Practical examination	75 Marks
Total	<b>100 Marks</b>

<b>Title of the Course</b>		<b>ORGANIC FARMING</b>					
<b>TANSICHE Course type</b>		<b>SEC-I</b>					
<b>Course Category</b>		<b>Skill Enhancement Course – I</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development ✓</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	1	<b>Credits</b>	2	<b>Course Code</b>	<b>23U1BSED1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		2	-----	-----		2	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Students to gain knowledge on the scope of organic farming and its significance.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To understand the knowledge on soil and its properties for agriculture.</li> <li>To enable students to gain knowledge on the scope of organic farming and its significance.</li> <li>To impart practical insights sustainable agriculture, green manuring, recycling and composting.</li> <li>To study sustainable agriculture.</li> <li>To know about the importance of biofertilizers.</li> </ul>					
<b>Course Outline</b>		<b>Unit I:</b> Soil – physical, chemical properties. Soil pollution – oil, chemicals – fertilizers, pesticide and herbicide, non-degradable solids, biomagnification, consequences of land pollution – damage to soil and crops.					
		<b>Unit II:</b> Organic farming – definition, basic concept of organic farming, integrated plant nutrient supply management, integrated insect pest and disease management, integrated soil and water management. Sustainable agriculture practices-crop rotation, mixed cropping.					
		<b>Unit – III:</b> Management of organic wastes and green manures: Farm manures, Composts, Mulches and pest control, importance of organic manure, importance of green manure, crops of green manure, oil cake. Animal based organic manure–cow dung, vermicompost-methods, production and utilization.					
		<b>Unit IV:</b> Biofertilizers–classification, nitrogen fixers– <i>Rhizobium</i> , Cyanobacteria, <i>Azolla</i> and Vesicular Arbuscular Mycorrhiza					
		<b>Unit V:</b> Recycling of bio-degradable municipal, agricultural and Industrial wastes – biocompost making methods.					

<b>Extended Professional Component (is a part of internal component only,)</b>	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will be enhanced the knowledge on organic farming and its components.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. NIIR Board. 2012. The complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.</li> <li>2. Sathe, T.V. 2004. Vermiculture and Organic Farming. Daya publishers.</li> <li>3. Subba Rao N.S. 2017. Biofertilizers in Agriculture and Forestry. Fourth Edition.Medtech.</li> <li>4. Vayas,S.C, Vayas, S. and Modi, H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.</li> <li>5. Dongarjal, R.P and Zade, S.B. 2019. Insect Ecology and Integrated Pest Management Akinik Publications, New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Vayas,S.C, Vayas, S and Modi, H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.</li> <li>2. Sathe, T.V.2004. Vermiculture and Organic Farming. Daya publishers.</li> <li>3. Subha Rao, N.S.2000. Soil Microbiology, Oxford &amp; IBH Publishers, New Delhi.</li> <li>4. Reddy, S.R. 2019. Fundamentals of Agronomy Kalyani Publications, Uttar Pradesh</li> <li>5. Tolanur, S. 2018. Fundamentals of Soil Science IIndEdition , CBS Publishers , New Delhi</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.com/Beginners-Practical-botanical-horticulture-landscape-ebook/dp/B00MOURUNY">https://www.amazon.com/Beginners-Practical-botanical-horticulture-landscape-ebook/dp/B00MOURUNY</a></li> <li>2. <a href="https://www.e-booksdirectory.com/listing.php?category=323">https://www.e-booksdirectory.com/listing.php?category=323</a></li> <li>3. <a href="http://www.freebookcentre.net/Biology/Agriculture-Books.html">http://www.freebookcentre.net/Biology/Agriculture-Books.html</a></li> <li>4. <a href="https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDF-downloads/TOFG-all.pdf">https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDF-downloads/TOFG-all.pdf</a>.</li> <li>5. <a href="https://www.amazon.in/s?k=the+organic+farming+manual&amp;hvadid=72636563575133&amp;hvbmmt=bb&amp;hvdev=c&amp;hvqmt=b&amp;tag=msndeskstdin-21&amp;ref=pd_sl_6sbf0qtxcy_b">https://www.amazon.in/s?k=the+organic+farming+manual&amp;hvadid=72636563575133&amp;hvbmmt=bb&amp;hvdev=c&amp;hvqmt=b&amp;tag=msndeskstdin-21&amp;ref=pd_sl_6sbf0qtxcy_b</a></li> </ol>

**COURSE OUTCOMES:**

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

<b>CO1</b>	Recognize the different forms of biofertilizers and their uses.	<b>K1</b>
<b>CO2</b>	Explain and interpret the components, patterns, and processes of bacteria for growth in crop production.	<b>K2</b>
<b>CO3</b>	Apply techniques for synthesizing green manure and develop strategies to increase crop yield.	<b>K3</b>
<b>CO4</b>	Analyze and decipher the significance of biofertilizers in soil fertility.	<b>K4</b>
<b>CO5</b>	Develop new strategies to enhance growth and quality check of medicinal herbs considering the practical issues pertinent to India.	<b>K5</b>

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:**

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

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>					
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>CLO1</b>	2	3	1	3	2	3	1	2	2	1	2	2
<b>CLO2</b>	3	1	2	2	3	2	3	2	2	1	1	2
<b>CLO3</b>	2	2	1	1	2	1	2	3	2	1	1	1
<b>CLO4</b>	2	2	1	3	3	2	2	3	3	2	2	3
<b>CLO5</b>	3	3	2	3	2	1	3	3	2	2	3	2

## Assessment Scheme

### Components of CIA

Component	Weight / Mark
Continuous Internal Assessment Test	10 Marks
Assignments	5 Marks
Quiz	5 Marks
Attendance/ Class participation	5 Marks
Total	<b>25 Marks</b>

### Blue for Internal CIA Examination

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
<b>Total Marks for each section</b>			<b>5</b>	<b>10</b>	<b>10</b>

### Blueprint for Semester Examination

Sl.No	Cos	K -Level	Section –A		Section –B		Section C (Either/ Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K - Level		
1	CO1	Up to K2	2	K1or K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Up to K3	2	K1or K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Up to K3	2	K1or K2	1	K2	2(K3&K3)	1(K3)
4	CO4	Up to K4	2	K1or K2	1	K2	2(K4&K4)	1(K4)
5	CO5	Up to K3	2	K1or K2	1	K2	2(K3&K3)	1(K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark for each question			1		2		5	10
Total Marks for each section			10		10		25	30

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>BASICS OF BOTANY</b>					
<b>TANSICHE Course type</b>		<b>FOUNDATION COURSE (FC)</b>					
<b>Course Category</b>		<b>FOUNDATION COURSE</b>					
<b>Nature of Course</b>		Employability <input type="checkbox"/> / Entrepreneurship <input checked="" type="checkbox"/> / Skill Development <input checked="" type="checkbox"/>					
<b>Category</b>	Core	<b>Year</b>	1	<b>Credits</b>	2	<b>Course Code</b>	<b>23U1BFCT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	
		2		-----		-----	
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		To recall the students about the basic aspects of botany.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To learn about the classification and salient features of algae, fungi, lichens, bryophytes, pteridophytes, Gymnosperms and Angiosperms.</li> <li>To understand the structure and functions of basic unit of life.</li> <li>To investigate the morphological traits of plants.</li> <li>Enable to learn the fundamental heredity of life.</li> <li>Understanding basic physiological functions of plants.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: BIODIVERSITY:</b> Systematics: Two Kingdom and Five Kingdom systems (R.H.Whittaker's) - Salient features of various Plant Groups: Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.					
		<b>Unit II: CELL BIOLOGY:</b> Cell as the basic unit of life - Ultra Structure of Prokaryotic and Eukaryotic Cells - Cell Wall - Cell Membrane Plastids, Ribosomes.					
		<b>Unit III: PLANT MORPHOLOGY:</b> Structure and Modification of Root, Stem and Leaf - Structure and Types of Inflorescences - Structure and Types of Fruits					
		<b>Unit IV: GENETICS</b> Concept of Heredity and Variation. Dominant and recessive allelic interactions, Chromosome structure and Central dogma of molecular biology					
		<b>Unit V: PLANT PHYSIOLOGY:</b> Cell as a Physiological Unit: Water relations –Diffusion, Osmosis, Imbibition, Plasmolysis. Metabolism: Anabolism and Catabolism. Overview of plant hormones					
<b>Extended Professional Component (is a part of internal component only)</b>		Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved					

<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will be provided the basic knowledge on biodiversity, cell biology, plant morphology and concepts of genetics in plants.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.</li> <li>2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.</li> <li>3. Sharma, O.P.2017. Bryophyta, MacMillan India Ltd. Delhi.</li> <li>4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.</li> <li>5. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I and II, S. Chand and Co. New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.</li> <li>2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.</li> <li>3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand &amp; Company Ltd, Delhi.</li> <li>4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.</li> <li>5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand &amp; Company Ltd, Delhi.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.kobo.com/us/en/ebook/the-algae-world">1.https://www.kobo.com/us/en/ebook/the-algae-world</a></li> <li>2. <a href="http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html">http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html</a></li> <li>3. <a href="http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm">http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm</a></li> <li>4. <a href="https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/">https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/</a></li> <li>5. <a href="https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf">5.https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf</a></li> </ol>

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

<b>CO1</b>	Relate the salient features of plant groups	<b>K1</b>
<b>CO2</b>	Outline the prokaryotic and eukaryotic cellular structures	<b>K2</b>
<b>CO3</b>	Make use of the morphological characteristics for identifications	<b>K3</b>
<b>CO4</b>	Infer the genetic background for inheritance and variations	<b>K4</b>
<b>CO5</b>	Appraise the life keeping physiological processes in plants	<b>K5</b>

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes (PSOs) 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	1	2	2	3	2	2	1	2	2	1	2	2
CLO2	2	2	1	2	2	1	2	3	1	3	2	2
CLO3	3	2	2	1	2	2	1	2	1	1	3	1
CLO4	2	1	3	2	2	1	2	1	2	3	2	2
CLO5	1	2	3	2	3	2	1	2	2	1	2	2

### Blue for Internal CIA Examination

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
<b>Total Marks for each section</b>			<b>5</b>	<b>10</b>	<b>10</b>

### Blueprint for Semester Examination

Sl. No	Cos	K -Level	Section –A		Section –B		Section C (Either/Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – level	No. of Questions	K - Level		
1	CO1	Up to K2	2	K1 or K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Up to K3	2	K1 or K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
4	CO4	Up to K4	2	K1 or K2	1	K2	2(K4&K4)	1(K4)
5	CO5	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark for each question			1		2		5	10
Total Marks for each section			10		10		25	30

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>PLANT DIVERSITY – II: FUNGI, BACTERIA, VIRUSES, PLANT PATHOLOGY AND LICHENS</b>					
<b>TANSICHE Course type</b>		<b>CORE COURSE</b>					
<b>Course Category</b>		<b>CORE -Theory III</b>					
<b>Nature of Course</b>		<b>Employability</b> <input checked="" type="checkbox"/> / <b>Entrepreneurship</b> <input checked="" type="checkbox"/> / <b>Skill Development</b> <input checked="" type="checkbox"/>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	1	<b>Credits</b>	5	<b>Course Code</b>	<b>23U2BCCT2</b>
		<b>Semester</b>	2				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	
		5		-----		-----	
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Students should be familiar with the basics of fungi, bacteria, viruses and lichens.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To describe the common characteristics of fungi as being heterotrophic, unicellular/multicellular.</li> <li>• To understand the beneficial and harmful effects of fungi.</li> <li>• To understand structure, function, reproduction and biological role of Lichens.</li> <li>• To identify the structure and properties of bacteria and viruses.</li> <li>• To understand the various types of plant diseases and their control measures.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: FUNGI:</b> General characteristics: Hyphae and mycelium, mode of nutrition, Reproduction: Vegetative, Asexual (Sporulation) and Sexual methods. Classification of fungi - (Alexopoulos and Mims, 1979), Structure and lifecycle of Zygomycotina ( <i>Pilobolus</i> , <i>Mucor</i> ), Ascomycotina ( <i>Aspergillus</i> , <i>Peziza</i> ), Basidiomycotina ( <i>Agaricus</i> , <i>Puccinia</i> ) and Deuteromycotina ( <i>Cercospora</i> ).					
		<b>Unit II: ECONOMIC IMPORTANCE OF FUNGI: Beneficial aspects</b> - Food (mushrooms). agriculture (biofertilizers), Mycotoxins (biopesticides), Fermentation: alcohol (ethanol), organic acids (citric acid), enzymes (protease). Nutraceuticals: Vitamins, Pharmaceuticals: antibiotics, immunosuppressant, hallucinogen (LSD). <b>Harmful aspects:</b> Dermatophytes, Mucormycosis, menace in food, paper and leather industries					

	<p><b>Unit III: LICHENS:</b> Symbiosis, occurrence and forms of lichens (crustose, foliose and fruticose), Reproduction: Vegetative – Cephaloidea, Isidia and Soredia; Sexual reproduction of mycobionts. Anatomy of lichens. Structure and lifecycle of <i>Usnea</i>.</p> <p><b>Economic importance of Lichens:</b> food, fodder and nutrition, flavour, tanning and dyeing, cosmetics and perfumes, Brewing and distillation, minerals, Natural products, medicine (Ayurvedic, Siddha), pharmaceutical products, biodegradation agent, air pollution and biomonitoring, soil formation, nitrogen fixation, Harmful aspects, poison from lichens</p>
	<p><b>Unit IV: BACTERIA and VIRUSES:</b> Ultrastructure of bacteria (E. Coli), Chemistry of peptidoglycan, Flagella and flagellation. Classification (Bergey's, Manual of determinative bacteriology, 1994). Viruses: general characters, structure (Bacteriophage and TMV) and reproduction (Lytic and lysogenic cycles)</p>
	<p><b>Unit V: PLANT PATHOLOGY:</b> General symptoms of plant diseases; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of the following plant diseases.</p> <p><b>Bacterial diseases</b> – Citrus canker and Bacterial wilt of Banana</p> <p><b>Viral diseases</b> – Vein clearing of Papaya</p> <p><b>Fungal diseases</b> – Blast disease in rice and Tikka disease</p>
<b>Extended Professional Component (is a part of internal component only)</b>	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will be enhanced the fundamental knowledge on fungi, bacteria, viruses, lichens and concepts of plant pathology.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Pandey, B.P. 1997. College Botany. Vol. I Fungi &amp; Pathology.</li> <li>2. Mehrotra, R.S and Aneja, K.R. 2003. An introduction to mycology. New age International (P) Ltd, Publishers, New Delhi.</li> <li>3. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.</li> <li>4. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.</li> <li>5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.</li> <li>6. Sharma, P.D. 2011. Plant Pathology, Rastogi Publication, Meerut, India.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. Introductory Mycology. 4th edition. John Wiley &amp; Sons (Asia) Singapore.</li> <li>Sharma, O.P. 2011. Fungi and allied microbes The McGraw –Hill companies, New Delhi.</li> <li>Burnett, J.H. 1971. The fundamentals of Mycology. ELBS Publication, London.</li> <li>Dharani Dhar Awasthi. 2000. A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.</li> <li>Mishra, A. and Agarwal, R.P. 1978. Lichens – A Preliminary Text. Oxford and IBH.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li><a href="https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YFDFE">https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YFDFE</a></li> <li><a href="http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html">http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html</a></li> <li><a href="http://www.freebookcentre.net/Biology/Mycology-Books.html">http://www.freebookcentre.net/Biology/Mycology-Books.html</a></li> <li><a href="https://www.kobo.com/us/en/ebook/introduction-to-fungi">https://www.kobo.com/us/en/ebook/introduction-to-fungi</a></li> <li><a href="http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html">http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html</a></li> </ol>

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

<b>CO1</b>	Recognize the general characteristics, lifecycle and classification of fungi	<b>K1</b>
<b>CO2</b>	Summarize the economic importance of fungi	<b>K2</b>
<b>CO3</b>	Utilize the economic and ecological potentials of lichens	<b>K3</b>
<b>CO4</b>	Discuss the structural and survival aspects of bacteria and viruses	<b>K4</b>
<b>CO5</b>	Evaluate the host parasite interaction and control measures of some plant diseases	<b>K5</b>

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes (PSOs) 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	1	1	2	3	1	1	1	3	2	1	3	3
CLO2	2	2	1	2	2	1	2	2	1	2	1	2
CLO3	3	2	3	1	3	2	1	2	1	2	3	2
CLO4	2	1	2	2	2	3	2	1	2	3	2	1
CLO5	1	2	2	2	1	2	1	3	2	3	1	2

### Blue for Internal CIA Examination

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
<b>Total Marks for each section</b>			<b>5</b>	<b>10</b>	<b>10</b>

### Blueprint for Semester Examination

Sl. No	Cos	K - Level	Section –A		Section –B		Section C (Either/Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – level	No. of Questions	K - Level		
1	CO1	Up to K2	2	K1 or K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Up to K3	2	K1 or K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
4	CO4	Up to K4	2	K1 or K2	1	K2	2(K4&K4)	1(K4)
5	CO5	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark for each question			1		2		5	10
Total Marks for each section			10		10		25	30

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>PLANT DIVERSITY – II: FUNGI, BACTERIA, VIRUSES, PLANT PATHOLOGY AND LICHENS – PRACTICAL – II</b>					
<b>TANSICHE Course type</b>		<b>CORE COURSE PRACTICAL – 2</b>					
<b>Course Category</b>		<b>CORE -PRACTICAL – II</b>					
<b>Nature of Course</b>		Employability <input checked="" type="checkbox"/> / Entrepreneurship <input checked="" type="checkbox"/> / Skill Development <input checked="" type="checkbox"/>					
<b>Category</b>	Core	<b>Year</b>	1	<b>Credits</b>	3	<b>Course Code</b>	23U2BCCP2
		<b>Semester</b>	2				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		-----		-----		3	3
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Students should be familiar with the basics of fungi and lichens.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To enable students to identify microscopic and macroscopic fungi.</li> <li>To prepare microslides of fungi and lichens.</li> <li>To know the presence of pathogen inside the plant tissues through microscopic sections.</li> <li>To identify the bacterial strains by Gram staining.</li> <li>To know the economic importance of the microbes studied.</li> </ul>					
<b>Course Outline</b>		<p><b>PRACTICALS</b></p> <ol style="list-style-type: none"> <li>Microscopic observation of vegetative and reproductive structures of types prescribed in the syllabus through temporary preparations and permanent slides.</li> <li>Identifying and observing the micro slides relevant to the syllabus.</li> <li>Herbarium specimens of pathological specimens/ bacterial diseases/photograph.</li> <li>Protocol for mushroom cultivation.</li> <li>Inoculation techniques for fungal culture (Demonstration only).</li> <li>Study of economically important products obtained from fungi: Fungal biofertilizers, biopesticides, biofungicide (<i>Trichoderma</i>), edible mushroom/Yeast, organic acids (citric acid) enzymes (protease), antibiotics and vitamins.</li> <li>Mycorrhiza: ecto-mycorrhiza and endo-mycorrhiza (Photographs) Visit to Mushroom cultivation centres.</li> <li>Ultrastructure of bacteria (Image / Photograph)/ Gram staining technique.</li> <li>Structure of bacteriophage (Image / Microphotograph).</li> <li>Micro-preparation of <i>Usnea</i> to study vegetative and reproductive structures.</li> </ol>					

	<p>11. Identifying the permanent micro slides relevant to the syllabus.</p> <p>12. Economic importance of Lichens - Dye and perfume.</p>
<b>Extended Professional Component</b>	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will enhance the practical knowledge on identification and applications of bacteria, viruses, fungi and lichens in various fields of biological industries.
<b>Text Book(s)</b>	<p><b>Recommended Texts:</b></p> <ol style="list-style-type: none"> <li>1. Chmielewski, J.G and Kravesky, D. 2013. General Botany laboratory Manual. Author House, Bloomington, USA.</li> <li>2. Das, S and Saha, R. 2020. Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi, India.</li> <li>3. Webster, J and Weber, R. 2007. Introduction to Fungi, 3<sup>rd</sup> Ed. Cambridge University Press, Cambridge.</li> <li>4. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.</li> <li>5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Alexopoulos, and Mims, W. 1985. Introductory Mycology, Wiley Eastern Limited New Delhi.</li> <li>2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany 1 ( 10<sup>th</sup>ed). Rastogi Publications, Meerut.</li> <li>3. Singh, R and U.C. Singh 2020. Modern mushroom cultivation, 3d Edition Agrobios (India), Jodhpur.</li> <li>4. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.</li> <li>5. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. Introductory Mycology. 4th edition. John Wiley &amp; Sons (Asia) Singapore.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.in/Practical-Manual-Fungi-Fungicides/dp/B0025AEFP4">https://www.amazon.in/Practical-Manual-Fungi-Fungicides/dp/B0025AEFP4</a></li> <li>2. <a href="https://books.google.co.in/books/about/Practical_Mycology.html?id=5ycJAQAAMAAJ&amp;redir_esc=y">https://books.google.co.in/books/about/Practical_Mycology.html?id=5ycJAQAAMAAJ&amp;redir_esc=y</a></li> <li>3. <a href="https://www.flipkart.com/colour-handbook-practical-plant-pathology/p/itmefsn6dyhfhs9b">https://www.flipkart.com/colour-handbook-practical-plant-pathology/p/itmefsn6dyhfhs9b</a></li> <li>4. <a href="https://books.google.co.in/books/about/Practical_Botany.html?id=T5narQEACAAJ&amp;redir_esc=y">https://books.google.co.in/books/about/Practical_Botany.html?id=T5narQEACAAJ&amp;redir_esc=y</a></li> <li>5. <a href="https://www.kobo.com/us/en/ebook/introduction-to-fungi">https://www.kobo.com/us/en/ebook/introduction-to-fungi</a></li> </ol>

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

<b>CO1</b>	Identify microbes, fungi and lichens using key identifying characters.	<b>K1</b>
<b>CO2</b>	Develop practical skills for culturing mushroom.	<b>K2</b>
<b>CO3</b>	Identify and select suitable control measures for the common plant diseases.	<b>K3</b>
<b>CO4</b>	Analyze the characteristics of bacteria, viruses, fungi and plant pathogens.	<b>K4</b>
<b>CO5</b>	Access the useful role of bacteria, fungi and lichens in various industries.	<b>K5</b>

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:**

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes (PSOs) 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
<b>CLO1</b>	3	2	1	3	2	2	1	2	2	1	2	1
<b>CLO2</b>	3	2	2	2	3	2	3	2	1	2	1	2
<b>CLO3</b>	2	3	2	1	1	1	2	2	2	1	2	1
<b>CLO4</b>	3	2	3	3	2	1	2	3	3	2	2	2
<b>CLO5</b>	3	2	2	3	3	1	3	2	3	2	2	3

**Scheme of valuation**

CIA Component	Weight / Mark
Continuous Internal Assessment of class practical/Attendance/experimental skill	10 Marks
Model practical examination	15 Marks
<b>Internal component</b>	<b>25 Marks</b>
End semester External Practical examination	75 Marks
Total	<b>100 Marks</b>

<b>Title of the Course</b>		<b>MUSHROOM CULTIVATION</b>					
<b>TANSICHE Course type</b>		<b>SEC-2</b>					
<b>Course Category</b>		<b>Skill Enhancement Course – 2</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b> ✓					
<b>Category</b>	<b>Core</b>	<b>Year</b>	1	<b>Credits</b>	2	<b>Course Code</b>	<b>23U2BSED2</b>
		<b>Semester</b>	2				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		2	-----		-----		2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic knowledge on structure and function of various groups of mushrooms.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To learn and develop skills in mushroom cultivation.</li> <li>• To understand and appreciate the role of mushrooms in Nutrition, Medicine and health.</li> <li>• To cultivate mushroom cultivation in small scale industry.</li> <li>• To learn about diseases and post-harvest technology.</li> <li>• To study new methods and strategies to contribute to mushroom production.</li> </ul>					
<b>Course Outline</b>		<b>Unit I:</b> Introduction: Morphology, Types of Mushrooms, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms.					
		<b>Unit II:</b> Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry.					
		<b>Unit – III:</b> Life cycle of <i>Pleurotus spp</i> and <i>Agaricus spp</i> .					
		<b>Unit IV:</b> Spawn production, growth media, spawn running and harvesting of mushrooms and marketing.					
		<b>Unit V:</b> Diseases and post-harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases.					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved					

<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will be enhanced the knowledge on types of edible mushrooms and their cultivation technology.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Handbook of Mushroom Cultivation. 1999. TNAU publication.</li> <li>2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.</li> <li>3. Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.</li> <li>4. Sing. 2005. Modern Mushroom Cultivation, International Book Distributors, Dehradun.</li> <li>5. 5. Verma, 2013. Mushroom: edible and medicinal: cultivation conservation, strainimprovement with their marketing. Daya Publishing House.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Handbook of Mushroom Cultivation. 1999. TNAU publication.</li> <li>2. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.</li> <li>3. Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.</li> <li>4. Nita Bahl. 2002. Handbook on Mushroom 4<sup>th</sup> edition Vijayprimlani for oxford &amp; IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.</li> <li>5. Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.in/Mushroom-Cultivation-India-B-C/dp/817035479X">https://www.amazon.in/Mushroom-Cultivation-India-B-C/dp/817035479X</a></li> <li>2. <a href="http://nrcmushroom.org/book-cultivation-merged.pdf">http://nrcmushroom.org/book-cultivation-merged.pdf</a></li> <li>3. <a href="http://agricoop.nic.in/sites/default/files/ICAR_8.pdf">http://agricoop.nic.in/sites/default/files/ICAR_8.pdf</a></li> <li>4. <a href="http://www.agrimoon.com/mushroom-culture-horticulture-icar-pdf-book/">http://www.agrimoon.com/mushroom-culture-horticulture-icar-pdf-book/</a></li> <li>5. <a href="https://books.google.co.in/books/about/Mushroom_Cultivation_in_Indiahtml?id=6AJx99OGTKEC&amp;redir_esc=y">https://books.google.co.in/books/about/Mushroom_Cultivation_in_Indiahtml?id=6AJx99OGTKEC&amp;redir_esc=y</a></li> </ol>

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

<b>CO1</b>	Recall various types and categories of mushroom.	<b>K1</b>
<b>CO2</b>	Explain about various types of food technologies associated with mushroom industry.	<b>K2</b>
<b>CO3</b>	Apply techniques studied for cultivation of various types of mushrooms.	<b>K3</b>
<b>CO4</b>	Analyze and decipher the environmental factors and economic value associated with mushroom cultivation.	<b>K4</b>
<b>CO5</b>	Develop new methods and strategies to contribute to mushroom production.	<b>K5</b>

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes (PSOs) 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	2	3	1	3	2	3	1	2	2	3	2	2
CLO2	3	1	2	2	1	2	3	2	2	1	1	2
CLO3	2	2	2	1	2	1	2	3	2	2	1	1
CLO4	2	3	1	3	2	2	2	1	2	1	2	3
CLO5	3	3	2	3	2	1	2	3	2	2	3	3

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Continuous Internal Assessment Test	10 Marks
Assignments	5 Marks
Quiz	5 Marks
Attendance/ Class participation	5 Marks
<b>Total</b>	<b>25 Marks</b>

#### Blue for Internal CIA Examination

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
<b>Total Marks for each section</b>			<b>5</b>	<b>10</b>	<b>10</b>

### Blueprint for Semester Examination

Sl.No	Cos	K -Level	Section –A		Section –B		Section C (Either/Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – level	No. of Questions	K - Level		
1	CO1	Up to K2	2	K1 or K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Up to K3	2	K1 or K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
4	CO4	Up to K4	2	K1 or K2	1	K2	2(K4&K4)	1(K4)
5	CO5	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark for each question			1		2		5	10
Total Marks for each section			10		10		25	30

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>BOTANICAL GARDENING AND LANDSCAPING</b>					
<b>TANSICHE Course type</b>		<b>SEC – 3</b>					
<b>Course Category</b>		<b>SKILL ELECTIVE COURSE – 3</b>					
<b>Nature of Course</b>		Employability <input type="checkbox"/> / Entrepreneurship <input checked="" type="checkbox"/> / Skill Development <input checked="" type="checkbox"/>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	1	<b>Credits</b>	2	<b>Course Code</b>	<b>23U2BSED3</b>
		<b>Semester</b>	2				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		2	-----	-----		2	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Students should know about the fundamental concepts of gardening and landscaping.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To know about the fundamental concepts of gardening and landscaping.</li> <li>To provide an overview of various gardening styles and its scope in recreation and bio-aesthetic planning.</li> <li>To illustrate the significance of garden adornments and propagation structures.</li> <li>To inculcate entrepreneurial skills in students for creative landscaping design using CAD software.</li> <li>To create the design outdoor and indoor gardens and inculcate entrepreneurial skills for landscaping.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I:</b> Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses and cacti succulents.</p> <p><b>Unit II:</b> Flower arrangement: importance, production experiments and cultural operations, constraints, post-harvest practices. Bioaesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.</p> <p><b>Unit III:</b> Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens. Landscape designs, Styles of garden, formal, informal and free style gardens, types of gardens, Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporate.</p>					

	<p><b>Unit IV:</b> Establishment and maintenance, special types of gardens, Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping</p> <p><b>Unit V:</b> Computer Aided Designing (CAD) for outdoor and indoorscaping Exposure to CAD (Computer Aided Designing)</p>
<b>Extended Professional Component (is a part of internal component only)</b>	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will be enhanced the fundamental concepts of gardening and landscaping.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Acquaah, J. 2009. Horticulture – principles and practices, 4th edition, PHI learning Pvt. Ltd.</li> <li>2. Rao Manibhushan K. 1991. Textbook of horticulture. MaC Millan India Ltd.</li> <li>3. Gangulee H. C. and Kar A. K. 2004. College Botany Vol II, New Central Book Agency</li> <li>4. Sharma V. K. 1999. Encyclopaedia of Practical Horticulture, Vol I –IV, Deep And Deep Publ. Pvt. Ltd.</li> <li>5. Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Berry, F. and Kress, J. 1991. Heliconia: An Identification Guide . Smithsonian Books.</li> <li>2. Butts, E. and Stensson, K. 2012. Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.</li> <li>3. Russell, T. 2012. Nature Guide: Trees: The world in your hands (Nature Guides).</li> <li>4. Acquaah, J. 2009. Horticulture – principles and practices, 4th edition, PHI learning Pvt. Ltd.</li> <li>5. Edment Senn Andrews. 1994. Fundamentals of Horticulture. Tata McGraw Hill Publishing Co., Ltd., Delhi.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.overdrive.com/subjects/gardening">https://www.overdrive.com/subjects/gardening</a></li> <li>2. <a href="https://www.scribd.com/book/530538456/Opportunities-in-Landscape-Architecture-Botanical-Gardens-and-Arboreta-Careers">https://www.scribd.com/book/530538456/Opportunities-in-Landscape-Architecture-Botanical-Gardens-and-Arboreta-Careers</a></li> <li>3. <a href="https://www.scribd.com/book/305542619/Botanic-Gardens">https://www.scribd.com/book/305542619/Botanic-Gardens</a></li> <li>4. <a href="https://www.overdrive.com/subjects/gardening">https://www.overdrive.com/subjects/gardening</a></li> </ol>

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

<b>CO1</b>	Recognize fundamental concepts of gardening and landscaping.	<b>K1</b>
<b>CO2</b>	Explain about significance of garden adornments and propagation structures.	<b>K2</b>
<b>CO3</b>	Apply techniques of landscaping for aesthetic purposes and gardening for recreation.	<b>K3</b>
<b>CO4</b>	Distinguish between formal, informal and free style gardens and their applications.	<b>K4</b>
<b>CO5</b>	Develop and design outdoor and indoor gardens and inculcate entrepreneurial skills for landscaping.	<b>K5</b>

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:**

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes (PSOs) 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
<b>CLO1</b>	1	2	2	1	2	2	1	2	3	2	3	2
<b>CLO2</b>	2	2	2	2	3	2	1	2	2	1	1	1
<b>CLO3</b>	2	1	2	2	2	1	2	2	1	2	2	2
<b>CLO4</b>	2	1	2	3	1	2	1	1	3	2	3	2
<b>CLO5</b>	2	2	3	2	2	1	2	3	1	1	2	2

**Blue for Internal CIA Examination**

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
<b>Total Marks for each section</b>			<b>5</b>	<b>10</b>	<b>10</b>

### Blueprint for Semester Examination

Sl.No	Cos	K -Level	Section –A		Section –B		Section C (Either/Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – level	No. of Questions	K - Level		
1	CO1	Up to K2	2	K1 or K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Up to K3	2	K1 or K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
4	CO4	Up to K4	2	K1 or K2	1	K2	2(K4&K4)	1(K4)
5	CO5	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark for each question			1		2		5	10
Total Marks for each section			10		10		25	30

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>



**THE MADURA COLLEGE**  
**An Autonomous Institution affiliated to Madurai Kamaraj University**  
**Re-accredited (3<sup>rd</sup> cycle) with 'A' grade by NAAC**  
**Vidya Nagar, T.P.K. Road, Madurai – 625 011**

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**B.Sc. ALLIED BOTANY (For Zoology)**

<b>Semester – I</b>	<b>Course description</b>	<b>Course code</b>	<b>Hours</b>	<b>Credits</b>
<b>Part – III</b>	Generic Elective – 1 Allied Botany theory	<b>23U3BAZT1</b>	<b>4</b>	<b>4</b>
	Generic Elective – 1 Allied Botany Practical	<b>23U3BAZP1</b>	<b>2</b>	<b>1</b>
<b>Semester – II</b>				
<b>Part – III</b>	Generic Elective – 2 Allied Botany theory	<b>23U4BAZT2</b>	<b>4</b>	<b>4</b>
	Generic elective – 2 Allied Botany Practical	<b>23U4BAZP2</b>	<b>2</b>	<b>1</b>

<b>Title of the Course</b>		<b>ALLIED BOTANY – I</b>					
<b>TANSICHE Course type</b>		<b>GENERIC ELECTIVE (for Zoology)</b>					
<b>Course Category</b>		<b>CORE ALLIED – I</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development ✓</b>					
<b>Category</b>	Core	<b>Year</b>	1	<b>Credits</b>	4	<b>Course Code</b>	<b>23U3BAZT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	
		4		-----		-----	
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		To study the basics of botany.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To study general characters, structure and reproduction of algae.</li> <li>• To describe the structure, life cycle and economic importance of Fungi, Bacteria and Viruses.</li> <li>• To familiarize characteristic features of Bryophytes, Pteridophytes and Gymnosperms.</li> <li>• To demonstrate the basic concepts of cell biology.</li> <li>• To understand the basic concepts of genetics and plant biotechnology.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Algae:</b> General characters of algae - Structure, reproduction and life cycle of the following genera - <i>Anabaena</i> and <i>Sargassum</i> and economic importance of algae.					
		<b>Unit II: Fungi, Bacteria and Virus:</b> General characters of fungi, structure, reproduction and life cycle of the following genera - <i>Penicillium</i> and <i>Agaricus</i> and economic importance of fungi. Bacteria - general characters, structure and reproduction of <i>Escherichia coli</i> and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage.					
		<b>Unit III: Bryophytes, Pteridophytes and Gymnosperms:</b> General characters of Bryophytes, Structure and life cycle of <i>Funaria</i> . General characters of Pteridophytes, Structure and life cycle of <i>Lycopodium</i> . General characters of Gymnosperms, Structure and life cycle of <i>Cycas</i>					
		<b>Unit IV: Cell biology:</b> Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.					

	<b>Unit V: Genetics and Plant Biotechnology:</b> Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - <i>In vitro</i> culture methods. Plant tissue culture and its application in biotechnology.
<b>Extended Professional Component (is a part of internal component only)</b>	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will be enhanced the fundamental knowledge on algae, fungi, bacteria, viruses, bryophytes, pteridophytes, gymnosperms and their beneficial applications for humankind.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.</li> <li>2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.</li> <li>3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.</li> <li>4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.</li> <li>5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S.Viswanathan Pvt. Ltd., Madras.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Parihar, N.S. 2012. An introduction to Embryophyta – Pteridophytes - Surjeet Publications, Delhi.</li> <li>2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.</li> <li>3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand &amp; Company Ltd, Delhi.</li> <li>4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.</li> <li>5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand &amp; Company Ltd, Delhi.</li> <li>6. Parihar, N.S. 2013. An introduction to Embryophyta – Bryophytes, Surjeet Publications, Delhi.</li> <li>7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &amp;II, S.Chand and Co. New Delhi..</li> </ol>

<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.kobo.com/us/en/ebook/the-algae-world">https://www.kobo.com/us/en/ebook/the-algae-world</a></li> <li>2. <a href="http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html">http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html</a></li> <li>3. <a href="http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm">http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm</a></li> <li>4. <a href="https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/">https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/</a></li> <li>5. <a href="https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf">https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf</a></li> <li>6. <a href="https://www.us.elsevierhealth.com/medicine/cell-biology">https://www.us.elsevierhealth.com/medicine/cell-biology</a></li> </ol>
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**COURSE OUTCOMES:** At the end of the course, the student will be able to:

<b>CO1</b>	Increase the awareness and appreciation of beneficial algae and their economic importance.	<b>K1</b>
<b>CO2</b>	Develop an understanding of microbes and fungi and appreciate their adaptive strategies.	<b>K2</b>
<b>CO3</b>	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	<b>K3</b>
<b>CO4</b>	Compare the structure and function of cells and cell organelles.	<b>K4</b>
<b>CO5</b>	Understand the core concepts and fundamentals of genetics and plant biotechnology.	<b>K5</b>

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:**

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

<b>CLO</b>	<b>Pos</b>						<b>PSOs</b>					
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>CLO1</b>	2	3	1	3	2	3	1	2	2	1	2	2
<b>CLO2</b>	3	2	2	2	3	2	3	2	2	1	1	2
<b>CLO3</b>	2	2	1	1	2	1	2	1	3	1	1	1
<b>CLO4</b>	2	3	1	3	3	2	2	3	3	2	2	3
<b>CLO5</b>	3	3	2	3	2	1	3	3	2	2	3	2

**Assessment Scheme**

**Components of CIA**

<b>Component</b>	<b>Weight / Mark</b>
Continuous Internal Assessment Test	10 Marks
Assignments	5 Marks
Quiz	5 Marks
Attendance/ Class participation	5 Marks
<b>Total</b>	<b>25 Marks</b>

### 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
<b>Total Marks for each section</b>			<b>5</b>	<b>10</b>	<b>10</b>

### Blueprint for Semester Examination

Sl.No	Cos	K -Level	Section –A		Section –B		Section C (Either/Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – level	No. of Questions	K - Level		
1	CO1	Up to K2	2	K1or K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Up to K3	2	K1or K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Up to K3	2	K1or K2	1	K2	2(K3&K3)	1(K3)
4	CO4	Up to K4	2	K1or K2	1	K2	2(K4&K4)	1(K4)
5	CO5	Up to K3	2	K1or K2	1	K2	2(K3&K3)	1(K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark for each question			1		2		5	10
Total Marks for each section			10		10		25	30

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>ALLIED BOTANY PRACTICAL – I</b>					
<b>TANSICHE Course type</b>		<b>ALLIED BOTANY – PRACTICAL</b>					
<b>Course Category</b>		<b>ALLIED BOTANY PRACTICAL– I</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development ✓</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	1	<b>Credits</b>	1	<b>Course Code</b>	<b>23U1BAZP1</b>
		<b>Semester</b>	2				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		-----	-----	2		2	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Practicals pertaining to algae, fungi, bryophytes, pteridophytes, gymnosperms, cell biology and plant biotechnology.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, fungi, bryophytes, pteridophytes and gymnosperms.</li> <li>• To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological features, anatomy and reproduction.</li> <li>• To be familiar with the basic concepts and principles of micropreparations for plant identification.</li> <li>• Understanding of basic functions of cells and cell components.</li> <li>• To learn about the concepts of genetics and plant biotechnology.</li> </ul>					
<b>Course Outline</b>		<b>PRACTICALS</b> <ol style="list-style-type: none"> <li>1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.</li> <li>2. Micro photographs and permanent slides for the respective lower organisms prescribed in the course.</li> <li>3. To make suitable micro preparations of anatomy materials prescribed in the syllabus.</li> <li>4. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy, Embryology, Cell biology and Biotechnology.</li> <li>5. Identify the structure and functions of cell organelles – Microphotographs/models</li> <li>6. To work out the simple genetic problems relevant to monohybrid and dihybrid cross.</li> </ol>					

<b>Extended Professional Component (is a part of internal component only)</b>	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will be enhanced the practical knowledge on identification and utilization of algae, bryophytes, pteridophytes, gymnosperms and also provided the fundamental concepts of cell biology and genetics.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.</li> <li>2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.</li> <li>3. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.</li> <li>2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.</li> <li>3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.</li> <li>4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press &amp; Wiley Publications.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883">https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883</a></li> <li>2. <a href="https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;gbpv=1&amp;dq=gymnosperms&amp;printsec=frontcover">https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&amp;gbpv=1&amp;dq=gymnosperms&amp;printsec=frontcover</a></li> <li>3. <a href="https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ">https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ</a></li> <li>4. <a href="https://medlineplus.gov/genetocs/understanding/basics/cell/">https://medlineplus.gov/genetocs/understanding/basics/cell/</a></li> </ol>

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

<b>CO1</b>	To study the internal organization of algae and fungi.	<b>K1</b>
<b>CO2</b>	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	<b>K2</b>
<b>CO3</b>	To study the classical micropreparation methods for plant identification.	<b>K3</b>
<b>CO4</b>	Understand the fundamental concepts of cell biology.	<b>K4</b>
<b>CO5</b>	To interpret the various concepts of genetics and plant biotechnology.	<b>K5</b>

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes (PSOs) 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
<b>CLO1</b>	3	3	1	3	2	3	1	2	2	1	2	2
<b>CLO2</b>	3	3	2	2	3	2	3	2	1	2	1	2
<b>CLO3</b>	2	2	1	1	2	1	2	1	3	1	1	1
<b>CLO4</b>	3	3	3	3	3	2	2	3	3	2	2	3
<b>CLO5</b>	3	3	2	3	2	1	3	3	3	2	1	2

### Scheme of valuation

CIA Component	Weight / Mark
Continuous Internal Assessment of class practical/Attendance/experimental skill	10 Marks
Model practical examination	15 Marks
<b>Internal component</b>	<b>25 Marks</b>
End semester External Practical examination	75 Marks
Total	<b>100 Marks</b>

<b>Title of the Course</b>		<b>ALLIED BOTANY – II</b>					
<b>TANSICHE Course type</b>		<b>ALLIED BOTANY – II</b>					
<b>Course Category</b>		<b>ALLIED BOTANY – II</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development ✓</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	1	<b>Credits</b>	4	<b>Course Code</b>	<b>23U2BAZT2</b>
		<b>Semester</b>	2				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		4	-----		-----		4
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		To study the basics of botany.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To be familiar with the basic concepts and principles of plant systematics.</li> <li>• Learn the importance of plant families and their description with economic importance of notable plants.</li> <li>• Understand the anatomical structure of higher plants.</li> <li>• To learn about the embryological process in flowering plants.</li> <li>• To know the energy production and physiological mechanisms in plants.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Morphology of Flowering Plants:</b> Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.					
		<b>Unit II: Taxonomy:</b> Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae.					
		<b>Unit III: Anatomy:</b> Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.					
		<b>Unit IV: Embryology:</b> Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.					
		<b>Unit V: Plant Physiology:</b> Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.					

<b>Extended Professional Component (is a part of internal component only)</b>	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will be enhanced the knowledge on plant morphology, taxonomy, embryology and plant physiology.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.</li> <li>2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.</li> <li>3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.</li> <li>4. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.</li> <li>5. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Lawrence. G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.</li> <li>2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.</li> <li>3. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.</li> <li>4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.</li> <li>5. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.</li> <li>6. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.</li> <li>7. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand &amp; Co., New Delhi.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&amp;redir_esc=y">https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&amp;redir_esc=y</a></li> <li>2. <a href="https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFUC&amp;redir_esc=y">https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFUC&amp;redir_esc=y</a></li> <li>3. <a href="https://archive.org/EXPERIMENTS/plantanatomy031773mbp">https://archive.org/EXPERIMENTS/plantanatomy031773mbp</a></li> <li>4. <a href="https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG">https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG</a></li> <li>5. <a href="https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692">https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692</a></li> </ol>

**COURSE OUTCOMES:**

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

<b>CO1</b>	Understand the fundamental concepts of plant anatomy and embryology.	<b>K1</b>
<b>CO2</b>	Analyze and recognize the different organs of plants and secondary growth.	<b>K2</b>
<b>CO3</b>	Understand water relation of plants with respect to various physiological processes.	<b>K3</b>
<b>CO4</b>	Classify aerobic and anaerobic respiration.	<b>K4</b>
<b>CO5</b>	Classify plant systematics and recognize the importance of herbarium and virtual herbarium.	<b>K5</b>

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes (PSOs) 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	2	3	1	2	2	3	1	2	2	1	2	2
CLO2	3	2	2	2	3	2	3	2	2	1	1	2
CLO3	2	2	1	1	2	1	2	1	3	2	1	1
CLO4	2	3	1	3	3	2	2	3	3	2	2	2
CLO5	3	3	2	2	1	1	3	3	2	2	3	2

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Continuous Internal Assessment Test	10 Marks
Assignments	5 Marks
Quiz / Model making	5 Marks
Attendance/ Class participation	5 Marks
<b>Total</b>	<b>25 Marks</b>

#### 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
<b>Total Marks for each section</b>			<b>5</b>	<b>10</b>	<b>10</b>

### Blueprint for Semester Examination

Sl.No	Cos	K -Level	Section –A		Section –B		Section C (Either/Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – level	No. of Questions	K - Level		
1	CO1	Up to K2	2	K1 or K2	1	K1	2(K1&K1)	1(K2)
2	CO2	Up to K3	2	K1 or K2	1	K1	2(K2&K2)	1(K3)
3	CO3	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
4	CO4	Up to K4	2	K1 or K2	1	K2	2(K4&K4)	1(K4)
5	CO5	Up to K3	2	K1 or K2	1	K2	2(K3&K3)	1(K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark for each question			1		2		5	10
Total Marks for each section			10		10		25	30

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>ALLIED BOTANY PRACTICAL – II</b>					
<b>TANSICHE Course type</b>		<b>ALLIED BOTANY PRACTICAL – II</b>					
<b>Course Category</b>		<b>ALLIED BOTANY PRACTICAL – II</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	1	<b>Credits</b>	1	<b>Course Code</b>	<b>23U2BAGEP2</b>
		<b>Semester</b>	2				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		-----	-----	2		2	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Practical pertaining to plant morphology, taxonomy, embryology and plant physiology.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To enhance information on the identification of flowering plants by their morphological characters.</li> <li>• To comprehend the fundamental concepts and methods used for description of higher plants by their systematic approach.</li> <li>• To be familiar with the basic concepts of economic importance and utilization of higher plants.</li> <li>• Understanding the fundamental embryological behaviour of flowering plants.</li> <li>• To learn about the physiological processes that underlie plant metabolism.</li> </ul>					
<b>Course Outline</b>		<b>PRACTICALS</b> <ol style="list-style-type: none"> <li>1. To identify the morphological features of higher plants by both vegetative and reproductive characters.</li> <li>2. To describe in technical terms, plants belonging to any of the family prescribed in the course content.</li> <li>3. To dissect a flower, construct floral diagram and write floral formula.</li> <li>4. To take the cross section of <i>Datura</i> anther.</li> <li>5. Identify the types of ovules from the permanent slides.</li> <li>6. Demonstrate the experiment for evolution of oxygen during photosynthesis.</li> <li>7. Demonstration physiological set up: 1. Ganong's Light screen and 2. Ganong's respiroscope</li> </ol>					
<b>Extended Professional Component (is a part of internal component only)</b>		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved					

<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will be provided the practical knowledge on plant identification, embryological behaviour of plants and concepts of physiological mechanisms.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.</li> <li>2. Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press &amp; Wiley Publications.</li> <li>2. Steward, F.C. 2012. Plant Physiology Academic Press, US.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ">https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarker-ebook/dp/B07CV96NZJ</a></li> <li>2. <a href="https://medlineplus.gov/genetocs/understanding/basics/cell/">https://medlineplus.gov/genetocs/understanding/basics/cell/</a></li> <li>3. <a href="https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf">https://apan.net/meetings/apan45/files/17/17-01-01-01.pdf</a></li> </ol>

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

<b>CO1</b>	To study the internal organization of algae and fungi.	<b>K1</b>
<b>CO2</b>	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	<b>K2</b>
<b>CO3</b>	To study the classical taxonomy with reference to different parameters.	<b>K3</b>
<b>CO4</b>	Understand the fundamental concepts of plant anatomy and embryology.	<b>K4</b>
<b>CO5</b>	To study the effect of various physical factors on photosynthesis.	<b>K5</b>

## MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES:

Mapping of Course Outcomes (CLO) against Programme Outcomes (PO) and Programme Specific Outcomes (PSOs) 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
<b>CLO1</b>	3	3	1	3	2	3	1	2	2	1	2	2
<b>CLO2</b>	3	3	2	2	3	2	3	2	1	2	1	2
<b>CLO3</b>	2	2	1	1	2	1	2	1	3	1	1	1
<b>CLO4</b>	3	3	3	3	3	2	2	3	3	2	2	3
<b>CLO5</b>	3	3	2	3	2	1	3	3	3	2	1	2

### Scheme of valuation

CIA Component	Weight / Mark
Continuous Internal Assessment of class practical/Attendance/experimental skill	10 Marks
Model practical examination	15 Marks
<b>Internal component</b>	<b>25 Marks</b>
End semester External Practical examination	75 Marks
<b>Total</b>	<b>100 Marks</b>



**THE MADURA COLLEGE**  
An Autonomous Institution affiliated to Madurai Kamaraj University  
Re-accredited (3<sup>rd</sup> cycle) with 'A' grade by NAAC  
Vidya Nagar, T.P.K. Road, Madurai – 625 011

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**BOTANY DEPARTMENT- POST GRADUATE (P.G)**

**Vision**

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

**Mission**

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

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

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

## EVALUATION (Theory)

Internal (Formative) : 25 Marks

External (Summative): 75 Marks

Total: 100 Marks

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

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

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

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

## EVALUATION (Practical)

Internal (Formative): 40 Marks

External (Summative): 60 Marks

Total: 100 Marks

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

S. No.	Components	Marks
1.	Major question (sections/dissections/experiments)	15
2.	Minor Question (sections/dissections/experiments)	08
3.	Spotters	12
4.	Record	05
	<b>Total</b>	<b>40 (Scale down to 25)</b>

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

S. No.	Components	Marks
1.	Major question (sections/dissections/experiments)	20
2.	Minor Question (sections/dissections/experiments)	15
3.	Spotters	20
4.	Record	05
	<b>Total</b>	<b>60 (Scale up to 75)</b>

**THE MADURA COLLEGE (AUTONOMOUS), MADURAI - 11**

**DEPARTMENT OF BOTANY**

**TANSCHÉ- Curriculum Structure for M.Sc. Botany (Major) to be implemented from June 2023- 2024**

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

<b>Title of the Course</b>		<b>Plant Diversity – I: Algae, Fungi, Lichens and Bryophytes</b>				
<b>TANSICHE Course type</b>		<b>CC1</b>				
<b>Course Category</b>		<b>Core</b>				
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>				
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>5</b>	<b>Course Code</b>
		<b>Semester</b>	<b>I</b>			
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		<b>4</b>	<b>2</b>		<b>-</b>	<b>6</b>
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>		<b>Total</b>	
		<b>25</b>	<b>75</b>		<b>100</b>	
<b>Pre-requisite(s)</b>		Students should be familiar with the basics of algae, fungi, lichens and Bryophytes.				
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes.</li> <li>To gain knowledge about the ecological and economic importance of algae, fungi, lichens and bryophytes.</li> <li>To spark interest in the evolutionary roots of various plant growth.</li> <li>To study the biodiversity by describing and explaining the morphology and reproductive processes of algae, fungi, bryophytes and microorganisms.</li> <li>To expose the beneficial and harmful aspects of plant groups mentioned.</li> </ul>				
<b>Course Outline</b>		<p><b>Unit I: Algae (20 hrs)</b> General account of algology, Contributions of Indian Phycologist (T.V. Desikachary, V. Krishnamurthy and V.S. Sundaralingam), Classification of algae by F.E. Fritsch (1935-45) &amp; Silva (1982). Salient features of major classes: Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae, Cryptophyceae, Dinophyceae, Chloromonadineae, Euglenophyceae, Charophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae.</p> <p>Range of thallus organization of algae, diverse habitats, reproduction (vegetative, asexual and sexual) and life cycles. Phylogeny and inter-relationships of algae, origin and evolution of sex in algae. Structure, reproduction and life cycle of the following genera: <i>Oscillatoria</i>, <i>Scytonema</i>, <i>Ulva</i>, <i>Codium</i>, <i>Diatoms</i>, <i>Dictyota</i> and <i>Gelidium</i></p> <p><b>Unit II: Fungi (20 hrs)</b> General Characteristics, occurrence and distribution. Mode of nutrition in fungi. Contributions of Indian Mycologists (C.V. Subramanian), Classification of Fungi by Alexopoulos and Mims (1979) &amp; Recent trends in the classification of fungi - Phylogeny and inter-relationships of major groups of fungi. General characters of major classes:</p>				

	<p>Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Heterothallism in fungi, sexuality in fungi, Para sexuality, sex hormones in fungi.</p> <p>Structure, reproduction and life histories of the following genera: <i>Plasmodiophora</i>, <i>Phytophthora</i>, <i>Rhizopus</i>, <i>Taphrina</i>, <i>Polyporus</i> and <i>Colletotrichum</i>.</p>
	<p><b>Unit III: Lichens (12 hrs)</b> Introduction and Classification (Hale, 1969). Occurrence and inter-relationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basidiolichens and Deuterolichens.</p>
	<p><b>Unit IV: Bryophytes (20 hrs)</b> General characters and Classification of Bryophytes by Watson (1971). Distribution, Structural variations and evolution of gametophytes and sporophytes in Hepaticopsida, Anthoceroopsida and Bryopsida. General characters of major groups - Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Reproduction - Vegetative and sexual, spore dispersal mechanisms in bryophytes, spore germination patterns in bryophytes.</p> <p>Structure, reproduction and life cycle of the following genera: <i>Targionia</i>, <i>Lunularia</i>, <i>Porella</i> and <i>Polytrichum</i>.</p>
	<p><b>Unit V: Economic Importance (18 hrs) Algae</b> - Economic importance in Food and feed - Single cell protein, Industrial products (Agar-Agar, Carrageenan, Alginic acid, Iodine, biofertilizers, Vitamins and biofuel), Medicinal value and Diatomaceous earth. <b>Fungi</b> – Economic importance in food, industries and medicine. Cultivation of mushrooms <i>Pleurotus</i>. <b>Lichen</b> – economic importance and as indicator pollution. <b>Bryophytes</b> – ecological and economic importance – industry, horticulture and medicine.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	<p>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)</p>
<b>Skills acquired from this course</b>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<b>Justification for nature of course</b>	<p>This course enables the students to classify and understand structure and reproduction of various lower non-vascular plant groups and their utilization.</p>
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Kumar, H.D.1999. Introductory Phycology. Affiliated East-West Press, Delhi.</li> <li>2. Barsanti, L. and Guadtieri, P. 2014. Algae: Anatomy, Biochemistry and Biotechnology, 2<sup>nd</sup> Edition, CRC Press, ISBN: 1439867321.</li> <li>3. Sharma, O.P. 2011. Fungi and Allied Microorganisms, Mc Graw Hill,</li> </ol>

	<p>ISBN:9780070700383, 0070700389</p> <p>4. Kevin K. 2018. Fungi biology and Application, 3rd Edition, Wiley Blackwell.</p> <p>5. Pandey, P.B. 2014. College Botany-1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.</p>
<b>Reference Book(s)</b>	<p>1. Sundaralingam, V. 1991. Marine algae. Bishen Singh and Mahendra Pal Singh Publishers, Dehradun.</p> <p>2. Edwardlee,R. 2018. Phycology, 5<sup>th</sup>Ed., Cambridge University Press, London.</p> <p>3. Nash, T.H. 2008. Lichen Biology, Cambridge University press.</p> <p>4. Johri, R.M., Lata, S. and Tyagi, K. 2012. A Textbook of Bryophyta. Dominant Publishers &amp; Distributors Pvt., Ltd., New Delhi. ISBN: 9789384207335.</p> <p>5. Alexopoulos, C.J. and Mims, M. 2007. Introductory Mycology. 4th Edition, Wiley Publishers, ISBN: 9780471522294</p> <p>6. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.</p> <p>7. Sharma, O.P. 2014. Bryophyta, Mcgraw Hill, ISBN: 9781259062872, 1259062872.</p>
<b>Websites and e-Learning resources</b>	<p>1. <a href="https://www.britannica.com/science/algae">https://www.britannica.com/science/algae</a></p> <p>2. <a href="https://en.wikipedia.org/wiki/Bryophyte">https://en.wikipedia.org/wiki/Bryophyte</a></p> <p>3. <a href="https://www.britannica.com/plant/bryophyte/Ecology-and-habits">https://www.britannica.com/plant/bryophyte/Ecology-and-habits</a></p> <p>4. <a href="https://www.livescience.com/53618-fungus.html">https://www.livescience.com/53618-fungus.html</a>.</p>

### COURSE OUTCOMES:

CO	At the end of the course, the student will be able to:	K-level
CO1	Relate to the structural organizations of algae, fungi, lichens and bryophytes.	K1
CO2	Demonstrate both the theoretical and practical knowledge in understanding the diversity of basic life forms and their importance.	K2
CO3	Explain life cycle patterns in algae, fungi, lichens and Bryophytes.	K3
CO4	Compare and contrast the mode of reproduction in diverse groups of Primitive plants.	K3
CO5	Discuss and develop skills for effective conservation and utilization of lower plant forms.	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	3	1	2	2	3	3
CLO2	3	3	2	2	3	2	3	2	3	3	2
CLO3	2	2	3	3	1	1	2	1	3	3	3
CLO4	3	3	3	3	3	2	2	3	3	2	2
CLO5	3	3	2	3	2	3	3	3	3	1	2

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Openchoice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 3	1	1 (K1/K2)	2(K2/ K3)	1 (K2&K3)
2	CLO y	Up to K 4	1	1( K1/K2)	2(K3/ K4)	1(K3/K4)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

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

K1 - Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

**Distribution of Section- wise marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	2	4	10	10	<b>26</b>	21.66	
K3	4	2	10	20	<b>36</b>	30.00	<b>30%</b>
K4	2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>	<b>Plant Diversity – II: Pteridophytes, Gymnosperms and Paleobotany</b>						
<b>TANSICHE Course type</b>	<b>CC2</b>						
<b>Course Category</b>	<b>Core</b>						
<b>Nature of Course</b>	<b>Employability / Entrepreneurship / Skill Development</b>						
<b>Category</b>	<b>Co re</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23P1BCCT2</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>	<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
	<b>4</b>		<b>2</b>		<b>-</b>	<b>6</b>	
<b>Marks</b>	<b>CIA</b>		<b>Semester</b>		<b>Total</b>		
	<b>25</b>		<b>75</b>		<b>100</b>		
<b>Pre-requisite(s)</b>	Students should know about the fundamentals of Pteridophytes, Gymnosperms and fossil records.						
<b>Objectives of the Course</b>	<ul style="list-style-type: none"> <li>To investigate the classification, distinctive traits, distribution and reproduction and life cycle of the various classes and major types of Pteridophytes and Gymnosperms.</li> <li>To identify and characterize diversity of non-flowering plants in order to comprehend the dynamics of diversity to realize the importance of diversity.</li> <li>To research the classification, phylogeny and economic importance of Pteridophytes and Gymnosperms.</li> <li>To study and understand the phylogeny and Paleontology of Pteridophytes and Gymnosperms.</li> <li>To learn about the concept of fossils and process of fossilization; distinctive characteristics of fossil records of Pteridophytes and Gymnosperms.</li> </ul>						
<b>Course Outline</b>	<b>Unit I: Pteridophytes (18 hrs)</b> General characteristics and classification (Reimer, 1954). Range of structure, reproduction and evolution of the gametophytes, Gametophyte types – sex organs. Apogamy and Apospory. Life cycles. Stelar evolution. Heterospory and seed habit, Morphogenesis; Telome concept, theory, Economic importance of Pteridophytes.						
	<b>Unit II: Pteridophytes (18 hrs)</b> Structure, anatomy, reproduction and life cycle of the following genera: <i>Isoetes</i> , <i>Equisetum</i> <i>Angiopteris</i> , <i>Osmunda</i> , <i>Pteris</i> and <i>Azolla</i> .						
	<b>Unit III: Gymnosperms (18 hrs)</b> General characters - A general account of distribution. Morphology, anatomy, reproduction, phylogeny and classification of Gymnosperms (K.R.Sporne, 1965). Economic importance of Gymnosperms.						
	<b>Unit IV: Gymnosperms (18 hrs)</b> Structure (Exomorphic and endomorphic), anatomy, reproduction and life cycle of the following genera: <i>Thuja</i> , <i>Cupressus</i> , <i>Araucaria</i> , <i>Podocarpus</i> , <i>Gnetum</i> and <i>Ephedra</i> .						

	<b>Unit V: Paleobotany (18 hrs)</b> Geological Time Scale; Radiocarbon dating; Contribution of Birbal Sahni. Gondwana flora of India. Study of fossils in understanding evolution. Fossilization and fossil types. Economic importance of fossils – fossil fuels and industrial raw materials and uses. Study of organ genera: <i>Rhynia, Lepidocarpon, Calamites, Cordaites</i> and <i>Lyginopteris</i> .
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course enables the students to classify and understand structure and reproduction of vascular plant groups and their utilization.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Vashishta, P.C. Sinha, A.K and Anil Kumar. 2016. Botany for Degree students. Gymnosperms. S. Chand and Company Ltd., New Delhi.</li> <li>2. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.</li> <li>3. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.</li> <li>4. Sharma, O.P. 2017. Pteridophyta, McGraw Hill Education, New York.</li> <li>5. Vashishta. P.C., A.K. Sinha and Anil Kumar. 2018. Botany for Degree students -Gymnosperms. S. Chand and Company Ltd., New Delhi.</li> <li>6. Parihar, N.S. 2019. An Introduction to Embryophyta Pteridophytes. 5th Edition, Surjeet Publication, Delhi.</li> <li>7. Rashid, A. 2013. An introduction to Pteridophyta – Diversity, Development and differentiation (2<sup>nd</sup> edition), Vikas Publications.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Johri, R.M, Lata, S, Tyagi, K. 2005. A text book of Gymnosperms, Dominate pub and Distributer, New Delhi.</li> <li>2. Pandey, S.N and Trivedi, P.S. 2015. A Text Book of Botany Vol. II- 12 th edition (Paper back), Vikas Publishing.</li> <li>3. Arnold A.C. 2005. An Introduction to Paleobotany. Agrobios (India). Jodhpur.</li> </ol>

	<ol style="list-style-type: none"> <li>4. Sporne, K.R. 2017. The morphology of Pteridophytes (The structure of Ferns and Allied Plants) (Paper back), Andesite Press.</li> <li>5. Sporne, K.R. 1967. The Morphology of Gymnosperms. Hutchinson &amp; Co., London.</li> <li>6. Taylor, E, Taylor, T, Krings, M. 2008. Paleobotany: The Biology and Evolution of FossilPlants, 2<sup>nd</sup> Edition, Academic Press.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/">https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/</a></li> <li>2. <a href="http://www.bsienviis.nic.in/Database/Pteridophytes-in-India_23432.aspx">http://www.bsienviis.nic.in/Database/Pteridophytes-in-India_23432.aspx</a></li> <li>3. <a href="https://trove.nla.gov.au/work/11471742?q&amp;versionId=46695996">https://trove.nla.gov.au/work/11471742?q&amp;versionId=46695996</a></li> <li>4. <a href="https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ">https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ</a></li> <li>5. <a href="https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-Pine-">https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-Pine-</a></li> </ol>

### COURSE OUTCOMES:

CO	At the end of the course, the student will be able to:	K-level
CO1	Recall on classification, recent trends in phylogenetic relationship, general characters of Pteridophytes and Gymnosperms.	K1 & K2
CO2	Learn the morphological/anatomical organization, life history of major types of Pteridophytes and Gymnosperms.	K3 & K4
CO3	Comprehend the economic importance of Pteridophytes, Gymnosperms, and fossils.	K3 & K4
CO4	Understanding the evolutionary relationship of Pteridophytes and Gymnosperms.	K3
CO5	Awareness on fossil types, fossilization and fossil records of Pteridophytes and Gymnosperms.	K1 & 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	2	3	3	3	3	2
CLO2	3	3	3	3	3	2	3	3	3	3	3
CLO3	2	3	3	3	3	3	1	3	3	3	2
CLO4	3	3	2	3	3	1	3	3	2	3	1
CLO5	3	2	2	2	2	1	2	2	1	2	1

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Openchoice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 3	1	1 (K1/K2)	2(K2/ K3)	1 (K2&K3)
2	CLO y	Up to K 4	1	1( K1/K2)	2(K3/ K4)	1(K3/K4)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

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

K1 - Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

**Distribution of Section- wise marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	2	4	10	10	<b>26</b>	21.66	
K3	4	2	10	20	<b>36</b>	30.00	<b>30%</b>
K4	2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>Core-III Laboratory Course-I: Covering Theory Papers I and II</b>					
<b>TANSICHE Course type</b>		<b>CC3</b>					
<b>Course Category</b>		<b>Core</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Categ ory</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>4</b>	<b>Course Code</b>	<b>23P1BCCP1</b>
		<b>Semeste r</b>	<b>I</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		<b>-</b>	<b>-</b>		<b>6</b>	<b>6</b>	
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>		<b>Total</b>		
		<b>40</b>	<b>60</b>		<b>100</b>		
<b>Pre-requisite(s)</b>		Students should be familiar with practical examination and identification of algae, fungi, lichens, bryophytes, pteridophytes, gymnosperms, & fossils in addition to essential laboratory techniques.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To learn the skills &amp; techniques of micro-preparation of vegetative and reproductive parts thallophytes and non-flowering plant groups.</li> <li>To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of algae, and fungi.</li> <li>To comprehend the fundamental concepts and methods used to identify bryophytes, pteridophytes and gymnosperms through morphological changes and evolution, anatomy and reproduction.</li> <li>To develop the technical abilities in staining, sectioning and characterizing. thallophytes, and other varieties of non-flowering plants.</li> <li>To compare the structural diversity of fossil and extinct plant species.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Algae</b> <ul style="list-style-type: none"> <li>Study of algae in the field and laboratory of the genera included in theory.</li> <li>External morphology and internal anatomy of the vegetative and reproductive structures of the following living forms: <i>Oscillatoria</i>, <i>Scytonema</i>, <i>Ulva</i>, <i>Codium</i>, <i>Diatoms</i>, <i>Dictyota</i> and <i>Gelidium</i> (depending on availability of the specimen).</li> <li>To record the local algal flora–Study of their morphology and structure.</li> <li>Identification of algae from algal mixture to species level (at least One).</li> <li>Preparation of culture media and culture of green algae and blue green algae in the laboratory (Demonstration).</li> </ul>					

	<p><b>Unit II: Fungi</b></p> <ul style="list-style-type: none"> <li>• Study of morphological and reproductive structures of the following living forms: <i>Plasmodiophora</i>, <i>Phytophthora</i>, <i>Rhizopus</i>, <i>Taphrina</i>, <i>Polyporus</i> and <i>Colletotrichum</i> (depending on availability of the specimen).</li> <li>• Isolation and identification of fungi from soil, air, and baiting method.</li> <li>• Preparation of culture media.</li> <li>• Cultivation of mushroom in the laboratory (Demonstration).</li> </ul> <p><b>Lichens</b></p> <ul style="list-style-type: none"> <li>• Study of morphological and reproductive structures of the genera <i>Parmelia</i>.</li> </ul> <p><b>Unit III: Bryophytes</b></p> <ul style="list-style-type: none"> <li>• External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: <i>Targionia</i>, <i>Lunularia</i>, <i>Porella</i> and <i>Polytrichum</i> (depending on availability of the specimen).</li> </ul> <p><b>Unit IV: Pteridophytes</b></p> <ul style="list-style-type: none"> <li>• External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: <i>Isoetes</i>, <i>Equisetum</i>, <i>Angiopteris</i>, <i>Osmunda</i>, <i>Pteris</i> and <i>Azolla</i> (depending on availability of the specimen).</li> <li>• Fossil slides observation: <i>Rhynia</i>, <i>Lepidocarpon</i>, <i>Calamites</i>.</li> </ul> <p><b>Unit V: Gymnosperms</b></p> <ul style="list-style-type: none"> <li>• External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: <i>Thuja</i>, <i>Cupressus</i>, <i>Araucaria</i>, <i>Podocarpus</i>, <i>Gnetum</i> and <i>Ephedra</i> (depending on availability of the specimen).</li> <li>• Fossil slides observation: <i>Cordaites</i> and <i>Lyginopteris</i>.</li> </ul>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>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)</p>
<p><b>Skills acquired from this course</b></p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Justification for nature of course</b></p>	<p>This course enables the students to acquire more practical skills in external and internal morphology and distinguishes to identify among the diverse group of plants.</p>

<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.</li> <li>2. Das, S and Saha, R. 2020. Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi, India.</li> <li>3. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.</li> <li>4. Sharma O.P and S, Dixit. 2002. Gymnosperms. Pragati Prakashan.</li> <li>5. Johri, R.M, Lata, S, Tyagi, K. 2005. A text book of Gymnosperms, Dominant pub and Distributer, New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Chmielewski, J.G and Kravesky, D. 2013. General Botany laboratory Manual. AuthorHouse, Bloomington, USA.</li> <li>2. Webster, J and Weber, R. 2007. Introduction to Fungi, 3<sup>rd</sup> Ed. Cambridge University Press, Cambridge.</li> <li>3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.</li> <li>4. Ashok, M. Bendre and Kumar. 2010. A text book of Practical Botany, Algae, Fungi, Lichen, Bryophyta, Pteridophyta, Gymnosperms and Palaeobotany. Revised edition. Published by Rakesh Kumar Rastogi publication.</li> <li>5. Gangulee, H.C and A.K. Kar. 2013. College Botany. Vth Edition. S. Chand.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.frontiersin.org/articles/10.3389/fmicb.2017.00923/full">https://www.frontiersin.org/articles/10.3389/fmicb.2017.00923/full</a></li> <li>2. <a href="https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf">https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf</a></li> <li>3. <a href="http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf">http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf</a></li> </ol>

**COURSE OUTCOMES:**

<b>CO</b>	<b>On completion of this course the student will be able to</b>	<b>K-Level</b>
<b>CO1</b>	Recall and applying the basic keys to distinguish at species level identification of important algae and fungi through its structural organizations.	K1 & K4
<b>CO2</b>	Demonstrate practical skills in thallophytes, Pteridophytes and Gymnosperms.	K2
<b>CO3</b>	Describe the structure of algae, fungi, lichens, Bryophytes, Pteridophytes and Gymnosperms.	K3
<b>CO4</b>	Determine the importance of structural diversity in the evolution of plant forms.	K3
<b>CO5</b>	Formulate techniques to isolate and culture of alga and fungi as well as to understand the diversity of plant forms.	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).

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	2	3	3	3	3	2	3	3	3	3	2
<b>CLO2</b>	3	3	2	3	3	3	3	1	3	2	1
<b>CLO3</b>	3	3	3	3	3	2	3	2	3	2	2
<b>CLO4</b>	3	3	2	1	2	1	2	1	2	1	2
<b>CLO5</b>	3	3	3	3	3	2	3	3	2	1	1

<b>Title of the Course</b>		<b>Microbiology, Immunology and Plant Pathology</b>					
<b>TANSCHÉ Course type</b>		<b>EC1</b>					
<b>Course Category</b>		<b>Elective (Generic / Discipline Specific)-I</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>3</b>	<b>Course Code</b>	<b>23P1BECT1</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		<b>3</b>	<b>2</b>		<b>-</b>	<b>5</b>	
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>		<b>Total</b>		
		<b>25</b>	<b>75</b>		<b>100</b>		
<b>Pre-requisite(s)</b>		The goal of the course is to provide students with basic understanding of microbiology, immunology, plant pathology and the etiology of specific plant diseases.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To provide comprehensive knowledge about microbes and its effect on man and environment.</li> <li>• To provide comparative analysis of major groups of microbes.</li> <li>• To study the principles of immune system, immunizing agents like antibodies and vaccines and gene therapy methods.</li> <li>• To enhance the knowledge and skills needed for self-employment using the microbial derived products</li> <li>• To appreciate the role of immune system in conferring disease resistance.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I: Bacteria:(18 hrs)</b> Types of microorganisms. General characteristic of bacteria – Outline classification of Bergey’s manual of 9th edition. Classification of bacteria based on morphological, cultural, physiological and molecular characteristics.</p> <p>Bacterial growth – batch culture and continuous culture. Growth Curve. Factors affecting growth. Determination of bacterial growth – Direct method: Haemocytometer, Viable plate count; Indirect method: Turbidity. Nutritional types. Reproduction - Fission and sporulation. Genetic recombination- Transformation, Transduction and Conjugation. Mycoplasma: Structure and classification.</p>					
		<p><b>Unit II: Viruses (12 hrs)</b> General characters, Classification based on nucleic acid, Structure, Multiplication. Overview of Phycoviruses, Mycoviruses, Plant &amp; Animal viruses. Cultivation of viruses – in embryonated egg and in plants. Control of viral infections. Bacteriophages- classification, replication of DNA and RNA phages - Lytic &amp; Lysogenic cycle. Viroids and prions.</p>					

	<p><b>Unit III: Soil Microbiology: (15 hrs)</b> Importance of Microbial flora of soil and factors affecting the microbial community. Interaction among soil microbes (positive and negative interactions) &amp; with higher plants (rhizosphere &amp; phyllosphere). <b>Environmental Microbiology:</b> Microbiology of water and air. Water borne diseases (diphtheria, Chiken box, Swine flu &amp; Measles). Microbial degradation of chemical pesticide and hydrocarbon.</p> <p><b>Unit IV: Plant Pathology (15 hrs)</b> History and significance of plant pathology. Classification of plant diseases based on causative organism, Symptomology (Importance of plant pathogens). Principles of Pathogenicity. Disease triangle. Host parasite interaction. Mechanism of penetration- Disease development of pathogen (colonization) and dissemination of pathogens. Role of enzymes and toxins in disease development. Defense mechanism of host – structural and biochemical. Important diseases of crop plants in India - Sheath blight of rice, Late blight of potato, Little leaf of Brinjal and Red rust of tea.</p> <p><b>Unit V: Immunology: (15 hrs)</b> Introduction; Types of Immunity - Innate and Acquired. Immune Cells – B lymphocytes, T lymphocytes &amp; NK cells. Introduction to inflammation. Antigen: Definition, Properties and types. Antibody – Structure, types and function. Antigen - Antibody interactions: Precipitation, Agglutination, Complement fixation. Immune Response – Humoral and Cell Mediated. Vaccines – history &amp; types. Immunodiagnosis –Blood Grouping, Widal test &amp; ELISA.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	<p>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)</p>
<b>Skills acquired from this course</b>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<b>Justification for nature of course</b>	<p>This course enables the students to explore knowledge in classification, structure, reproduction and economic importance of microorganisms. Also further to learn about immune reactions and control of diseases caused by various microbes.</p>
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Singh, R.S. 2018. Introduction to Principles of Plant Pathology, 4th Edition.</li> <li>2. Bilgrami, K.S and H.C. Dube. 2010 A text book of Modern Plant Pathology – Vikas Publishing House (P) Ltd., New Delhi</li> <li>3. Mehrotra, R.S. and Aggarwal, A. 2017. Plant Pathology. McGraw Hill Publisher.</li> </ol>

	<ol style="list-style-type: none"> <li>4. Dube, H.C. 2010. A text Book of Fungi, Bacteria and Viruses, 3rd Edition, Agrobios India, ISBN: 8188826383.</li> <li>5. Vaman Rao, C. 2006. Immunology. 2nd Edition. Narosa Publisher.</li> <li>6. Kenneth, M. 2017. Janeway's Immunobiology. 9th Edition. Garland Publisher.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Agrios, A.G. 2007. Plant Pathology, Elsevier. ISBN: 9780120445653.</li> <li>2. Jeffery, C., Pommerville. 2014. Alcamos Fundalmedals of Microbiology. 10th Edition. Johnsand Bartlett Learning.</li> <li>3. Pelczar, M. J. 2007. Microbiology. 35th Edition, Tata-McGraw Hill Publications, New York, ISBN: 0074623260.</li> <li>4. Ravi Chandra, N.G. 2013. Fundamentals of Plant Pathology, Phi Learning, ISBN:812034703X.</li> <li>5. Willie, J. and Sherwood, L. 2016. Prescott's Microbiology McGraw-Hill Education; 10<sup>th</sup> Edition, ISBN: 978-1259281594</li> <li>6. Chaube, H.S. and Singh, R. 2015. Introductory Plant Pathology CBS Publishers, ISBN: 978-8123926704.</li> <li>7. Rangasamy, G. 2006. Disease of crop plants in India (4th edition). Tata Mc Graw Hill New Delhi.</li> <li>8. Mishra, A., A. Bohra and A, Mishra. 2011. Plant Pathology- Disease and Management. Agro Bios, Jodhpur.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.wileyindia.com/a-textbook-of-plant-pathology.html">https://www.wileyindia.com/a-textbook-of-plant-pathology.html</a></li> <li>2. <a href="https://www.britannica.com/science/plant-disease">https://www.britannica.com/science/plant-disease</a>.</li> <li>3. <a href="https://www.planetatural.com/pest-problem-solver/plant-disease/">https://www.planetatural.com/pest-problem-solver/plant-disease/</a></li> <li>4. <a href="https://www.elsevier.com/books/plant-pathology/agrios/978-0-08-047378-9">https://www.elsevier.com/books/plant-pathology/agrios/978-0-08-047378-9</a></li> <li>5. <a href="https://www.elsevier.com/life-sciences/immunology-and-microbiology/books">https://www.elsevier.com/life-sciences/immunology-and-microbiology/books</a></li> </ol>

### COURSE OUTCOMES:

CO	On completion of this course the student will be able to	K- Level
CO1	Recognize the general characteristics of microbes, plant defense and immune cells.	K1
CO2	Explain about the stages in disease development and various defense mechanisms in plants and humans	K2
CO3	Elucidate concepts of microbial interactions with plant and humans.	K3
CO4	Analyze the importance of harmful and beneficial microbes and immune system	K4
CO5	Determine and interpret the detection of pathogens and appreciate their adaptive strategies.	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	2	3	2
CLO2	3	3	2	2	3	3	3	2	1	2	3
CLO3	3	3	3	3	3	2	3	1	3	3	2
CLO4	3	3	2	2	3	2	3	2	1	2	1
CLO5	3	3	3	3	3	1	3	3	2	1	1

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Openchoice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 3	1	1 (K1/K2)	2(K2/ K3)	1 (K2&K3)
2	CLO y	Up to K 4	1	1( K1/K2)	2(K3/ K4)	1(K3/K4)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

Sl. No	LOs	K- Level	Section – A		Section – B		Section C (Either/ Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K – Level		
1	CLO 1	Up to K 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 (K4)
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	K4 & K4	1	K3	2(K4& K4)	1 (K4)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1 - Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

**Distribution of Section- wise marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	2	4	10	10	<b>26</b>	21.66	
K3	4	2	10	20	<b>36</b>	30.00	<b>30%</b>
K4	2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>Horticulture</b>					
<b>TANSICHE Course type</b>		<b>EC2</b>					
<b>Course Category</b>		<b>Elective (Generic / Discipline Specific)-II</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>3</b>	<b>Course Code</b>	<b>23P1BECT2</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>			<b>Practical</b>	<b>Total</b>	
	<b>3</b>	<b>2</b>			<b>-</b>	<b>5</b>	
<b>Marks</b>	<b>CIA</b>	<b>Semester</b>			<b>Total</b>		
	<b>25</b>	<b>75</b>			<b>100</b>		
<b>Pre-requisite(s)</b>		Students should know fundamental knowledge on horticulture principles, methodologies and applications.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To know about the brief history, divisions, classification of horticultural plants,</li> <li>• to understand the influence of abiotic factors, soil composition, nutrients, fertilizers, potting media, and growth control techniques in order to create optimal growing environments and effectively manage plant growth for desired outcomes in horticulture,</li> <li>• to learn the various methods and techniques involved in reproducing plants, including seed propagation, vegetative propagation, and propagation through specialized underground structures, to efficiently and effectively propagate plants for horticultural purposes,</li> <li>• to understand and apply the principles of design, explore various horticultural aesthetics, and develop skills in creating visually appealing landscapes, arrangements, and indoor environments and</li> <li>• to explore techniques and technologies that enhance the quality, shelf life, marketability, and value of horticultural and to understand the potential applications and benefits of robotic systems in addressing challenges faced by farmers and growers.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Introduction to Horticulture (15 hrs)</b> Definition; Brief History, Divisions of Horticulture, Classification of horticultural plants based on habit, life span, climatic requirements and plant parts used for consumption. Importance of Horticulture.					
		<b>Unit II: Factors Affecting Plant Growth (15 hrs)</b> Plant Growth Environment: Abiotic factors, Soil –Profile structure, Primary and Secondary nutrients and their functions, Organic matter, Fertilizers –organic, Inorganic and Potting Media, Bio inoculants, Methods of fertilizer application, Directing Plant Growth-Training -Pruning and thinning.					

	<p><b>Unit III: Plant Propagation (15 hrs)</b> Plant propagation: Seeds –Advantages, Viability, Mechanism of Dormancy Breaking: Methods of Direct and Indirect Seedling Production in Nurseries and Transplantation; Propagation through specialized underground structures –Corm, Tuber, Sucker, Bulb, Bulbil, Rhizome; Vegetative Propagation –Cutting, Layering, Grafting and Budding.</p> <p><b>Unit IV: Aesthetics of Horticulture: (15 hrs)</b> Design: Elements and Principles of Design, Flower Arrangement, Terrarium Culture, Bonsai, Growing Plants Indoors, Turf Production, Landscaping-Principles, Types of Parks, Xeriscaping.</p> <p><b>Unit IV: Value Addition (15 hrs)</b> Post-harvest handling of Horticultural Products –Harvesting, Storage, Preservation, Processing, Packaging, Elements of Marketing. Value addition of cucumber and tomato – rose and jasmine – mango and gooseberry. Robotics in Horticulture.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>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)</p>
<p><b>Skills acquired from this course</b></p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Justification for nature of course</b></p>	<p>This course enables the students to understand and develop various horticultural skills followed in plant propagations.</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Acquaah, G. 2011. Horticulture: Principles and Practices. (4th ed), Pearson Education, London, UK.</li> <li>2. Janik, J. 1972. Horticultural Science. W.H. Freeman &amp; Company, San Francisco.</li> <li>3. Kumar, N. 1994. Introduction to Horticulture, Rajalakshmi Publication, India.</li> <li>4. Manibhushan Rao, K. 2005. Text Book of Horticulture. (2nd ed), Macmillan India Ltd., New Delhi.</li> <li>5. Schilletter, J. C. and Richey, H. W. 2005. Text Book of general Horticulture. 2nd ed. Biotech Books, Delhi.</li> <li>6. Sharma, R.R. 2016. Propagation of horticultural crops. Kalyani Publishers, New Delhi.</li> <li>7. Subba Rao, N.S. 1997. Biofertilizers in Agriculture and Forestry. India Book House Limited, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Acquaah, G. 2002. Horticulture Principles and Practices. 2nd ed. Pearson Education (Singapore) Pvt. Ltd.</li> <li>2. Ashman, M.A. and Puri, G. 2002. Essential soil science-A clear and concise introduction to soil science. Blackwell scientific publishers, London.</li> <li>3. Denisen, E.L. 1979. Principles of Horticulture. MacMillan Publishing co, Inc. New York.</li> <li>4. Thomson, L.M. and Troen, F.R. 1975. Soils and soil fertility Tata, McGraw Hill Publication Co. Ltd. New Delhi.</li> <li>5. Tolanus, S. 2006. Soil fertility, Fertilizer and Integrated Nutrient management. CBS Publication, Delhi, India.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.kobo.com/in/en/ebooks/horticulture">https://www.kobo.com/in/en/ebooks/horticulture</a></li> <li>2. <a href="https://www.gale.com/gardening-and-horticulture">https://www.gale.com/gardening-and-horticulture</a></li> <li>3. <a href="https://www.iaritoppers.com/p/horticulture-icar-ecourse-pdf-books.html">https://www.iaritoppers.com/p/horticulture-icar-ecourse-pdf-books.html</a></li> </ol>

### **COURSE OUTCOMES:**

<b>CO</b>	<b>On completion of this course, the students will be able to:</b>	<b>K- Level</b>
<b>CO1</b>	Identify the importance of horticulture and the plant parts used for production and economic development	K1
<b>CO2</b>	Demonstrate knowledge of directing plant growth through various techniques.	K2
<b>CO3</b>	Apply various methods of plant propagation through plant parts for nursery management and transplantation	K3
<b>CO4</b>	Apply and demonstrate skills in flower arrangement, indoor plant cultivation and landscaping and	K4
<b>CO5</b>	Apply horticultural skills and knowledge to explore career opportunities in horticulture industry.	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
<b>CLO1</b>	3	3	3	3	3	3	3	3	3	2	3
<b>CLO2</b>	2	1	3	3	3	3	3	3	3	3	2
<b>CLO3</b>	3	1	3	3	3	2	3	3	2	3	3
<b>CLO4</b>	3	3	3	1	1	2	2	2	3	2	2
<b>CLO5</b>	3	3	3	3	3	1	3	2	3	3	1

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Openchoice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 3	1	1 (K1/K2)	2(K2/ K3)	1 (K2&K3)
2	CLO y	Up to K 4	1	1( K1/K2)	2(K3/ K4)	1(K3/K4)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

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

K1 - Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

**Distribution of Section- wise marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	2	4	10	10	<b>26</b>	21.66	
K3	4	2	10	20	<b>36</b>	30.00	<b>30%</b>
K4	2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>Nursery and Gardening</b>					
<b>TANSICHE Course type</b>		<b>SEC-1</b>					
<b>Course Category</b>		<b>Skill Enhancement Course</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>	<b>23P1BSED1</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		<b>2</b>	<b>-</b>		<b>-</b>	<b>2</b>	
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>		<b>Total</b>		
		<b>25</b>	<b>75</b>		<b>100</b>		
<b>Pre-requisite(s)</b>		Students should know methods and applications employed in nursery and gardening practices.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To recognize the importance of nursery and gardening</li> <li>• To gain an understanding of nursery management.</li> <li>• To develop skills necessary to manage a wholesale nursery.</li> <li>• To acquire knowledge regarding theory and practice of rising plants.</li> <li>• To develop an interest to become an entrepreneur.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Nursery (6 hrs)</b> Definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.					
		<b>Unit II: Seed (6 hrs)</b> Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification.					
		<b>Unit III: Vegetative Propagation (6 hrs)</b> Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glasshouse.					
		<b>Unit IV: Gardening (6 hrs)</b> Definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping.					
		<b>Unit V: Gardening Operations (6 hrs)</b> Soil laying, manuring, watering, management of pests and diseases and harvesting. Sowing/raising of seeds and seedlings: Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course enables the students to understand the principle and applications of nursery and gardening techniques and develop entrepreneur skills..
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Bose T.K and Mukherjee, D. 1972. Gardening in India, Oxford &amp; IBH Publishing Co., New Delhi.</li> <li>2. Sandhu, M.K. 1989. Plant Propagation, Wile Eastern Ltd., Bengaluru.</li> <li>3. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.</li> <li>4. Edmond Musser and Andres. 1957. Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.</li> <li>5. Agrawal, P.K. 1993. Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. N.L. Patel, S.L. Chawla, T.R. Ahlawat: Commercial Horticulture, 2016, ASPEE College of Horticulture, Navsari Agricultural University, Navsari 396 450, Gujarat,</li> <li>2. Prasad S &amp; Kumar U. 2005. Greenhouse Management for Horticultural Crops. 2nd Ed. Agrobios.</li> <li>3. George Acquaah, 2002, Horticulture-principles and practices. Prentice-Hall of India pvt. Ltd., New Delhi.</li> <li>4. Abraham, A and Vatsala, P. 1981. Introduction to Orchids. Trop. Bot. Garden, Trivandrum.</li> <li>5. Hartman, H.T and Kester, D.E. 1989. Plant propagation. Printice Hall Ltd., New Delhi.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.kopykitab.com/Nursery-And-Gardening-SEC-by-Prof-C-D-Patil-Dr-G-M-Rane-Dr-S-A-Patil">https://www.kopykitab.com/Nursery-And-Gardening-SEC-by-Prof-C-D-Patil-Dr-G-M-Rane-Dr-S-A-Patil</a></li> <li>2. <a href="https://www.wonderslate.com/nursery-and-gardening-management/ebook-details?siteName=books&amp;bookId=38078&amp;preview=true">https://www.wonderslate.com/nursery-and-gardening-management/ebook-details?siteName=books&amp;bookId=38078&amp;preview=true</a></li> <li>3. <a href="https://books.google.co.in/books/about/Nursery_Hindi_Book_Bonsai_Plants_Nursery.html?id=-nfDDwAAQBAJ&amp;redir_esc=y">https://books.google.co.in/books/about/Nursery_Hindi_Book_Bonsai_Plants_Nursery.html?id=-nfDDwAAQBAJ&amp;redir_esc=y</a></li> </ol>

**COURSE OUTCOMES:**

<b>CO</b>	<b>On completion of this course, the students will be able to:</b>	<b>K- Level</b>
CO1	Recognize the basic process required for growing and maintaining plants in nurseries.	K1
CO2	Explain the different methods of plant propagation and various gardening styles.	K2
CO3	Apply techniques for effective hardening of plants and computer applications for creative gardening.	K3
CO4	Compare and contrast cultivation of different vegetables and growth of plants in nursery and gardening.	K4
CO5	Develop new strategies to enhance growth and quality of nursery plants.	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
<b>CLO1</b>	3	3	1	3	2	3	1	2	2	3	2
<b>CLO2</b>	3	3	2	2	3	3	3	2	3	3	3
<b>CLO3</b>	2	2	3	3	1	2	2	1	3	2	1
<b>CLO4</b>	3	3	3	3	3	2	2	3	3	2	2
<b>CLO5</b>	3	3	2	3	2	1	3	1	2	1	1

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Openchoice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 3	1	1 (K1/K2)	2(K2/ K3)	1 (K2&K3)
2	CLO y	Up to K 4	1	1( K1/K2)	2(K3/ K4)	1(K3/K4)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

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

K1 - Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

**Distribution of Section- wise marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	2	4	10	10	<b>26</b>	21.66	
K3	4	2	10	20	<b>36</b>	30.00	<b>30%</b>
K4	2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>Taxonomy of Angiosperms and Economic Botany</b>					
<b>TANSICHE Course type</b>		<b>CC4</b>					
<b>Course Category</b>		<b>Core</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23P2BCCT3</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		<b>4</b>	<b>2</b>		<b>-</b>	<b>6</b>	
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>		<b>Total</b>		
		<b>25</b>	<b>75</b>		<b>100</b>		
<b>Pre-requisite(s)</b>		Prior knowledge on morphological, anatomical characteristics of angiosperm plants classification and economic value of plants.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To be familiar with the basic concepts and principles of plant systematics.</li> <li>To develop a suitable method for correct characterization and identification of plants.</li> <li>To understand the importance of taxonomic relationships in research of plant systematics.</li> <li>To provide information on various classification systems</li> <li>To know about the economic importance of plants.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I: Taxonomy and Systematics:(18 hrs)</b> Botanical exploration and contribution with special reference to India by William Roxburgh, J.D. Hooker, Robert Wright, Nathaniel Wallich and Gamble, J.S. Principles of classification as proposed – Artificial – Linnaeus, Natural – Bentham and Hooker, Phylogenetic system - Hutchinson, Modern – APG-IV. Botanical gardens and herbaria of world, preparation and maintenance of Herbarium, Botanical survey of India – its organization and role.</p>					
		<p><b>Unit II: Modern Trends in Taxonomy : (18 hrs)</b> Modern trends in taxonomy, chemotaxonomy, numerical taxonomy, biosystemics. ICN polynomial systems- binomial nomenclature, importance and principle. Important articles, typification, principles of priority, effective and valid publication, author citation, recommendations and amendments of code. Glossaries and dictionaries, Taxonomic literature (Index Kewensis), IPNI.</p>					
		<p><b>Unit III: Systematic Analysis of Plants-I:(18 hrs)</b> <i>Polypetalae</i>– Nymphaeaceae, Portulacaceae, Sterculiaceae, Rhamnaceae, Vitaceae, Sapindaceae, Combretaceae, Turneraceae. <i>Gamopetalae</i>– Sapotaceae, Oleaceae, Boraginaceae, Convolvulaceae.</p>					
		<p><b>Unit IV: Systematic Analysis of Plants –II (18 hrs)</b> <i>Gamopetalae</i> Scrophulariaceae, Bignoniaceae, Acanthaceae, Verbenaceae.: <i>Monochlamydeae</i>- Nyctaginaceae, Aristolochiaceae, Casuarinaceae. <i>Monocots</i>– Orchidaceae, Amaryllidaceae, Liliaceae, Commelinaceae, Cyperaceae.</p>					

	<p><b>Unit V: Economic Botany : (18 hrs)</b> General account on utilization of selected crop plants: (i) Cereals (rice and wheat) – (ii) Pulses (red gram and black gram), (iii) Drug yielding plants (<i>Withania somnifera</i> and <i>Coleus aromaticus</i>) (iv) Oil yielding plants (Groundnut, sunflower).(v) Sugar yielding plants (sugarcane and sugar beet), (vi) Spices and condiments (cardamom, cinnamon). (vii) Commercial crops - fibre (jute), (viii) Timber (Teak and red sanders wood), (ix) Resins and gums (Asafoetida and gum arabic) – (x) Essential oils (lemon grass and menthol), (xi) Beverages (tea, coffee), (xii) Plants used as avenue trees for shade, pollution control and aesthetics (xiii) Energy plantation - uses of <i>Casuarina</i>.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>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)</p>
<p><b>Skills acquired from this course</b></p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Justification for nature of course</b></p>	<p>Demonstration of principles and skills of plant taxonomy to equip students by taking them to fields of different vegetation thru identification and authentic naming of higher plants.</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Pandey, B.P. 2013. Taxonomy of Angiosperms, S. Chand Publishing, New Delhi.</li> <li>2. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.</li> <li>3. Singh, G. 2007. Plant systematics theory and practices. Oxford and IBH Publishing Co.</li> <li>4. Jain, S.K and Rao R.R. 1993. A handbook of field and herbarium methods. Today and Tomorrow Publ.</li> <li>5. Pandurangan, A.G., Vrinda, K.B and Mathew Dan. 2013. Frontiers in plant taxonomy. JNTBGRI, Thiruvananthapuram, Kerala.</li> <li>6. Vardhana, R. 2009. Economic Botany. 1st ed. Sarup Book Publishers Pvt Ltd. New Delhi.</li> <li>7. Subramaniam, N.S. 1997. Modern plant taxonomy. Vikas Publishing House, New Delhi.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Wallis, T.E. 1999. Text book of Pharmacognosy. CBS Publishers and Distributors, New Delhi.</li> <li>2. Kumaresan, V and Annie Regland. 2004. Taxonomy of Angiosperms systematic Botany, Economic Botany, Botany &amp; Ethnobotany.</li> <li>3. Anonymous, 2004. Cultivation of Selected Medicinal Plants. National Medicinal Plants Board, Govt. of India, New Delhi.</li> <li>4. Acharya Vipul Rao. 2000. Herbal cure for common diseases. Diamond books, Pvt. Ltd.</li> <li>5. Dey, A.C. 1998. Indian medicinal plants used in Ayurvedic preparations, Bishen Singh Mahendra Pal Singh.</li> <li>6. Sathya, S., Jaiganesh, K.P and Sudha, T. 2019. Current Trends in Herbal Drug Technology. Pharmacy Council of India New Delhi.</li> <li>7. Lewis, W.H and M.P.F. Elwin Lewis. 1976. Medical Botany. Plants affecting Man's Health. A Wiley Inter Science Publication. John Wiley and Sons, New York.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.ipni.org/">https://www.ipni.org/</a></li> <li>2. <a href="http://www.theplantlist.org/">http://www.theplantlist.org/</a></li> <li>3. <a href="https://www.tropicos.org/home">https://www.tropicos.org/home</a></li> <li>4. <a href="http://apps.kew.org/herbcat/gotoHerbariumGrowthPage.do">http://apps.kew.org/herbcat/gotoHerbariumGrowthPage.do</a></li> <li>5. <a href="https://www.absbooksindia.com/shop/science/botany/textbook-of-economic-botany">https://www.absbooksindia.com/shop/science/botany/textbook-of-economic-botany</a></li> </ol>

### COURSE OUTCOMES:

<b>CO</b>	<b>On completion of this course, the students will be able to:</b>	<b>K-Level</b>
<b>CO1</b>	Explain the various types of classification. Distinguish its advantages and disadvantages and familiarize with herbarium preparation.	K1, K2
<b>CO2</b>	Expound the principles of taxonomy. Summarize the taxonomic hierarchy and Binomial nomenclature.	K1, K2
<b>CO3</b>	Describe the vegetative and floral characters and construction of floral formula and floral diagram of selected polypetalae and gamopetalous families.	K1, K2 K3, K4
<b>CO4</b>	Illustrate and explain the characteristic features and list out the economic importance of the selected families in monochlamydeae and monocots.	K1, K2 K3, K4
<b>CO5</b>	Familiarize the medicinal and crop plants and its economic importance.	K1, K2 K3, 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	2	3	3	3	3	3
CLO2	3	3	2	3	3	3	2	2	1	3	3
CLO3	3	3	2	3	1	2	3	2	3	2	3
CLO4	3	2	3	3	2	2	3	3	1	2	2
CLO5	3	3	2	2	1	1	2	1	3	2	1

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Openchoice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 3	1	1 (K1/K2)	2(K2/ K3)	1 (K2&K3)
2	CLO y	Up to K 4	1	1( K1/K2)	2(K3/ K4)	1(K3/K4)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

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

K1 - Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

**Distribution of Section- wise marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	2	4	10	10	<b>26</b>	21.66	
K3	4	2	10	20	<b>36</b>	30.00	<b>30%</b>
K4	2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>Plant Anatomy and Embryology of Angiosperms</b>					
<b>TANSICHE Course type</b>		<b>CC5</b>					
<b>Course Category</b>		<b>Core</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23P2BCCT4</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		<b>4</b>	<b>2</b>		<b>-</b>	<b>6</b>	
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>		<b>Total</b>		
		<b>25</b>	<b>75</b>		<b>100</b>		
<b>Pre-requisite(s)</b>		To acquire knowledge on the anatomical structure and reproductive phase of angiosperms.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Understand the internal organization of plant systems.</li> <li>• Classify meristems and identify their structures, functions and roles in monocot and dicot plants growth and secondary growth of woody plants.</li> <li>• Trace the development of male and female gametophyte.</li> <li>• Understand the recent advances in palynology and polyembryony.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I: Shoot organization (25 hrs)</b> Meristems: Classifications: Theories of shoot and root apices, Cytological zonation in shoot apex. Vascular Cambium: Composition and organization – multiplicative and additive divisions. Cell Wall; Morphological and physico- chemical changes; Plasmodesmata- types of pits – growth of cell wall – formation of intercellular spaces; Xylem: Primary and secondary xylem – tracheary elements and vessels – vesselless dicots – xylem rays and axial parenchyma of angiosperm wood; Dendrochronology – grain, texture and figure in wood; reaction wood; ring porous and diffuse porous wood. Phloem: Ultra structure and ontogeny of sieve tube elements and companion cell. Evolution of tracheary elements.</p> <p><b>Unit II: Anatomy &amp; Secondary Growth (15 hrs)</b> Periderm; Structure, organization and activity of phellogen. Polyderm and Rhytiderm – wound periderm. Normal secondary thickening in Dicots; Anomalous secondary growth in Dicots (Amaranthaceae, Aristolochiaceae, Bignoniaceae, Piperaceae, Nyctaginaceae) and arborescent Monocots. Primary thickening in palms; Ontogeny of leaf, Structure and types of Stomata; Major nodal types; Kranz anatomy and its significance.</p>					

	<p><b>Unit III: Microsporangium (18 hrs)</b> Male Gametophyte: Structure and development of Anther; Ultrastructure of anther and functions of tapetum; Male gametophyte; Palynology: Morphology and ultrastructure of pollen wall, pollen kitt, pollen analysis, pollen storage, pollen sterility and pollen physiology.</p> <p><b>Unit IV: Megasporangium (20 hrs)</b> Female Gametophyte: Structure and development of Megasporangium; Types of ovules, Endothelium, obturator and nucellus. Megasporogenesis: Female gametophyte: Structure, types, haustorial behavior and Nutrition of embryo sacs. Fertilization: Double fertilization and triple fusion; Endosperm: Development, types, physiological efficiency of endosperm haustoria and functions; Ruminant endosperm. Embryogeny: Development of monocot (Grass) and dicot (Crucifer) embryos.</p> <p><b>Unit V: Polyembryony (12 hrs)</b> Causes of Polyembryony, classification, induction and practical application. Apomixis and its significance. Seed and Fruit development and role of growth substances. Parthenocarpy and its importance.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course will help the students to inculcate knowledge on both external and internal structures of vegetative and flower parts of plants for grouping of higher plants.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.</li> <li>2. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.</li> <li>3. Sharma, P.C. 2017. Text Book of Plant Anatomy. Arjun Publishing House, New Delhi.</li> <li>4. Pandey.S.N and Ajanta Chandha. 2006. Plant Anatomy and Embryology. Vikas Publishing House Pvt. Ltd, New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry. S. Viswanathan &amp; Co., Madras.</li> <li>2. Swamy, B.G.L and Krishnamurthy. K.V 1990. From flower to fruits, Tata – McGraw Hill publishing Co Ltd, New Delhi.</li> </ol>

	<ol style="list-style-type: none"> <li>3. Pullaiah, T., Lakshiminarayana, K and Hanumantha Rao, B. 2006. Text book of Embryology of Angiosperms. Regency Publications, New Delhi.</li> <li>4. Bierhorst, D.W. 1971. Morphology of Vascular Plants. Macmillan publishers, New York.</li> <li>5. Crang, R., Lyons-Sobaski, S and Wise, R. 2018. Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants. Springer International Publishing.</li> <li>6. Cutler, D. F., Botha, T and Stevenson, D.W. 2008. Plant Anatomy: An Applied Approach. Blackwell Publishing, Malden, USA.</li> <li>7. Eames, A.J and Mac Daniels, L.H. 2013. Introduction to Plant Anatomy, 3rd Edition. McGraw-Hill Inc., US.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.ipni.org/">https://www.ipni.org/</a></li> <li>2. <a href="http://www.theplantlist.org/">http://www.theplantlist.org/</a></li> <li>3. <a href="https://faculty.etsu.edu/liuc/plant_anatomy_sites.htm">https://faculty.etsu.edu/liuc/plant_anatomy_sites.htm</a></li> <li>4. <a href="http://aryacollegeludhiana.in/E_BOOK/Botany/plant_anatomy.pdf">http://aryacollegeludhiana.in/E_BOOK/Botany/plant_anatomy.pdf</a></li> <li>5. <a href="https://www.uou.ac.in/sites/default/files/slm/BSCBO-202.pdf">https://www.uou.ac.in/sites/default/files/slm/BSCBO-202.pdf</a></li> </ol>

#### **COURSE OUTCOMES:**

<b>CO</b>	<b>On completion of this course, the students will be able to:</b>	<b>K- Level</b>
<b>CO1</b>	Learn the structures, functions and roles of apical vs lateral meristems in monocot and dicot plant growth.	K1& K2
<b>CO2</b>	Study the function and organization of woody stems derived from secondary growth in dicot and monocot plants.	K1&K4
<b>CO3</b>	Apply their idea on sectioning and dissection of plants to demonstrate various stages of plant development.	K2& K3
<b>CO4</b>	Understand the various concepts of plant development and reproduction.	K3& K4
<b>CO5</b>	Apply reproductive mechanism in plants with a professional and entrepreneurial skills.	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
<b>CLO1</b>	3	3	3	3	3	2	3	3	3	3	3
<b>CLO2</b>	3	1	3	3	3	3	3	3	3	3	2
<b>CLO3</b>	3	1	3	3	3	3	3	3	2	3	1
<b>CLO4</b>	3	3	3	1	1	2	2	3	2	2	2
<b>CLO5</b>	3	3	3	3	3	2	3	2	3	1	2

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Openchoice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 3	1	1 (K1/K2)	2(K2/ K3)	1 (K2&K3)
2	CLO y	Up to K 4	1	1( K1/K2)	2(K3/ K4)	1(K3/K4)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

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

K1 - Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

**Distribution of Section- wise marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	2	4	10	10	<b>26</b>	21.66	
K3	4	2	10	20	<b>36</b>	30.00	<b>30%</b>
K4	2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

Title of the Course		Core-VII Laboratory Course -II Covering Papers IV and V					
TANSICHE Course type		CC6					
Course Category		Core					
Nature of Course		Employability / Entrepreneurship / Skill Development					
Category	Core	Year	I	Credits	4	Course Code	23P2BCCP2
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical	Total	
		-	-		6	6	
Marks		CIA	Semester		Total		
		40	60		100		
Pre-requisite(s)		Theoretical understanding of plant taxonomy, ecology and phytogeography, plant anatomy and embryology as well as basic laboratory skills for the relevant core course.					
Objectives of the Course		<ul style="list-style-type: none"> <li>Understand and develop skill sets in plant morphological, floral characteristics and artificial key preparation.</li> <li>Expedite skilled workers to carry out research in frontier areas of plant science.</li> <li>Learn the importance of plant anatomy in plant production systems.</li> <li>Classify meristems and identify their structures, functions and roles in monocot and dicot plants growth and secondary growth of woody plants</li> <li>Know about different vegetation sampling methods.</li> </ul>					
Course Outline		<b>Unit I: Taxonomy and Economic Botany of Angiosperms</b> <ul style="list-style-type: none"> <li>Preparation of taxonomic keys.</li> <li>Description of a species, based on virtual herbarium and live specimens of the families mentioned in the theory.</li> <li>Study the products of plants mentioned in the syllabus of economic botany with special reference to the morphology, botanical name and family.</li> <li>Solving nomenclature problems.</li> <li><b>Field trip:</b> A field trip at least 3-4 days to a floristically rich area to study plants in nature and field report submission of not less than 20 herbarium sheets representing the families studied.</li> </ul>					
		<b>Unit II: Anatomy</b> <ul style="list-style-type: none"> <li>Study of shoot apex of <i>Hydrilla</i></li> <li>Observation of cambial types.</li> <li>Sectioning and observation of nodal types.</li> <li>Study of anomalous secondary growth of the following:</li> <li>Stem - <i>Nyctanthus</i>, <i>Bouerhavia</i>, <i>Aristolochia</i>, <i>Bignonia</i>, <i>Piper</i> petal and <i>Mirabilis</i>.</li> </ul>					

	<ul style="list-style-type: none"> <li>• Root: <i>Acyranthus</i></li> <li>• Observation of stomatal types by epidermal peeling.</li> <li>• Maceration of wood and observation of the components of xylem.</li> <li>• Microtechniques: Double staining technique to study tissue components.</li> </ul>
	<p><b>Unit III: Embryology</b></p> <ul style="list-style-type: none"> <li>• Observation of T.S. of anther.</li> <li>• Observation of ovule types.</li> <li>• Observation of mature embryo sacs.</li> <li>• Dissection and observation of embryos (globular and cordate embryos).</li> <li>• Study of pollen morphology</li> <li>• Study of <i>in vitro</i> pollen germination.</li> <li>• Observation of endosperm types.</li> </ul>
	<p><b>Unit IV: Ecology &amp; Conservation Biology</b></p> <ul style="list-style-type: none"> <li>• Determination of the quantitative characters of a plant community by random quadrat method (abundance, density, dominance, species diversity, frequency) in grazing land, forests.</li> <li>• Estimation of above ground and below ground biomass in a grazing land employing minimum size of quadrat.</li> <li>• To determine soil moisture, porosity and water holding capacity of soil collected from varying depth at different locations.</li> <li>• Determination of pH of soil and water by universal indicator (or) pH meter.</li> <li>• Determination of dissolved oxygen.</li> <li>• Estimation of carbonate.</li> <li>• Estimation of bicarbonate. Mapping of world vegetation</li> <li>• Mapping of Indian vegetation.</li> <li>• Remote sensing – Analyzing and interpretation of Satellite photographs- Vegetation/ weather.</li> <li>• Visit to remote sensing laboratory.</li> </ul>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>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)</p>

<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course enables the students to explore practical knowledge on plant systematics and plant anatomy of vegetative and flower parts of higher plants.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.</li> <li>2. Sundara, R. S. 2000. Practical manual of plant anatomy and embryology. Anmol Publ. PVT LTD, New Delhi.</li> <li>3. Panshin, A.J and C. de Zeeuw.1980.Textbook of wood technology. Structure, identification and uses of the commercial woods of the United States and Canada. Fourth Edition. New York: McGraw-Hill Book Company.</li> <li>4. Sharma, H.P. 2009. Plant Embryology: Classical and Experimental, Bombay Popular Prakashan, ISBN-8173199698, 9788173199691.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Mann J. Davidson, R.S and J.B. Hobbs, D.V. Banthorpe, J.B. Harborne.1994. <i>Natural Products</i>. Longman Scientific and Technical Essex.</li> <li>2. Traditional plant medicines as sources of new drugs. PJ Houghton in Pharmacognosy.Trease and Evan's.16 Ed .2009.</li> <li>3. Sundara Rajan, S, 2003. Practical Manual of Plant Anatomy and Embryology 1st ed, Anmol Publications, ISBN-812610668.</li> <li>4. Katherine Esau. 2006. Anatomy of Seed Plants. 2nd edition, John Wiley and Sons.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://stemandrootapex.org.com">http://stem and root apex org.com</a></li> <li>2. <a href="http://anatomyofwood.in">http//anatomy of wood.in</a></li> <li>3. <a href="http://plantdescription.org">http//plant description org.</a></li> </ol>

**COURSE OUTCOMES:**

<b>CO</b>	<b>On completion of this course, the students will be able to:</b>	<b>K- Level</b>
<b>CO1</b>	Gain recent advances in plant morphological and floral characteristics.	K1
<b>CO2</b>	Understand about different floral characteristics and artificial key preparation which employed for plant identification and conservation.	K2
<b>CO3</b>	Recall or remember the information including basic and advanced in relation with plant anatomy and embryology.	K3
<b>CO4</b>	Apply their idea on sectioning of plants to demonstrate various stages of plant development.	K4
<b>CO5</b>	Experience the dissection of various plants vegetative and flower parts.	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).

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	3	3	3	3	3	3	3	3	3	3	2
<b>CLO2</b>	3	3	2	3	3	3	2	1	2	3	3
<b>CLO3</b>	3	3	3	3	3	2	3	3	3	3	3
<b>CLO4</b>	3	3	3	3	3	2	3	3	1	2	2
<b>CLO5</b>	3	2	2	3	3	1	3	3	2	2	1

<b>Title of the Course</b>		<b>Research Methodology, Computer Applications &amp; Bioinformatics</b>					
<b>TANSICHE Course type</b>		<b>EC3</b>					
<b>Course Category</b>		<b>Elective (Generic / Discipline Specific)-III</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>3</b>	<b>Course Code</b>	<b>23P2BECT3</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		<b>3</b>	<b>2</b>		<b>-</b>	<b>5</b>	
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>		<b>Total</b>		
		<b>25</b>	<b>75</b>		<b>100</b>		
<b>Pre-requisite(s)</b>		To impart expertise about analysis and research.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To equip students to collect, analyze and evaluate data generated by their own inquiries in a scientific manner.</li> <li>• To provide an overview on modern equipments that they would help students gain confidence to instantly commence research careers and/or starts entrepreneurial ventures.</li> <li>• To develop interdisciplinary skills in using computers in botany to learn about the biological database.</li> <li>• Students aware with the most recent technologies for sequencing and bioinformatics analysis and is able to apply them to the structural and functional genomics of plants.</li> <li>• Operate various software resources with advanced functions and its open office substitutes.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I: Basics of Research (15 hrs)</b> Components of research, Literature collection: bibliography —bibliometrics (scientometrics): definition- laws - citations and bibliography - biblioscope- plagiarism- project proposal writing- dissertation writing- paper presentation (oral/poster)- E-learning tools- monograph- introduction and writing-Standard operating procedure (SOP)- introduction and preparation- Research Institutions – Role of R&amp;D sectors.</p> <p><b>Unit II: Biological Techniques (15 hrs)</b> Basic principles and applications of pH meter, UV-visible spectrophotometer, centrifuge, lyophilizer, chromatography- TLC, Gas chromatography with mass spectrum (GC/MS), and HPLC- Scanning electron microscopy- Agarose gel Electrophoresis- Polyacrylamide Gel Electrophoresis- Polymerase chain reaction.</p> <p><b>Unit III: Components of Computers (15 hrs)</b> Introduction to computers and Bioinformatics. Types of hardware and software operating systems. Fundamentals of networking, operation of networks, telnet, ftp, www, Internet. Biological Research on the web: Using search engines, finding scientific articles.</p>					

	<p><b>Unit IV: Bioinformatics (15 hrs)</b> Public biological databases: Types- Nucleic acid and protein data bases: NCBI, EMBL, DDBJ, UniProt &amp; PDB. Protein structure prediction methods. Techniques in Bioinformatics- BLAST, FASTA &amp; Multiple Sequence alignment.</p> <p><b>Unit V: Intellectual Property Rights: (15 hrs)</b> Intellectual Property Rights - Introduction, Kinds of IPR- Patents, Trademarks, Copyrights, Trade Secrets. Need for IPR intellectual property right, Advantages and Disadvantages. International Regime Relating to IPR- GATT, TRIPS, WIPO &amp; WTO. IPR in India. Geographical Indication- introduction, types. Patent filing procedure for ordinary application.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course enables the students to inculcate knowledge on framing of hypothesis, understanding the methodologies, execution of scientific experiments employed in research projects.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Veerakumari, L. 2017. Bioinstrumentation. MJP Publisher, India. p578.</li> <li>2. SreeRamulu, V.S.1988. Thesis Writing, Oxford&amp; IBH Pub. New Delhi.</li> <li>3. Kotheekar, V and T.Nandi. 2009. An introduction to Bioinformatics. Panima publishing crop, New Delhi.</li> <li>4. Mani, K and N. Vijayaraj. 2004. Bioinformatics – A Practical Approach.1st Edn. Aparna publication, Coimbatore.</li> <li>5. Gurumani, N. 2019. Research Methodology: For Biological Sciences, MP. Publishers.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Jayaraman, J. 2000. Laboratory manual of Biochemistry, Wiley Eastern Limited, New Delhi 110 002.</li> <li>2. Pevsner, J. 2015. Bioinformatics and functional genomics. Hoboken, NJ: Wiley-Blackwell.</li> <li>3. Arthur Conklin W.M and Greg White, 2016. Principles of computer security. TMH. McGraw-Hill Education; 4 edition.</li> <li>4. Irfan Ali Khan and Attiya Khanum (eds.). 2004. Introductory Bioinformatics. Ukaaz Publications, Hyderabad.</li> </ol>

	<p>5. Arthur Conklin W.M., and Greg White. 2016. Principles of computer security. TMH., McGraw-Hill Education; 4<sup>th</sup> edition</p> <p>6. Mishra Shanthi Bhusan. 2015. Handbook of Research Methodology - A Compendium for Scholars &amp; Researchers, Ebooks2go Inc.</p> <p>7. Narayana, P.S.D. Varalakshmi, T. Pullaiah. 2016. Research Methodology in Plant Science, Scientific Publishers, Jaipur, Rajasthan.</p>
<b>Websites and e-Learning resources</b>	<p>1. <a href="https://www.kobo.com/in/en/ebook/bioinstrumentation-1">https://www.kobo.com/in/en/ebook/bioinstrumentation-1</a></p> <p>2. <a href="https://www.worldcat.org/title/bioinstrumentation/oclc/74848857">https://www.worldcat.org/title/bioinstrumentation/oclc/74848857</a></p> <p>3. <a href="https://www.Bioinstrumentation-M-H-Fulekar-Bhawana-Pandey-ebook/dp/B01JP3M9TW">https://www.Bioinstrumentation-M-H-Fulekar-Bhawana-Pandey-ebook/dp/B01JP3M9TW</a></p> <p>4. <a href="https://en.wikipedia.org/wiki/bioinstrumentation">https://en.wikipedia.org/wiki/bioinstrumentation</a></p> <p>5. <a href="https://www.britannica.com/science/chromatography">https://www.britannica.com/science/chromatography</a></p> <p>6. <a href="https://en.wikipedia.org/wiki/electrophoresis">https://en.wikipedia.org/wiki/electrophoresis</a></p>

### COURSE OUTCOMES:

CO	On completion of this course, the students will be able to:	K- Level
CO1	Learn the components of the research and frame hypothesis of selected research area.	K1 & K2
CO2	Realize the need of centrifuges, chromatography and agarose gel electrophoresis and their uses in research work	K2 & K3
CO3	Understand the components of computers and internet website to collect literature collection of research.	K2 & K3
CO4	Understand the concept of pair wise alignment of DNA sequences using algorithms and interpret the features of nucleic acid and protein databases.	K3 & K4
CO5	Analyses the IPR, trademarks and patents and document scientific innovations.	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
<b>CLO1</b>	3	2	2	2	3	3	3	3	1	3	2
<b>CLO2</b>	3	2	2	3	3	3	3	3	2	3	3
<b>CLO3</b>	3	1	2	3	3	2	3	3	1	2	3
<b>CLO4</b>	3	2	1	3	3	2	3	2	1	2	2
<b>CLO5</b>	3	1	2	2	3	1	3	3	2	1	1

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Openchoice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 3	1	1 (K1/K2)	2(K2/ K3)	1 (K2&K3)
2	CLO y	Up to K 4	1	1( K1/K2)	2(K3/ K4)	1(K3/K4)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

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

K1 - Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

**Distribution of Section- wise marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	2	4	10	10	<b>26</b>	21.66	
K3	4	2	10	20	<b>36</b>	30.00	<b>30%</b>
K4	2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>Ecology and Conservation Biology</b>					
<b>TANSICHE Course type</b>		<b>EC4</b>					
<b>Course Category</b>		<b>Elective (Generic / Discipline Specific)-IV</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>3</b>	<b>Course Code</b>	<b>23P2BECT4</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		<b>3</b>	<b>2</b>		<b>-</b>	<b>5</b>	
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>		<b>Total</b>		
		<b>25</b>	<b>75</b>		<b>100</b>		
<b>Pre-requisite(s)</b>		Understanding the environmental factors impacting biodiversity is crucial after taking this course and basic understanding of how laws are structured and interpreted.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To analyze and comprehend the fundamental ideas of plant ecology as a scientific study of environment.</li> <li>• To study the plant communities and plant succession stages.</li> <li>• To be aware of the causes, impacts and control measures of pollution.</li> <li>• To study biodiversity management and conservation.</li> <li>• To enhance the knowledge of the students and equip them in evaluate and protecting invaluable components of nature and interactions with the environment.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Ecological Principles (15 hrs)</b> Introduction- History, scope, concepts. Diversity of plant life; growth form, life form. Basic concepts of population ecology; population dynamics- Regulation of population density. Basics concepts of community - characteristics, composition, structure, origin and development; community dynamics- trends of succession.					
		<b>Unit II: Ecosystem and Resource Ecology (15 hrs)</b> Introduction – kinds – major types – functional aspects of ecosystem: Food chain and food web, energy flow, laws of thermodynamics. Productivity – primary and secondary productivity – GPP & BPP. Resource Ecology: Energy resources; renewable and non-renewable. Soil: Formation, types and profile - erosion and conservation, Water resources – conservation and management.					
		<b>Unit III: Environment Deterioration (15 hrs)</b> Climate change - Greenhouse effect and global warming, ozone depletion and acid rain. Waste management - Solid and e-waste, recycling of wastes. Eco-restoration/remediation ecological foot prints - carbon foot print - ecolabeling - environmental auditing.					

	<p><b>Unit IV: Phytogeography (15 hrs)</b> Phytogeographical Zones - Vegetation types of India and Tamil Nadu, Distribution: Continuous, Discontinuous and Endemism. Theories of discontinuous distribution: Continental drift, Age and area hypothesis. Geographical Information System (GIS) Principles of remote sensing and its applications.</p> <p><b>Unit V: Biodiversity and Conservation (15 hrs)</b> Definition, types of biodiversity – values of biodiversity – Hot spots – Threats to biodiversity: habitat loss. Poaching of wild life – Invasion of exotic species, man and wild life conflicts - endangered and endemic plant species of India, Red list categories of IUCN, Biotechnology assisted plant conservation- <i>in situ</i> and <i>ex situ</i> methods.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	<p>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)</p>
<b>Skills acquired from this course</b>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<b>Justification for nature of course</b>	<p>This course enables the students to understand the various concepts and components of ecology and biodiversity.</p>
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Sharma, P.D. 2017. Ecology and Environment- Rastogi Publication, Meerut.</li> <li>2. Pushpa Dahiya and Manisha Ahlawat. 2013. Environmental Science- A New Approach, Narosa Pub. House, New Delhi.pp.2.1-2.60.</li> <li>3. Eugene Odum, 2017. Fundamentals of Ecology 5th Ed. Cengage, Bengaluru.</li> <li>4. Sharma P.D. 2019. Plant ecology and phytogeography, Rastogi Publications, Meerut.</li> <li>5. Neeraj Nachiketa. 2018 Environmental &amp; Ecology A Dynamic approach. 2nd Edition GKP Access Publishing.</li> <li>6. Chandra, A.M and Ghosh, S.K. 2010. Remote sensing and Geographical Information System, Narosa Publishing House Pvt. Ltd. New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences. 2nd ed. Cambridge University Press. ISBN. 978-1107114234.</li> <li>2. Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity- Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.</li> </ol>

	<ol style="list-style-type: none"> <li>5. Ahuja, V.K. 2017. Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.</li> <li>6. Nithyananda, K.V. 2019. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.</li> <li>7. Venkataraman M. 2015. An introduction to Intellectual property rights. Create space Independent Pub.North Charleston, USA.</li> <li>8. Kormondy, E.J. 2017. Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.</li> <li>9. Gillson, L. 2015. Biodiversity Conservation and Environmental Change, Oxford University Press, Oxford.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.intechopen.com/chapters/56171">https://www.intechopen.com/chapters/56171</a></li> <li>2. <a href="https://plato.stanford.edu/entries/biodiversity/">https://plato.stanford.edu/entries/biodiversity/</a></li> <li>3. <a href="https://sciencing.com/four-types-biodiversity-8714.html">https://sciencing.com/four-types-biodiversity-8714.html</a>.</li> <li>4. <a href="https://www.iaea.org/topics/plant-biodiversity-and-genetic-resources">https://www.iaea.org/topics/plant-biodiversity-and-genetic-resources</a></li> <li>5. <a href="http://www.bsienvi.nic.in/Database/Status_of_Plant_Diversity_in_India_17566.aspx">http://www.bsienvi.nic.in/Database/Status_of_Plant_Diversity_in_India_17566.aspx</a></li> <li>6. <a href="https://www.youtube.com/watch?v=qtTLiQoYTyQ">https://www.youtube.com/watch?v=qtTLiQoYTyQ</a></li> <li>7. <a href="https://www.youtube.com/watch?v=208B6BtXOPs">https://www.youtube.com/watch?v=208B6BtXOPs</a></li> </ol>

**COURSE OUTCOMES:**

<b>CO</b>	<b>On completion of this course, the students will be able to:</b>	<b>K- Level</b>
<b>CO1</b>	Understand the scope and importance of population ecology, plant communities and ecosystemecology.	K1 & K2
<b>CO2</b>	Understand the applied aspect of environmental botany.	K1 & K2
<b>CO3</b>	Students will spot the sources and pollution and seek remedies to mitigate and rectify them.	K3
<b>CO4</b>	Analyze insight into the vegetation types, species interaction and their importance and the factors influencing the environmental conditions.	K3 & K4
<b>CO5</b>	Recognize different plant communities, categorize plant biomes and identify threatened, endangered plant species and create awareness program in protection of biodiversity.	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	2	3	3	2	1	3	2
CLO2	3	3	2	3	3	3	2	3	3	3	3
CLO3	3	2	3	2	2	2	3	1	1	3	2
CLO4	3	3	2	3	3	2	2	2	3	2	3
CLO5	3	3	3	3	3	1	3	3	3	3	2

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Openchoice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 3	1	1 (K1/K2)	2(K2/ K3)	1 (K2&K3)
2	CLO y	Up to K 4	1	1( K1/K2)	2(K3/ K4)	1(K3/K4)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

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

K1 - Remembering and recalling facts with specific answers

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

K3- Application oriented – Solving Problems

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

**Distribution of Section- wise marks with K Levels**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	2	4	10	10	<b>26</b>	21.66	
K3	4	2	10	20	<b>36</b>	30.00	<b>30%</b>
K4	2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

<b>Title of the Course</b>		<b>Organic Farming</b>					
<b>TANSICHE Course type</b>		<b>SEC-NME 1</b>					
<b>Course Category</b>		<b>Skill Enhancement Course- NME</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>	<b>23P2BSEN1</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		<b>2</b>	<b>-</b>		<b>-</b>	<b>2</b>	
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>		<b>Total</b>		
		<b>25</b>	<b>75</b>		<b>100</b>		
<b>Pre-requisite(s)</b>		To understand the students about the organic farming.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To study various aspects of organic farming.</li> <li>To understand the relevance of organic farming, its advantages and short comings against conventional high input agriculture.</li> <li>To know the importance of organic farming in the present scenario and its impact on environment and soil health.</li> <li>Awareness on the importance of organic farming in the present scenario and its impact on environment and soil health.</li> <li>Expose the students to about quality aspect and grading.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Agronomy (6 hrs):</b> Organic farming- concept, characteristics, significance, organic ecosystem, scope of organic farming in India - Principles and types of organic farming. Choice of crops & varieties in organic farming - Organic production methods for cereals, vegetables and fruit crops					
		<b>Unit II: Soil Science (6 hrs):</b> Organic farming for sustainable agriculture; Manures- compost, methods of composting - Green manuring, vermicompost and biofertilizer. Organic farming practices for improving soil health. Soil fertility in organic farming systems.					
		<b>Unit III: Fundamental of Organic Farm Management (6 hrs):</b> Land management in organic farming - Water management in organic farming. Organic insect disease management - Organic pest disease management - Identification of different fungal and bacterial biocontrol agents Weed and nutrient management in organic farming					
		<b>Unit IV: Post Harvesting Management (6 hrs):</b> Harvest; shelf-life; value addition. Processing, labeling of organic produce - Storage and transport of organic produce.					
		<b>Unit V: Organic Quality Control Standards (6 hrs):</b> Certification- types, process & procedure and agencies. Grading - Packaging and handling. Economic considerations and viability of organic products - Export of organic product and marketing.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This course enables the students to understand practices organic farming principles, methodologies and significance. Further, learn to production of organic products in a large scale for commercial application and its marketing strategies.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. NIIR Board. 2012. The complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.</li> <li>2. Sathe, T.V. 2004. Vermiculture and Organic Farming. Daya publishers.</li> <li>3. Subba Rao N.S. 2017. Biofertilizers in Agriculture and Forestry. Fourth Edition. Medtech.</li> <li>4. Vayas,S.C, Vayas, S. and Modi, H.A. 1998. Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.</li> <li>5. Singh, S M. 2018. Organic Manure: Sources Preparation and Usage in Farming Lands, Siya Publishing House</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Reddy, S.R. 2019. Fundamentals of Agronomy Kalyani Publications, Uttar Pradesh</li> <li>2. Tolanur, S. 2018. Fundamentals of Soil Science IInd Edition, CBS Publishers , New Delhi</li> <li>3. Reddy, S.R. 2017. Principles of Organic Farming Kalyani Publishers, New Delhi</li> <li>4. Dongarjal, R.P and Zade, S.B. 2019. Insect Ecology and Integrated Pest Management Akinik Publications, New Delhi.</li> <li>1. Ahmad Mehraban. 2013. The Basis of Organic Fertilizers, LAP LAMBERT Academic Publishing.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.amazon.in/Healthy-earth-organic-Hari-prasad-ebook/dp/B08L5KFKDV">https://www.amazon.in/Healthy-earth-organic-Hari-prasad-ebook/dp/B08L5KFKDV</a></li> <li>2. <a href="https://www.kobo.com/in/en/ebook/organic-farming-for-sustainable-agriculture">https://www.kobo.com/in/en/ebook/organic-farming-for-sustainable-agriculture</a></li> <li>3. <a href="https://www.elsevier.com/books/organic-farming/chandran/978-0-12-813272-2">https://www.elsevier.com/books/organic-farming/chandran/978-0-12-813272-2</a></li> <li>4. <a href="https://link.springer.com/book/10.1007/978-3-030-04657-6">https://link.springer.com/book/10.1007/978-3-030-04657-6</a></li> <li>5. <a href="https://www.afrimash.com/product-category/livestock-section/book/organic-farming-ebooks/">https://www.afrimash.com/product-category/livestock-section/book/organic-farming-ebooks/</a></li> </ol>

**COURSE OUTCOMES:**

CO	On completion of this course, the students will be able to:	K-Level
CO1	Acquire knowledge on various aspects of organic farming.	Up to K2
CO2	Understand the relevance of organic farming, its advantages.	Up to K2
CO3	Explain the short comings against conventional high input agriculture.	Up to K2
CO4	Compare the packaging methods of harvest.	Up to K2
CO5	Discuss and develop skills for post harvest management.	Up to 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	1	2	2	3	1	2	2	3	3
CLO2	2	3	2	2	3	3	3	2	3	2	3
CLO3	2	2	3	3	2	2	2	1	2	3	2
CLO4	3	3	3	3	3	2	2	3	3	2	1
CLO5	3	2	1	3	1	1	2	3	3	2	1

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

Sl. No	CLOs	K- Level	Section – A		Section B (Either/ Choice)	Section C (Open choice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO x	Up to K 2	1	1 (K1/K2)	2(K2/ K2)	1 (K1)
2	CLO y	Up to K 2	1	1( K1/K2)	2(K2/ K2)	1(K2)
No. of Question to be asked			2		2	2
No. of Question to be answered			2		2	1
Mark for each question			2.5		5	10
Total Marks for each section			05		10	10

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

Sl. No	CLOs	K- Level	Section –A		Section B (Either/ Choice)	Section C (Open Choice)
			Short Answer			
			No. of Questions	K – Level		
1	CLO 1	Up to K 2	1	K1	2(K1 & K1)	1 (K1)
2	CLO 2	Up to K 2	1	K1	2(K2 & K2)	1 (K2)
3	CLO 3	Up to K 2	1	K2	2(K2 & K2)	1 (K1)
4	CLO 4	Up to K 2	1	K2	2(K2 & K2)	1(K2)
5	CLO 5	Up to K 2	1	K2	2(K2 & K2)	1 (K1)
No. of Question to be asked			5		10	5
No. of Question to be answered			5		5	3
Mark 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 fact 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	4	10	-	<b>16</b>	13.33	<b>35%</b>
K2	4	10	10	<b>26</b>	21.66	
K2	2	10	20	<b>36</b>	30.00	<b>30%</b>
K2	-	20	20	<b>42</b>	35.00	<b>35%</b>
Total Marks	20	50	50	<b>120</b>	100.00	<b>100%</b>



# DEPARTMENT OF ZOOLOGY

**Revised Curriculum**

**TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION (TANSCHE)**

**(Choice Based Credit system with Outcome Based Education)**

**Academic Year 2023-2024 onwards**

**I and II semesters (B.Sc. Zoology)**

**Allied Courses**

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

### **VISION**

The Department, being a centre of excellence in teaching and research in zoology, envisions fostering critical thinking and learning process, science education, highest values of life infuse ethical values, holistic development of student for their welfare and society at the central point and stride towards sustainable future.

### **MISSION**

- To impart holistic and advanced knowledge on Zoology to enrich the students meeting the global competence through academic excellence.
- To provide specialized skills to the students to excel in their careers and also to serve society.
- To infuse ethics, values, and responsibility to the students for the conservation of fauna, thereby creating sustainable environment.
- To develop an attitude among the students towards applications for the welfare of the mankind, thereby promoting Eco protection.
- To inculcate awareness on the issues on local environmental problems, job demand through field visits and discussions, online courses and web resources.

### **Programme Outcomes (defined by TANSICHE):**

**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

<b>PSO1</b>	<b>Placement:</b> To prepare the students who will demonstrate respectful engagement with others' ideas, behaviours, beliefs and apply diverse frames of reference to decisions and actions.
<b>PSO 2</b>	<b>Entrepreneur:</b> To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.
<b>PSO3</b>	<b>Research and Development:</b> Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.
<b>PSO4</b>	<b>Contribution to Business World:</b> To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
<b>PSO 5</b>	<b>Contribution to the Society:</b> To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

### Qualification for Admission

Candidates should have passed the Higher Secondary Examination, Zoology/Biology as one of the subject, conducted by the State Board of School Examinations, Government of Tamil Nadu, CBSC & ICSE or any other examination approved by Madurai Kamaraj University as equivalent.

### Duration of the Course

The students shall undergo prescribed course of study for the period of three academic years under CBCS semester pattern with outcome based education.

**Medium of Instruction:** English.

**System:** Choice Based Credit System with Outcome Based Model.

### Evaluation (Theory)

Internal (Formative)	: 25 marks
External (Summative)	: 75 marks
Total	: 100 marks

**Continuous Internal Assessment: 25 Marks**

<b>Components</b>	<b>Marks</b>
Test (Average of two tests) Conducted for 25 marks and converted into 10 marks)	10
Quiz/Assignment (usage of Library)	5
Seminar/Poster/chart preparation	5
Attendance/Activity/ Model preparation	5
<b>Total</b>	<b>25</b>

**Question paper pattern for test component of Internal Assessment (Duration 1 hour)**

<b>Pattern</b>	<b>No. of questions</b>	<b>Marks per question</b>	<b>Total marks</b>
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 - open choice – one question to be answered out of 2 question asked)	1/2	10	10
<b>Total marks</b>			<b>25</b>

**Blueprint for test component of CIA**

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

\*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.

**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 marks)	10
B- Either/Or type (5 X 5 marks)	25
C- Open Choice type (3out of 5 X 10 marks)	30
<b>Total</b>	<b>75</b>

**Blueprint for Semester Examination**

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

## EVALUATION (PRACTICAL)

Internal (Formative)	: 25 marks
External (Summative)	: 75 marks
Total	: 100 marks

### Question Paper Pattern for External Practical Examination (Major): 75 Marks

Components	Marks
I – Major question	25
II – Minor question	20
III – Spotters (5 x 4)	20
IV – Record book	10
<b>Total</b>	<b>75</b>

### Question Paper Pattern for External Examination (Ancillary): 75 Marks

Components	Marks
I – Major question	25
II – Minor question	20
III – Spotter (4 x 5)	20
IV – Record book	10
<b>Total</b>	<b>75</b>

In respect of external examinations passing minimum is 35% for Under Graduate Courses and in total, aggregate of 40%.

The curriculum is revised to suit the changing trends by propagation of ideas ensuring professional growth through innovative method of teaching. The curriculum is strengthened through the latest amendments and revisions as per UGC and TANSCHÉ Norms.

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

**Credit Distribution for B.Sc. Zoology**

**Semester – I**

Part	Course Code	Course description	Credits	Hours
I	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	Tamil / Hindi / Sanskrit	3	6
II	23U1NENG1	English	3	6
III	23U1ZCCT1	Invertebrata	5	5
	23U1ZCCP1	Invertebrata Lab Course	3	3
	23U1CGET1 (Z)	Theory (Generic Elective) I Chemistry	4	4
	23U1CGEP1	Practical (Generic Elective) I Chemistry	1	2
IV	23U1ZFCT1	Foundation course (FC)- Applied Zoology	2	2
	23U1ZSED1	Medical Laboratory Techniques	2	2

**Semester – II**

Part	Course Code	Course description	Credits	Hours
I	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	Tamil / Hindi / Sanskrit	3	6
II	23U2NENG2	English	3	6
III	23U2ZCCT2	Chordata	5	5
	23U2ZCCP2	Chordata Lab Course	3	3
	23U2CGET2 (Z)	Theory (Generic Elective) I Chemistry	4	4
	23U2CGEP2	Practical (Generic Elective) I Chemistry	1	2
IV	23U2ZSED2	Skill Enhancement Course (SEC-2)	2	2
	23U2ZSED3	Skill Enhancement Course (SEC-3)	2	2

<b>Title of the Course</b>		<b>INVERTEBRATA</b>					
<b>TANSICHE Course type</b>		<b>CC1</b>					
<b>Course Category</b>		<b>Core</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>FIRST</b>	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23U1ZCCT1</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		5					5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Biology / Zoology knowledge at Higher Secondary level					
<b>Objectives of the Course</b>		<ol style="list-style-type: none"> <li>1. To study the systematic classification of Animal kingdom.</li> <li>2. To differentiate various groups of among invertebrates based on their functional morphology, modes of life</li> <li>3. To understand the modes of reproduction among invertebrates</li> <li>4. To infer economic importance of Invertebrates</li> </ol>					
<b>Course Outline</b>		<p><b>Unit I:</b>  <b>Protozoa:</b> Introduction to Classification, Binomial nomenclature. General characters and classification of Phylum Protozoa up to classes. Type study - <i>Paramecium</i> - Parasitic protozoans (<i>Entamoeba</i>, <i>Leptospirosis</i>) - Economic importance and Nutrition in protozoa - Locomotion in protozoa  <b>Porifera:</b> General characters and classification up to Classes. Type study - Ascon (<i>Leucosolenia</i>) - Canal system in sponges - Skeleton in sponges, Economic importance, Reproduction in sponges.</p>					
		<p><b>Unit II:</b>  <b>Coelenterata:</b> General characters and classification up to classes – Type study - <i>Obelia</i> and <i>Aurelia</i> - Corals and coral reefs - Polymorphism in Coelenterata - Mesenteries in Anthozoa - Economic importance of Coelenterata - Polymorphism in Hydrozoa.</p>					
		<p><b>Unit III:</b>  <b>Platyhelminthes:</b> General characters and classification up to classes. Type study – <i>Fasciola hepatica</i>. Life cycle of <i>Taenia solium</i>– Parasitic adaptations of Helminth parasites.  <b>Aschelminthes:</b> General characters and classification of up to classes - Type study - <i>Ascaris lumbricoides</i>. Nematode Parasites and diseases – <i>Wuchereria bancrofti</i>, <i>Enterobius vermicularis</i>, <i>Ancylostome duodenale</i>.</p>					

	<p><b>Unit IV:</b>  <b>Annelida:</b> General characters and classification up to Classes. Type study – <i>Nereis</i> Metamerism in Annelida. Functions of Nephridium and coelomoducts in Annelids - Modes of life in Annelids. Reproduction in polychaetes.  <b>Arthropoda:</b> General characters and outline classification of Phylum Arthropoda up to Classes. External morphology of <i>Penaeus indicus</i>. Affinities of Peripatus – Larval forms in Crustacea. Insect metamorphosis. Economic importance of insects. Trilobita –structure, life history and affinities.</p> <p><b>Unit V:</b>  <b>Mollusca:</b> General characters and outline classification of Phylum Mollusca up to Classes. External morphology of <i>Pila globosa</i>. Foot and Torsion in Mollusca. Respiration in Molluscs – Ctenidia and pulmonary sacs. Economic importance of Molluscs – Cephalopoda are advanced molluscs.  <b>Echinodermata:</b> General characters and outline classification of Phylum Echinodermata up to Classes. External morphology of <i>Asterias</i>. Water vascular system in Echinodermata – Larval forms of Echinoderms.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Visit to a marine ecosystem/museum/attend lectures.</p>
<p><b>Skills acquired from this course</b></p>	<p>Professional skills such as broader taxonomic identification of invertebrates, learn the physiology and evolution of Invertebrates.</p>
<p><b>Justification for nature of course</b></p>	<p>Learn the systematic classification of animal kingdom and naming of animals.  Understand the adaptation of animals in the ecological perspectives.  Unravel the phylogenetic approach of invertebrate evolution.</p>
<p><b>Test Books</b></p>	<ol style="list-style-type: none"> <li>1. Ekambaranatha Iyer, (2000). <i>A Manual of Zoology</i>, 10th edition, Viswanathan, S., Printers &amp; Publishers Pvt Ltd</li> <li>2. Jordan, E.L. and Verma P.S, 1995. <i>Invertebrate Zoology</i>, 12th edn. S. Chand &amp; Co.</li> <li>3. Kotpal, R.L, (1992). <i>Protozoa, Porifera, Coelenterata, Annelida, Arthropoda</i>.</li> <li>4. Nair, N.C., Leelavathy, S., Soundarapandian, N, Murugan, T. and N. Arumugam. (2020). <i>A text book of Invertebrates</i>. Saras publications. Nagercoil.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ruppert and Barnes, R.D. (2006). <i>Invertebrate Zoology</i>, VIII Edition. Holt Saunders International Edition.</li> <li>2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). <i>The Invertebrates: A New Synthesis</i>, III Edition, Blackwell Science.</li> <li>3. Barrington, E.J.W. (1979). <i>Invertebrate Structure and Functions</i>. II Edition, E.L.B.S. and Nelson</li> <li>4. Hyman, L.H, 1955. <i>The invertebrates</i> - Vol. I to Vol. VII – Mc Graw Hill Book Co.</li> <li>5. Parker, J. and Haswell, 1978. <i>A text book of Zoology</i>, Vol. I - Williams and Williams.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.nationalgeographic.com/animals/invertebrates/">https://www.nationalgeographic.com/animals/invertebrates/</a></li> <li>2. <a href="https://bit.ly/3kABzKa">https://bit.ly/3kABzKa</a></li> <li>3. <a href="https://www.nio.org/">https://www.nio.org/</a></li> <li>4. <a href="https://greatbarrierreef.org/">https://greatbarrierreef.org/</a></li> </ol>

### COURSE OUTCOMES:

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

CLO	CLO Statement	Knowledge level
CO1	Recall the basic structure and economic importance of Protozoa and Porifera	K2
CO2	Understand the morphology, economic importance and polymorphism in Colenterates	K3
CO3	Analyze the general characters, parasitic adaptations in Helminth worms	K3
CO4	Apply the knowledge on modes of life, reproduction in polychaetes to unravel the life strategies of Annelids and Arthropods	K4
CO5	Examine the general characters and modes of life in Mollusca and Echinodermata	K4

### MAPPING WITH PROGRAMME OUTCOMES:

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

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

### Blueprint for test component of CIA

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

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

### Blueprint for Semester Examination

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

#### Distribution of Section-wise Marks with K Levels

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

<b>Title of the Course</b>		<b>INVERTEBRATA LAB COURSE</b>					
<b>TANSCHÉ Course type</b>		<b>CC2</b>					
<b>Course Category</b>		<b>Skill Enhancement Course</b>					
<b>Nature of Course</b>		<b>Employability / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>FIRST</b>	<b>Credits</b>	<b>3</b>	<b>Course Code</b>	<b>23U1ZCCP1</b>
		<b>Semester</b>	<b>1</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	
						3	
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Biology / Zoology knowledge at Higher Secondary level					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To identify the different groups of invertebrate animals by observing their external characteristics.</li> <li>To understand the organs, organ system and their functions in lower animals.</li> <li>To get knowledge about the different modes of life and their adaptation based on the environment.</li> <li>Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Major Dissection:</b> Cockroach: Circulatory system, Nervous system, Reproductive system. Leech: Nervous System, Reproductive system. Earthworm: Nervous System, Reproductive system. <i>Pila globosa</i> : Nervous system. Prawn: Nervous system (including Appendages).					
		<b>Unit II: Minor Dissection:</b> Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts. <i>Pila globosa</i> : Digestive system (Including radula). Freshwater Mussel: Digestive system.					
		<b>Unit III: Mounting:</b> Earthworm: Body setae; Pineal setae. <i>Pila globosa</i> : Radula. Freshwater muscle: Pedal ganglia.					
		<b>Unit IV: Mounting:</b> Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts.					
		<b>Unit V: Spotters: (i). Protozoa:</b> <i>Amoeba</i> , <i>Paramoecium</i> , <i>Paramoecium</i> Binary fission and Conjugation, <i>Vorticella</i> , <i>Entamoeba histolytica</i> , <i>Plasmodium vivax</i> ; <b>(ii). Porifera:</b> Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule; <b>(iii). Coelenterata:</b> <i>Obelia</i> – Colony & Medusa, <i>Aurelia</i> , <i>Physalia</i> , <i>Velella</i> , <i>Corallium</i> , <i>Gorgonia</i> , <i>Pennatula</i> ; <b>(iv). Platyhelminthes:</b> <i>Planaria</i> , <i>Fasciola hepatica</i> , <i>Fasciola</i> larval forms – Miracidium, Redia, <i>Cercaria</i> , <i>Echinococcus granulosus</i> , <i>Taenia solium</i> , <i>Schistosoma haematobium</i> ; <b>(v). Nematelminthes:</b> <i>Ascaris</i> (Male & Female), <i>Drancunculus</i> , <i>Ancylostoma</i> , <i>Wuchereria</i> ; <b>(vi). Annelida:</b> <i>Nereis</i> , Aphrodite, <i>Chaetopteurs</i> , Hirudinaria, Trochophore larva; <b>(vii).</b>					

	<p><b>Arthropoda:</b> <i>Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus</i>, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male &amp; female <i>Anopheles</i> and <i>Culex</i>, Mouthparts of Housefly and Butterfly; <b>(viii).</b></p> <p><b>Mollusca:</b> <i>Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus</i>, Glochidium larva; <b>(ix).</b></p> <p><b>Echinodermata:</b> <i>Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon</i>, Bipinnaria larva.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Visit to terrestrial and aquatic ecosystem/museum/attend lectures.
<b>Skills acquired from this course</b>	Professional skills such as identification of invertebrates, learn the physiology and evolution of Invertebrates.
<b>Justification for nature of course</b>	The students will able to understand structural organization of animals and develop skill in identification of animals in their habitat by analysing unique structures and functions.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ekambaranatha Iyyar and Ananthakrishnan, T. N. (1995). A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai</li> <li>2. Ganguly, Sinha and Adhikari, (2011). Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.</li> <li>3. Sinha, Chatterjee and Chattopadhyay, (2014). Advanced Practical Zoology, Books &amp; Allied Ltd; 3rd Revised edition, 1070 pp.</li> <li>4. Lal, S. S, (2016). Practical Zoology Invertebrate, Rastogi Publications.</li> <li>5. Verma, P.S. (2010). A Manual of Practical Zoology: Invertebrates, S Chand, 497pp.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). <i>The Invertebrates: A New Synthesis</i>, III Edition, Blackwell Science.</li> <li>2. Barnes, R.D. (1982). <i>Invertebrate Zoology</i>, V Edition. Holt Saunders International Edition.</li> <li>3. Barrington, E.J.W. (1979). <i>Invertebrate Structure and Functions</i>. II Edition, E.L.B.S. and Nelson.</li> <li>4. Boradale, L.A. and Potts, E.A. (1961). <i>Invertebrates: A Manual for the use of Students</i>. Asia Publishing Home.</li> <li>5. Lal, S.S. (2005). <i>A text Book of Practical Zoology: Invertebrate</i>, Rastogi, Meerut.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://nbb.gov.in/">https://nbb.gov.in/</a></li> <li>2. <a href="http://www.agshoney.com/training.htm">http://www.agshoney.com/training.htm</a></li> <li>3. <a href="https://icar.org.in/">https://icar.org.in/</a></li> </ol>

## COURSE OUTCOMES:

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

CO		K-level
CO1	Identify and label the external features of different groups of invertebrate animals.	K2
CO2	Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals.	K3
CO3	Differentiate and compare the structure, function and mode of life of various groups of animals.	K3
CO4	To compare and distinguish the dissected internal organs of lower animals.	K4
CO5	Prepare and develop the mounting procedure of economically important invertebrates.	K4

## MAPPING WITH PROGRAMME OUTCOMES:

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

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

## EVALUATION (PRACTICAL)

Internal (Formative)	: 25 marks
External (Summative)	: 75 marks
Total	: 100 marks

### Question Paper Pattern for External Practical Examination (Major): 75 Marks

Components	Marks
I – Major question	25
II – Minor question	20
III – Spotters (5 x 4)	20
IV –Record book	10
<b>Total</b>	<b>75</b>

<b>Title of the Course</b>		<b>APPLIED ZOOLOGY</b>					
<b>TANSCHE Course type</b>		<b>Foundation Course</b>					
<b>Course Category</b>		<b>Skill Enhancement Course</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Foundat ion	<b>Year</b>	<b>FIRST</b>	<b>Credits</b>	2	<b>Course Code</b>	<b>23U1ZFCT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		2					2
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Biology / Zoology knowledge at Higher Secondary level					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To create awareness among the students about the applied aspects of Zoology.</li> <li>To understand the economic importance of animals.</li> <li>To illustrate and examine the association of insects with human.</li> <li>To compare and distinguish the developmental stages and describe the important biological process.</li> <li>To motivate the students for the employment.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Insects associated with human</b> Beneficial Insects: Insect pollinators – predators – parasites. Insects associated with human diseases: Mosquitoes and housefly. Insects associated with household materials: Termites and Silver fish.					
		<b>Unit II: Insect pests, life cycle and types of damage to plants</b> Pest of rice: Rice stem borer ( <i>Scirpophaga incertulas</i> ); Pest of Sugarcane: The shoot borer ( <i>Chilo infuscatellus</i> ); Pest of coconut: The rhinoceros beetle ( <i>Oryctes rhinoceros</i> ). Pest of cotton: Pink bollworm: <i>Pectinophora gossypiella</i> ; Pest of stored products: The rice weevil ( <i>Sitophilus oryzae</i> ). Principles of Integrated Pest Management.					
		<b>Unit III: Apiculture &amp; Sericulture</b> Apiculture: Types of honey bees, Bee colony, Newton’s bee hive, uses of honey. Sericulture: Types of silkworm, Life cycle of mulberry silkworm, <i>Bombyx mori</i> , Rearing of appliances.					
		<b>Unit IV: Poultry &amp; Dairy farming</b> Poultry: Breeds of poultry, Principles for construction of poultry house, Poultry diseases (Ranikhet disease & Fowl Pox). Dairy farming: Economically important cattle, Nutritive value of milk, Livestock diseases: Foot and mouth diseases and Rinder pest.					

	<p><b>Unit V: Career options for Zoology Graduates:</b> Higher Education, UPSC/TNPSC examinations, Directly and Indirectly Associated Career Options, Major Zoology organizations: ZSI, SACON, ICFRE, ICMR, ICAR &amp; NIOT.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Visit to terrestrial ecosystem/museum/attend lectures.</p>
<p><b>Skills acquired from this course</b></p>	<ol style="list-style-type: none"> <li>1. Learn the rearing techniques for economic importance of animals.</li> <li>2. Identification of Insect pest and their life cycle on various agricultural crops.</li> <li>3. Knowledge on insects associated with human.</li> </ol>
<p><b>Justification for nature of course</b></p>	<p>The students will able to (i) classify the insects, pollinators, predators and parasites; (ii) identify the insect pest and their life cycle on various agricultural crops.</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. David, B. and Ananthakrishnan, T.N. (2006). General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India</li> <li>2. Pruthi, H.S. (1969). Text book on Agricultural Entomology, I.C.A.R. Publication, New Delhi.</li> <li>3. Ravindranathan, K.R. (2005). A text book of economic zoology, Dominant publishers and distributors, New Delhi.</li> </ol>
<p><b>Reference Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. AbishekShukla, D. (2009). <i>A Hand Book of Economic Entomology</i>, Vedamse Books, New Delhi.</li> <li>2. Vasantharaj David, B. (2001). <i>Elements of Economic Entomology</i>, Popular Book Depot, Chennai. 400pp.</li> </ol>
<p><b>Websites and e-Learning resources</b></p>	<ol style="list-style-type: none"> <li>1. <a href="https://ncipm.icar.gov.in/NCIPMPDFs/FOLDERS/fruits.pdf">https://ncipm.icar.gov.in/NCIPMPDFs/FOLDERS/fruits.pdf</a></li> <li>2. <a href="https://ncipm.icar.gov.in/NCIPMPDFs/folders/VegetableCropsenglish.pdf">https://ncipm.icar.gov.in/NCIPMPDFs/folders/VegetableCropsenglish.pdf</a></li> <li>3. <a href="https://www.youtube.com/watch?v=msKC5bx_Mn0">https://www.youtube.com/watch?v=msKC5bx_Mn0</a></li> <li>4. <a href="https://www.youtube.com/watch?v=peTiFhQOLxM">https://www.youtube.com/watch?v=peTiFhQOLxM</a></li> <li>5. <a href="https://www.youtube.com/watch?v=goLOcmWD2tM">https://www.youtube.com/watch?v=goLOcmWD2tM</a></li> <li>6. <a href="https://edunuts.com/career-options-after-bsc-zoology/">https://edunuts.com/career-options-after-bsc-zoology/</a></li> </ol>

**COURSE OUTCOMES:**

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

<b>COs</b>	<b>Course Outcomes</b>	<b>K-level</b>
<b>CO1</b>	Recall the interaction of insects with humans and household materials.	K2
<b>CO2</b>	Understand the insect pest on rice, sugarcane, coconut, cotton and stored products and Integrated Pest Management.	K3
<b>CO3</b>	Analyse the insect and their types, rearing techniques and its uses.	K3
<b>CO4</b>	Apply the knowledge to execute the culture practices of bees and silkworm.	K4
<b>CO5</b>	Infer the awareness about the organizations and career options for Zoology graduates.	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).

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	3			3			2		1		2
<b>CLO2</b>	3		2		2	2	2		3	2	3
<b>CLO3</b>	2	3	3	3	2	3	3	3	3	3	3
<b>CLO4</b>	2		3	3	2	3	3	3	3	3	3
<b>CLO5</b>	2	2	3	3	2	3	3	3	3	3	3

### Blueprint for test component of CIA

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

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

### BLUE PRINT FOR EXTERNAL

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

<b>Title of the Course</b>		<b>MEDICAL LABORATORY TECHNIQUES</b>					
<b>TANSICHE Course type</b>		<b>SEC1</b>					
<b>Course Category</b>		<b>Elective (Generic / Discipline Specific)</b>					
<b>Nature of Course</b>		<b>Employability</b>					
<b>Category</b>	Skill Enhancement Course	<b>Year</b>	FIRST	<b>Credits</b>	2	<b>Course Code</b>	<b>23U1ZSED1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		2				2	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Biology / Zoology knowledge at Higher Secondary level.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To understand the different protocols and procedures to collect clinical samples.</li> <li>To explain the characteristics of clinical samples.</li> <li>To demonstrate skill in handling clinical equipment.</li> <li>To evaluate the safety precautions while handling clinical samples.</li> <li>To summarise the control measures to avoid contamination of clinical samples.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Laboratory Safety and Human Health and Hygiene:</b> Laboratory safety – toxic chemicals and biohazards waste-biosafety level- good laboratory practice – hygiene and health issue – physiology effect of alcohol, tobacco, smoking & junk food & its treatment - biomedical waste management.					
		<b>Unit II: Haematology:</b> Composition of blood and their function-collection of blood & lab procedure-haemopoiesis- types of anaemia- mechanism of blood coagulation- bleeding time-clotting time- determination of hemoglobin-erythrocyte sedimentations rate- packed cell volume.					
		<b>Unit III: Blood components and diagnosis:</b> Total count of RBC & WBC- Differential count WBC- blood grouping and typing-haemostasis- bleeding disorder of man - Haemolytic disease of newborn, Platelet count, reticulocytes count, Absolute Eosinophil count.					
		<b>Unit IV: Medical Microbiology and Instrumentation Techniques:</b> Definition and scope of microbiology- structure and function of cells - parasites - <i>Entamoeba- Plasmodium-Leishmania</i> and <i>Trypanosome</i> - Computer tomography (CT scan) – Magnetic Resonance imaging – flow cytometry – treadmill test – PET.					

	<b>Unit V: Medical Physiology:</b> Cardiovascular system- Blood pressure - Pulse – regulation of heart rate, cardiac shock. Heart sounds, Electrocardiogram (ECG) – significance – ultra sonography- Electroencephalography (EEG).
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Visit to terrestrial and aquatic ecosystem/molecular laboratory/diagnostic centres/attend lectures.
<b>Skills acquired from this course</b>	<ul style="list-style-type: none"> <li>• Protocols and procedures to collect clinical samples for blood analysis.</li> <li>• Learn the characteristics of clinical samples.</li> <li>• Operational method of clinical equipment.</li> <li>• Evaluate the hematological and histological parameters of biological samples.</li> <li>• Learn the medical laboratory techniques in health care industry.</li> </ul>
<b>Justification for nature of course</b>	Relationships of the animal groups, understand the nucleic acids and immune mechanisms, disease and their control, vaccination, process of immune interactions.
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Manoharan,A, and Sethuraman, 2003. Essential of Clinical Heamatology, Jeypee brothers, New Delhi.</li> <li>2. Richard, A, McPherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia.Published by Tata McGraw-Hill Education Pvt. Ltd.,</li> <li>3. Ochei. J., A. Kolhatkar (2000). Medical Laboratory science: Theory and practice, Published by Tata McGraw-Hill Education Pvt. Ltd, First edition.</li> </ol>
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai.</li> <li>2. Guyton and Hall, 2000. Text Book of medical Physiology, 10th edition, Elseiner, New Delhi.</li> <li>3. Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol,I,II,III. Tata MC GrawHill, New Delhi.</li> <li>4. Sood, R, 2009. Medical Laboratory technology, Methods and interpretation.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://bit.ly/3tUs8In">https://bit.ly/3tUs8In</a></li> <li>2. <a href="https://bit.ly/2XKu7mT">https://bit.ly/2XKu7mT</a></li> <li>3. <a href="https://bit.ly/3hNS1EP">https://bit.ly/3hNS1EP</a></li> <li>4. <a href="https://bit.ly/2ZgrLga">https://bit.ly/2ZgrLga</a></li> <li>5. <a href="https://bit.ly/3hTBO1b">https://bit.ly/3hTBO1b</a></li> </ol>

**COURSE OUTCOMES:**

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

COs	Course Outcomes	K-level
CO1	Understand protocols and procedures to collect clinical samples for blood analysis and to study human physiology.	K2
CO2	Explain the characteristics of clinical samples.	K3
CO3	Demonstrate skill in handling clinical equipment.	K3
CO4	Evaluate the hematological and histological parameters of biological samples.	K4
CO5	Elaborate the role of medical laboratory techniques in health care industry.	K4

**MAPPING WITH PROGRAMME OUTCOMES:**

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

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

### Blueprint for test component of CIA

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

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

### BLUE PRINT FOR EXTERNAL

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

<b>Title of the Course</b>		<b>ALLIED ZOOLOGY – I</b>					
<b>TANSICHE Course type</b>		<b>EC1</b>					
<b>Course Category</b>		<b>Elective (Generic / Discipline Specific)</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Elective	<b>Year</b>	<b>FIRST</b>	<b>Credits</b>	4	<b>Course Code</b>	<b>23U1ZGET1 (B)</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		4				4	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Biology / Zoology knowledge at Higher Secondary level.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida.</li> <li>• To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata.</li> <li>• To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia.</li> <li>• To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia.</li> <li>• To acquire detailed knowledge of selected system of invertebrate and chordate forms.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Diversity of Invertebrates–I</b>					
		Principles of taxonomy. Criteria for classification, Symmetry and Coelom, Binomial nomenclature. Salient features and Classification of Protozoa, Coelenterata, Helminthes and Annelida (upto class level with example).					
		<b>Unit II: Diversity of Invertebrates–II</b>					
		General characters and Classification of Arthropoda, Mollusca and Echinodermata (upto class level with example). Arthropoda–Mouth parts in insects; Mollusca–Economic importance; Echinodermata–Water vascular system in starfish.					
		<b>Unit III: Diversity of Chordates–I</b>					
		General characters and Classification of Prochordata, Pisces and Amphibia up to orders with example. Pisces- Migration of fishes and parental care: Amphibia- Metamorphosis					
		<b>Unit IV: Diversity of Chordates–II</b>					
General characters and Classification of Reptilia, Aves and Mammalia up to orders with example. Reptilia – Poisonous snakes of South India. Aves- Flight adaptations and Mammalia- Structure of typical tooth and types of dentitions.							

	<p><b>Unit V: Animal organisation</b></p> <p>Structure and organization of (1). Earthworm – Locomotion and Reproductive system (2) Fish – Shark- Scales and Fins, Respiratory system (3) Rabbit –Digestive system &amp; Circulatory system.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Visit to terrestrial and aquatic ecosystem/museum/attend lectures.
<b>Skills acquired from this course</b>	<ul style="list-style-type: none"> <li>• Learning to identify the Invertebrates and Chordates.</li> <li>• Interlinking different grades of organizations of the Invertebrates and Chordate Organ systems.</li> <li>• Ability to generate hypothesis in Invertebrates and Chordate structures.</li> <li>• To analysis the diversity of functions and their relations with the environment.</li> </ul>
<b>Justification for nature of course</b>	Relationships of the Invertebrates and Chordates with such other animal groups/Phyla, Evolution and functional relationships of particular organ/structure/feature.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ekambaranatha Iyer, (2000). A Manual of Zoology, 10th edition, Viswanathan, S., Printers &amp; Publishers Pvt Ltd</li> <li>2. Jordan, E.L. and Verma P.S, (1995). Invertebrate Zoology, 12th edn. S. Chand&amp; Co.</li> <li>3. Nair, N.C., Leelavathy, S., Soundara pandian, N, Murugan, T. and N. Arumugam. (2020). A text book of Invertebrates. Saras publications. Nagercoil.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ekambaranatha Iyer and T.N. Ananthakrishnan, (1992). <i>Manual of Zoology</i> Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.</li> <li>2. Parker, J. and Haswell, (1978). <i>A text book of Zoology</i> Vol. I - Williams and Williams.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.youtube.com/watch?v=KQBE94x5TfE">https://www.youtube.com/watch?v=KQBE94x5TfE</a></li> <li>2. <a href="https://www.youtube.com/watch?v=oYtdu4aIB8U">https://www.youtube.com/watch?v=oYtdu4aIB8U</a></li> <li>3. <a href="https://www.youtube.com/watch?v=ut0QWN0IoG0">https://www.youtube.com/watch?v=ut0QWN0IoG0</a></li> <li>4. <a href="https://www.youtube.com/watch?v=oYtdu4aIB8U">https://www.youtube.com/watch?v=oYtdu4aIB8U</a></li> <li>5. <a href="https://www.youtube.com/watch?v=8c8FH0G3iVQ">https://www.youtube.com/watch?v=8c8FH0G3iVQ</a></li> <li>6. <a href="https://www.youtube.com/watch?v=GM9tPmbEIPw">https://www.youtube.com/watch?v=GM9tPmbEIPw</a></li> <li>7. <a href="https://www.youtube.com/watch?v=OrWUtCQSm_Q">https://www.youtube.com/watch?v=OrWUtCQSm_Q</a></li> <li>8. <a href="https://www.youtube.com/watch?v=EmllsH4pIz0">https://www.youtube.com/watch?v=EmllsH4pIz0</a></li> </ol>

**COURSE OUTCOMES:**

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

COs	Course Outcomes	K-level
CO1	Recall the general characteristic features of Protozoa, Coelenterata, Helminthes and Annelida.	K2
CO2	Classify Arthropoda, Mollusca and Echinodermata up to class level and their general characters.	K3
CO3	Distinguish the characters of Prochordata, Pisces and Amphibia up to orders.	K3
CO4	Categorize the Reptilia, Aves and Mammalia up to orders.	K4
CO5	Explain and discuss the structural and functional organization of some invertebrates and chordates.	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	2								3		
CLO2	3								3	3	
CLO3	3							1	3	3	2
CLO4	3							1	3	3	2
CLO5	3	1	3		3			3	3	2	3

### Blueprint for test component of CIA

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

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

### BLUE PRINT FOR EXTERNAL

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

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

K1- Remembering and recalling facts with specific answers

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

K3- Application oriented- Solving Problems

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

<b>Title of the Course</b>		<b>ALLIED ZOOLOGY LAB COURSE</b>					
<b>TANSCHÉ</b> <b>Course type</b>		<b>EC1-P</b>					
<b>Course Category</b>		<b>Skill Enhancement Course</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	FIRST	<b>Credits</b>	1	<b>Course Code</b>	<b>23U1ZGEP1 (B)</b>
		<b>Semester</b>	1				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
				2		2	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Biology / Zoology knowledge at Higher Secondary level					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>Acquire the basic knowledge of diversity and organisation of</li> <li>Phylum Protozoa, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Chordata.</li> <li>Gain knowledge in the taxonomic position of the Phylum.</li> <li>Comparing the structural and functional organisations of lower organisms with human systems enables them to invent medicines for a particular disease.</li> <li>Get placements in pharma companies to invent new ointments, antibiotics and interferons for endemic epidemic and pandemic diseases.</li> <li>Paves the path for DNA recombinant technology.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Major Dissection:</b> Digestive system of Cockroach, Digestive system of Fish.					
		<b>Unit II:</b> Preparation of an antibiotic cream / lotion. Gut content analysis in insects.					
		<b>Unit III: Mounting:</b> Mouth parts – Cockroach, Honey Bee and House fly. Body setae - Earthworm; Placoid scale of Fish.					
		<b>Unit IV: Osteology:</b> Frog: Pectoral girdle, Pelvic girdle, Forelimb, Hindlimb and Urostyle.					
		<b>Unit V: Spotters: Invertebrata</b> (i). Protozoa: <i>Plasmodium</i> (ii). Porifera: <i>Leucosolenia</i> , (iii). Coelenterata: Obelia-Colony, (iv). Platyhelminthes: <i>Fasciola hepatica</i> , (v). Nematelminthes: <i>Ascaris</i> (Male & Female), (vi). Annelida: Trochophore larva (vii). Arthropoda: Prawn, (viii). Mollusca: <i>Pila</i> , (ix). Echinodermata: star fish. <b>Chordata:</b> (i) Hemichordata: <i>Balanoglossus</i> , (ii). Protochordata: <i>Amphioxus</i> , (iii). Cyclostomata: <i>Petromyzon</i> , (iv). Pisces: <i>Hippocampus</i> , (v). Amphibia: Frog, (vi). Reptilia: <i>Vipera russelli</i> , <i>Naja</i> , (vii). Aves: Feather of bird, (viii). Mammalia: Loris.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Visit to terrestrial and aquatic ecosystem/museum/attend lectures.
<b>Skills acquired from this course</b>	Analyse, compare and distinguish the features of lower organisms with chordates.
<b>Justification for nature of course</b>	Preparing the students for placements by inculcating valuable knowledge and providing trainings.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ekambaranatha Iyyar and T. N. Ananthakrishnan, (1995). A manual of Zoology, Vol. I (Part 1, 2), S. Viswanathan, Chennai.</li> <li>2. Lal, S.S, (2016). Practical Zoology Invertebrate, Rastogi Publications.</li> <li>3. Verma, P.S, (2000). A Manual of Practical Zoology: Chordates, S. Chand Limited, 627pp.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Lal, S.S. (2005). <i>A text Book of Practical Zoology: Invertebrate</i>, Rastogi, Meerut.</li> <li>2. Robert William Hegner, 2015. <i>Practical Zoology</i>, Biblio Life, 522 pp.</li> <li>3. Verma, P.S. (2010). <i>A Manual of Practical Zoology: Invertebrates</i>, S Chand, 497pp.</li> <li>4. Young, J.Z. (1972). <i>The life of vertebrates</i>. Oxford Uni. London.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.youtube.com/watch?v=b04hc_kOY10">https://www.youtube.com/watch?v=b04hc_kOY10</a></li> <li>2. <a href="https://bit.ly/3CzTEy8">https://bit.ly/3CzTEy8</a></li> <li>3. <a href="http://tolweb.org/Chordata/2499">http://tolweb.org/Chordata/2499</a></li> <li>4. <a href="http://www.agshoney.com/training.htm">http://www.agshoney.com/training.htm</a></li> <li>5. <a href="https://www.nationalgeographic.com/animals/invertebrates/">https://www.nationalgeographic.com/animals/invertebrates/</a></li> <li>6. <a href="http://www.csrtimys.res.in/">http://www.csrtimys.res.in/</a></li> </ol>

**COURSE OUTCOMES:**

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

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

**MAPPING WITH PROGRAMME OUTCOMES:**

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

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



# DEPARTMENT OF COMPUTER SCIENCE

## Revised Curriculum

**TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION (TANSCHE)**

(Choice-Based Credit system with Outcome Based Education)

Academic Year 2023-2024 onwards

**I and II semesters (B.Sc. Computer Science)**

*(Aided & SF stream)*

**The Madura College (Autonomous), Madurai-11**  
**DEPARTMENT OF COMPUTER SCIENCE**

**Vision:**

- To Produce quality human resources in the field of Computer Science, and related areas for the development of the country's IT industry needs.
- Creating knowledge of fundamental principles and innovative technologies in the core areas of computer science and also in inter-disciplinary topics.
- To serve the local and the national community by creating awareness about computer-related products and to impress upon them the importance of knowledge management.

**Mission:**

- To produce successful graduates with personal and professional responsibilities and commitment to lifelong learning
- To produce highly qualified and motivated graduates through a rigorous curriculum of theory and application that develops the ability to solve problems, individually and in teams.
- To provide quality education to the students so as to equip them with strong fundamental concepts, critical thinking, programming, and problem-solving skills by providing hands-on experience, professional ethics, and leadership qualities to serve the Society.

**Programme Outcomes (Defined by TANSICHE):**

- 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-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

### Programme-Specific Outcomes:

<b>PSO1</b>	<b>Placement:</b> To prepare the students who will demonstrate respectful engagement with others' ideas, behaviours, beliefs and apply diverse frames of reference to decisions and actions.
<b>PSO2</b>	<b>Entrepreneur:</b> To create effective entrepreneurs by enhancing their critical thinking, problem-solving, decision making and leadership skill that will facilitate startups and high potential organizations.
<b>PSO3</b>	<b>Research and Development:</b> Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.
<b>PSO4</b>	<b>Contribution to Business World:</b> To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
<b>PSO5</b>	<b>Contribution to the Society:</b> To contribute to the development of society by collaborating with stakeholders for mutual benefit.

### Eligibility for Admission:

A candidate must have passed their 10+2 in Science stream with Physics , Mathematics, Chemistry, and Computer Science as their core subjects, conducted by the State Board of School Examinations, Government of Tamil Nadu, CBSC & ICSE or any other examination approved by Madurai Kamaraj University as equivalent.

### Duration of the Course :

The students shall undergo prescribed course of study for the period of three academic years under the CBCS semester pattern with outcome-based education.

**Medium of Instruction:** English.

**System:** Choice-Based Credit System with Outcome-Based Model.

**THE MADURA COLLEGE (Autonomous)**

**Department of Computer Science**

**Curriculum Structure**

**Semester : I**

<b>Part</b>	<b>Course description</b>	<b>Hours</b>	<b>Credits</b>
I	Language - I Tamil / Hindi / Sanskrit	6	3
II	Language - II English	6	3
III	Core Theory -1	5	5
	Core Practical -1	3	3
	Allied Theory -1	6	5
IV	Skill Enhancement Course SEC-1	2	2
	Foundation course (FC)	2	2
	Total	30	23

**Semester : II**

<b>Part</b>	<b>Course description</b>	<b>Hours</b>	<b>Credits</b>
I	Language - I Tamil / Hindi / Sanskrit	6	3
II	Language - II English	6	3
III	Core Theory -2	5	5
	Core Practical -2	3	3
	Allied Theory -2	6	5
IV	Skill Enhancement Course SEC-2	2	2
	Skill Enhancement Course SEC-3	2	2
	Total	30	23

**Detailed Curriculum :**

**Semester : I**

<b>Part</b>	<b>Sub-Code</b>	<b>Course description</b>	<b>Hours</b>	<b>Credits</b>
I		Language - I Tamil / Hindi / Sanskrit	6	3
II		Language - II English	6	3
III	23U1DCCT1	Core Theory -1 Programming in C	5	5
	23U1DCCP1	Core Practical -1 Programming in C Lab	3	3
	23U1MGET1(D)	Allied Theory -1 Numerical Methods	6	5
IV	23U1DSED1	Skill Enhancement Course SEC-1 Introduction to HTML	2	2
	23U1DFCT1	Foundation course (FC) Problem-Solving Techniques	2	2
		Total	<b>30</b>	<b>23</b>

<b>Semester : II</b>				
<b>Part</b>		<b>Course description</b>	<b>Hours</b>	<b>Credits</b>
I		Language - I Tamil / Hindi / Sanskrit	6	3
II		Language - II English	6	3
III	23U2DCCT2	Core Theory -2 Data Structures and Algorithms	5	5
	23U2DCCP2	Core Practical -2 Data Structures and Algorithms Lab.	3	3
	23U2MGET2(D)	Allied Theory -2 Graph Theory and its Applications	6	5
IV	23U2DSED2	Skill Enhancement Course SEC-2 Fundamentals of Information Technology	2	2
	23U2DSED3	Skill Enhancement Course SEC-3 Office Automation	2	2
		Total	<b>30</b>	<b>23</b>

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23U1DCCT1	PROGRAMMING IN C	Core	5	-	-	-	5	5	25	75	100
<b>Learning Objective</b>											
LO1	To familiarize the students with the Programming basics and the fundamentals of C, Datatypes in C, Mathematical and logical operations.										
LO2	To understand the concept using if statements and loops										
LO3	This unit covers the concept of Arrays and Functions										
LO4	This unit covers the concept of Structures and unions and Pre-processors										
LO5	To understand the concept of implementing pointers.										
UNIT	Contents									No. of Hours	
I	<p><b>Overview of C:</b> Importance of C, sample C program, C program structure, executing C program.</p> <p>Constants, Variables, and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables, Assigning values to variables---Assignment statement, declaring a variable as constant, as volatile.</p> <p><b>Operators and Expression:</b> Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators, arithmetic expressions, operator precedence, type conversions, mathematical functions</p> <p><b>Managing Input and Output Operators:</b> Reading and writing a character, formatted input, formatted output.</p>									15	
II	<p><b>Decision Making and Branching:</b> Decision making with If, simple IF, IF ELSE, nested IF ELSE , ELSE IF ladder, switch, GOTO statement.</p> <p><b>Decision Making and Looping:</b> While, Do-While, For, Jumps in loops.</p>									15	
III	<p><b>Arrays:</b> Declaration and accessing of one &amp; two-dimensional arrays, initializing two-dimensional arrays, multidimensional arrays.</p> <p><b>Functions:</b> The form of C functions, Return values and types, calling a function, categories of functions, Nested functions, Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions.</p>									15	
IV	<p><b>Structures and Unions:</b> Defining, giving values to members, initialization and comparison of structure variables, arrays of structure, arrays within structures, structures within structures, structures, and functions, and unions.</p> <p><b>Pre-processors:</b> Macro substitution, file inclusion.</p>									15	

V	<b>Pointers:</b> definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor, pointers and arrays, pointers and functions, pointers and structures.	15
<b>Total</b>		<b>75</b>

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
CO1	Remember the program structure of C with its syntax and semantics	PO1,PO3,PO5
CO2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2,PO3,PO6
CO3	Apply the programming principles learned in real-time problems	PO3,PO4,PO5
CO4	Analyze the various methods of solving a problem and choose the best method	PO4,PO5,PO6
CO5	Code, debug and test the programs with appropriate test cases	PO5,PO6

### Text Book

1. E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.

### Reference Books

1. Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.
2. Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998
3. Yashavant Kanetkar, Let Us C, Eighteenth Edition, BPB Publications, 2021

### Web Resources

1. <https://codeforwin.org/>
2. <https://www.geeksforgeeks.org/c-programming-language/>
3. <http://en.cppreference.com/w/c>
4. <http://learn-c.org/>
5. <https://www.cprogramming.com/>

**COURSE OUTCOMES:**

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

CO's	Course Learning Outcome	Knowledge Level
CO1	Know the knowledge of the structured programming and basic syntax of 'C' language.	Up to K2
CO2	Identify the fundamental operators, data types and all library functions	Up to K3
CO3	Identify and design the various features such as Flow control and control structures.	Up to K3
CO4	Analyse and construct the programs for Bitwise operators, Union and Structure concept	Up to K4
CO5	Design C programs with the concept of pointers, pointers & Arrays, Pointers & Files.	Up to K3

**Mapping with Programme Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	2	3	3
CO 3	2	3	2	3	3	2
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	2
<b>Weight age of course contributed to each PSO</b>	14	15	14	14	15	13

S-Strong-3    M-Medium-2    L-Low-1

**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 Test Component of CIA:**

**Blue Print – Programming in C**

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

**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 1	Up to K 2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 3	Up to K 3	1	K1	2 (K3&K3)	1(K3)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**Blueprint for Semester Examination:**  
**Learning Outcome Based Education & Assessment (LOBE)**  
**Blue Print –Programming in C**

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

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

### Distribution of Unit-wise questions with K Levels

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

K1 –Remembering and recalling facts with specific answers

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

K3 – Application oriented – Solving Problems

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

## LESSON PLAN

UNIT	Description	Hours	Mode
I	<b>Overview of C:</b> Importance of C, sample C program, C program structure, executing C program.	5	Problem solving
	Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables,	5	Lecture
	Constants, Variables, and Assigning values to variables---Assignment statement, declaring a variable as constant, as volatile.	5	Problem-solving
II	<b>Decision Making and Branching:</b> Decision making with If, simple IF,	5	Lecture
	IF ELSE, nested IF ELSE , ELSE IF ladder, switch, GOTO statement.	5	PPT
	<b>Decision Making and Looping:</b> While, Do-While, For, Jumps in loops.	5	Lecture
III	<b>Arrays:</b> Declaration and accessing of one & two-dimensional arrays, initializing two-dimensional arrays, multidimensional arrays.	5	Problem-solving
	<b>Functions:</b> The form of C functions, Return values and types, calling a function, categories of functions, Nested functions,	5	Lecture
	Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions.	5	Problem solving
IV	<b>Structures and Unions:</b> Defining, giving values to members, initialization and comparison of structure variables,	5	Lecture
	arrays of structure, arrays within structures, structures within structures, structures, and functions, and unions.	5	Problem solving
	<b>Pre-processors:</b> Macro substitution, file inclusion.	5	Lecture
V	<b>Pointers:</b> definition, declaring and initializing pointers, pointer increments and scale factor,	5	Tutorial
	accessing a variable through address and through pointer, pointer expressions,	5	Problem solving
	pointers and arrays, pointers and functions, pointers and structures.	5	Problem solving
Total		<b>75</b>	

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23U1DCCP1	PROGRAMMING IN C LAB	Core	-	-	3	-	3	3	25	75	100
<b>Course Objective</b>											
LO1	To familiarize the students with the Programming basics and the fundamentals of C, Datatypes in C, and Mathematical and logical operations.										
LO2	To understand the concept using if statements and loops										
LO3	This unit covers the concept of Arrays and Functions										
LO4	This unit covers the concept of Structures and unions and Pre-processors										
LO5	To understand the concept of implementing pointers and files										
UNIT	List of Exercises								No. of Hours		
I	<b>Unit I : Variables, Data types, Constants and Operators</b> <ol style="list-style-type: none"> <li>Evaluation of expression ex: <math>((x+y)^2 * (x+z))/w</math></li> <li>Temperature conversion problem (Fahrenheit to Celsius)</li> <li>Program to convert days to months and days (Ex: 364 days = 12 months and 4 days)</li> <li>Solution of quadratic equation</li> <li>Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales)</li> </ol>								12		
II	<b>Unit II: Decision making Statements</b> <ol style="list-style-type: none"> <li>Maximum of three numbers</li> <li>Calculate Square root of five numbers (using gototatement)</li> <li>Pay-Bill Calculation for different levels of employee (Switch statement)</li> <li>Fibonacci series</li> <li>Floyds Triangle</li> <li>Pascal's Triangle</li> </ol>								12		
III	<b>Unit III: Arrays, Functions and Strings</b> <ol style="list-style-type: none"> <li>Prime numbers in an array</li> <li>Sorting data (Ascending and Descending)</li> <li>Matrix Addition and Subtraction</li> <li>Matrix Multiplication</li> <li>Function with no arguments and no return values</li> <li>Function that convert lower case letters to upper case</li> <li>Factorial using recursion.</li> <li>Perform String Operations using Switch Case.</li> </ol>								12		

IV	<b>Unit IV : Structures and Macros</b> <ol style="list-style-type: none"> <li>Structure that describes a Hotel (name, address, grade, avg room rent, number of rooms) Perform some operations (list of hotels of a given grade etc.)</li> <li>Using Pointers in Structures.</li> <li>Cricket team details using Union.</li> <li>Write a macro that calculates the max and min of two numbers</li> <li>Nested macro to calculate Cube of a number.</li> </ol>	12
V	<b>Unit V : Pointers and Files</b> <ol style="list-style-type: none"> <li>Evaluation of Pointer expressions</li> <li>Function to exchange two pointer values</li> <li>Creation, insertion and deletion in a linked list</li> <li>Program to read a file and print the data.</li> <li>Program to receive a file name and a line of text as command line arguments and write the text to the file</li> <li>Program to copy the content of one file to another file.</li> </ol>	12
<b>Total</b>		<b>60</b>

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Remember the program structure of C with its syntax and semantics	PO1,PO3,PO5
2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2,PO3,PO6
3	Apply the programming principles learnt in real-time problems	PO3,PO4
4	Analyze the various methods of solving a problem and choose the best method	PO4,PO5,PO6
5	Code, debug and test the programs with appropriate test cases	PO4,PO6

### Text Book

- E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.

### Reference Books

- Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.
- Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998
- Yashavant Kanetkar, Let Us C, Eighteenth Edition, BPB Publications, 2021

### Web Resources

- <https://codeforwin.org/>
- <https://www.geeksforgeeks.org/c-programming-language/>
- <http://en.cppreference.com/w/c>
- <http://learn-c.org/>
- <https://www.cprogramming.com/>

**Mapping with Programme Outcomes:**

<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO 1</b>	3	3	3	3	3	3
<b>CO 2</b>	2	3	3	3	3	3
<b>CO 3</b>	3	3	2	3	3	2
<b>CO 4</b>	3	3	3	3	3	3
<b>CO 5</b>	3	3	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	14	15	14	15	15	14

S-Strong-3

M-Medium-2

L-Low-1

<b>Title of the Course</b>		NUMERICAL METHODS					
<b>TANSICHE Course type</b>		EC1					
<b>Course Category</b>		Elective Course 1					
<b>Nature of Course</b>		Skill Development					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	23U1MGET1(D)
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		6	-	--		6	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Basic Knowledge of Programming concept					
<b>Objectives of the Course</b>		<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> <li>1. To introduce the various topics in Numerical methods.</li> <li>2. To make understand the fundamentals of algebraic equations.</li> <li>3. To apply interpolation and approximation on examples.</li> <li>4. To solve problems using numerical differentiation and integration.</li> <li>5. To solve linear systems, numerical solution of ordinary differential equations.</li> </ol>					
<b>Course Outline</b>		<p><b>Unit-I</b>  <b>FUNDAMENTALS OF ALGEBRAIC EQUATION:</b> 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 .  <b>Chapter - 3 : 3.1 – 3.4, Chapter - 4 : 4.1 – 4.2</b></p>					
		<p><b>Unit-II</b>  <b>ITERATIVE, INTERPOLATION AND APPROXIMATION:</b> 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.  <b>Chapter - 4 : 4.7– 4.9 Chapter - 13 : 13.1 – 13.2</b>  <b>Chapter - 8</b></p>					
		<p><b>Unit-III</b>  <b>INTERPOLATION WITH EQUAL INTERVAL:</b> Difference operators and relations. -Interpolation with equal intervals – Newton’s forward and backward difference formulae. <b>Chapter - 9 : 9.1 – 9.3</b></p>					

	<p><b>Unit-IV</b>  <b>NUMERICAL DIFFERENTIATION AND INTEGRATION:</b>  Approximation of derivatives using interpolation polynomials –  Numerical integration using Trapezoidal, Simpson’s 1/3 rule  <b>Chapter - 9: 9.9 &amp; 9.13</b></p> <p><b>Unit-V</b>  <b>INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS:</b> 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  <b>Chapter - 11 : 11.1 – 11.7,11.9, 11.11 – 11.12, 11.16 – 11.17</b></p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	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.
<b>Text Book(s)</b>	1. P. Kandasamy , K. Thilagavathy and K. Gunavathy – “Numerical Methods”, S.Chand& Company Ltd., Reprint 2019.
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, - “Numerical Methods”- 2022(Reprint) scitech publications(India) Pvt.Ltd.</li> <li>2. Balasubramaniam,Pand Venkatraman, M.K. (1972) Numerical Mathematics, Part I and II, Rochouse and Sons, New Delhi.</li> <li>3. Saxena, H.C. (1972) Finite differences, S. Chand &amp; Co, New Delhi.</li> <li>4. Rajaraman, V.(1993) Computer Oriented Numerical Methods, PHI learning, New Delhi.</li> <li>5. Sastry, S. S. (1993) Introductory Methods of Numerical Analysis, PHI learning, New Delhi.</li> <li>6. Hutchison, I. H. (2015)A student guide to Numerical Methods, Cambridge University Press, Cambridge.</li> </ol>
<b>Websites and e-Learning resources</b>	e-books, tutorials on MOOC/SWAYAM courses on the subject 1. <a href="https://onlinecourses.swayam2.ac.in/cec22_cs20/preview">https://onlinecourses.swayam2.ac.in/cec22_cs20/preview</a>

**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 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 Test component of CIA**

**BLUE PRINT – CIA – I**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 1	Up to K 2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT – CIA - II**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 3	Up to K 2	1	K1	2 (K2&K2)	1(K3)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**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
<b>K1</b>	5	4	10	-	19	15.83	41.66%
<b>K2</b>	5	6	10	10	31	25.83	
<b>K3</b>	-	-	20	30	50	41.67	41.67%
<b>K4</b>	-	-	10	10	20	16.67	16.67%
<b>Total</b>	10	10	50	50	120	100	100%

## LESSON PLAN

UNIT	Description	Hours		Mode
I	Solution of algebraic and transcendental equations-Bisection method.	3	12	Problem solving
	Fixed point iteration method – Newton Raphson method –linear system of equations.	4		Lecture
	linear system of equations – Gauss elimination method – Gauss Jordan method.	5		Problem-solving
II	Iterative methods - Gauss Jacobi and Gauss-Seidel	4	12	Lecture
	Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices.	4		PPT
	Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation.	4		Lecture
III	Difference operators and relations.	3	12	Problem-solving
	Interpolation with equal intervals	4		Lecture
	Newton's forward and backward difference formulae.	5		Problem solving
IV	Approximation of derivatives using interpolation polynomials.	6	12	Lecture
	Numerical integration using Trapezoidal	3		Problem solving
	Numerical integration using Simpson's 1/3 rule	3		Lecture
V	Single step methods – Taylor's series method	4	12	Tutorial
	Euler's method – Modified Euler's method	4		Problem solving
	Runge Kutta method for solving( first, second , Third and 4th) order equations – Multi step methods	4		Problem solving
	Total	<b>60</b>		

**Course Designer:**

**Prof. N. Sriviveka Saratha**, Assistant Professor, Department of Mathematics.

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23U1DS ED1	Introduction to Html	Skill Enha. Course (SEC-1)	2	-	-		2	25	75	100
<b>Learning Objectives</b>										
LO1	Insert a graphic within a web page.									
LO2	Create a link within a web page.									
LO3	Create a table within a web page.									
LO4	Insert heading levels within a web page.									
LO5	Insert ordered and unordered lists within a web page. Create a web page.									
UNIT	Contents									No. Of. Hours
I	Introduction :WebBasics: What is Internet–Web browsers–What is Webpage – HTML Basics: Understanding tags.									6
II	TagsforDocumentstructure(HTML,Head,BodyTag).Blockleveltextelements:Headingsparagraph(<p> tag)– Fontstyleelements:(bold,italic,font,small,strong,strike,bigtags)									6
III	Lists: Types of lists: Ordered, Unordered– Nesting Lists–Other tags: Marquee, HR, BR- Using Images –Creating Hyper links.									6
IV	Tables:CreatingbasicTable,Tableelements,Caption–Tableandcellalignment– Rowspan,Colspan–Cellpadding.									6
V	Frames: Frameset–Targeted Links–No frame–Forms: Input, Text area, Select, Option.									6
<b>TOTAL HOURS</b>										<b>30</b>

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Concept of adding images, Understand the table creation.	PO1, PO2, PO3, PO4, PO5, PO6

### Textbooks

1. “Mastering HTML5 and CSS3 Made Easy”, TeachUComp Inc., 2014.
2. Thomas Michaud, “Foundations of Web Design: Introduction to HTML & CSS”

### Web Resources

1. <https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf>
2. <https://www.w3schools.com/html/default.asp>

**Mapping with Programme Outcomes:**

<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO 1</b>	3	3	3	3	3	3
<b>CO 2</b>	3	3	2	3	3	3
<b>CO 3</b>	2	3	3	3	3	3
<b>CO 4</b>	3	3	3	3	3	3
<b>CO 5</b>	3	3	3	2	3	3
<b>Weightage of course contributed to each PSO</b>	14	15	14	14	15	15

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

**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).

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>		
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>
<b>CLO1</b>	3	-	1	1	2	1	2	3	1
<b>CLO2</b>	3	1	1	1	-	1	2	3	1
<b>CLO3</b>	3	-	1	1	-	1	2	3	1
<b>CLO4</b>	3	2	1	1	1	1	2	3	1
<b>CLO5</b>	2	2	1	1	-	1	2	3	1

**Assessment Schema  
Components of CIA**

Component	Weight / Mark
Assignment	5
Quiz	5

**BLUE PRINT – CIA – I**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 1	Up to K 2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT – CIA - II**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 3	Up to K 2	1	K1	2 (K2&K2)	1(K3)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT - 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)	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(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	K1	2(K4 & K4)	1(K3)	
5	CLO 5	Up to K3	2	K1&K2	1	K2	2(K3 & K3)	1(K3)	
No. of Questions to be asked			10		5		10	5	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	6	10	-	21	17.5	50
K2	5	4	10	20	39	32.5	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	-	10	8.33	8
Total marks	10	10	50	50	120	100	100

**Lesson Plan :**

S.NO.	UNIT	DESCRIPTION	TAKING HOURS	PEDAGOGY
1.	I	Introduction :Web Basics: What is Internet–Web browsers–What is Webpage –HTML Basics: Understanding tags.	6	Chalk and Talk, problem solving, Tutorials
2.	II	TagsforDocumentstructure(HTML,Head,BodyTag).Blockleveltextelements:Headingsparagraph(<p> tag)–Fontstyleelements:(bold,italic,font,small,strong,strike,bigtags)	6	Chalk and Talk, Problem Solving
3.	III	Lists: Types of lists: Ordered, Unordered– Nesting Lists–Other tags: Marquee, HR, BR- Using Images – Creating Hyperlinks.	6	Chalk and Talk, Quiz
4.	IV	Tables:CreatingbasicTable,Tableelements,Caption–Tableandcellalignment–Rowspan,Colspan–Cellpadding.	6	Chalk and Talk, quiz, group discussion
5.	V	Frames: Frameset–Targeted Links–No frame–Forms: Input, Text area, Select, Option.	6	Chalk and Talk, Quiz
		Total	30	

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23U1DFCT1	Problem Solving Techniques	FC	2	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
LO1	Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving.										
LO2	Implement different programming constructs and decomposition of problems into functions.										
LO3	Use data flow diagram, Pseudo code to implement solutions.										
LO4	Define and use of arrays with simple applications										
LO5	Understand about operating system and their uses										
UNIT	Contents								No. Of. Hours		
I	<b>Introduction:</b> History, characteristics and limitations of Computer. Hardware/Anatomy of Computer: CPU, Memory, Secondary storage devices, Input Devices and Output devices. Types of Computers: PC, Workstation, Minicomputer, Main frame and Supercomputer. Software: System software and Application software. <b>Programming Languages:</b> Machine language, Assembly language, High-level language, 4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers.								<b>6</b>		
II	<b>Data:</b> Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC). <b>Structured Programming: Algorithm:</b> Features of good algorithm, Benefits and drawbacks of algorithm. <b>Flowcharts:</b> Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts. <b>Pseudocode:</b> Writing a pseudocode. Coding, documenting and testing a program: Comment lines and types of errors. <b>Program design:</b> Modular Programming.								<b>6</b>		
III	<b>Selection Structures:</b> Relational and Logical Operators - Selecting from Several Alternatives – Applications of Selection Structures. <b>Repetition Structures:</b> Counter Controlled Loops –Nested Loops– Applications of Repetition Structures.								<b>6</b>		

IV	<b>Data:</b> Numeric Data and Character Based Data. <b>Arrays:</b> One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters.	<b>6</b>
V	<b>Data Flow Diagrams:</b> Definition, DFD symbols and types of DFDs. <b>Program Modules:</b> Subprograms-Value and Reference parameters- Scope of a variable - Functions – Recursion. <b>Files:</b> File Basics-Creating and reading a sequential file- Modifying Sequential Files.	<b>6</b>
<b>TOTAL HOURS</b>		<b>30</b>

<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
CO1	Study the basic knowledge of Computers. Analyze the programming languages.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Study the data types and arithmetic operations. Know about the algorithms. Develop program using flow chart and pseudocode.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Determine the various operators. Explain about the structures. Illustrate the concept of Loops	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Study about Numeric data and character-based data. Analyze about Arrays.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Explain about DFD Illustrate program modules. Creating and reading Files	PO1, PO2, PO3, PO4, PO5, PO6

### Textbooks

1. Stewart Venit, “Introduction to Programming: Concepts and Design”, Fourth Edition, 2010, Dream Tech Publishers.

### Web Resources

1. <https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm>
2. <http://www.nptel.iitm.ac.in/video.php?subjectId=106102067>
3. [http://utubersity.com/?page\\_id=876](http://utubersity.com/?page_id=876)

**Mapping with Programme Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	2	3	3	3	3
CO 4	3	3	2	3	3	3
CO 5	3	3	3	3	3	2
<b>Weightage of course contributed to each PSO</b>	15	14	14	15	15	14

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

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

**Assessment Schema**

**Components of CIA**

Component	Weight / Mark
Assignment	5
Quiz	5

**BLUE PRINT – CIA – I**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 1	Up to K 2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT – CIA - II**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 3	Up to K 2	1	K1	2 (K2&K2)	1(K3)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT - 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)	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(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	K1	2(K4&K4)	1(K3)	
5	CLO 5	Up to K3	2	K1&K2	1	K2	2(K3 & K3)	1(K3)	
No. of Questions to be asked			10		5		10	5	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	6	10	-	21	17.5	50
K2	5	4	10	20	39	32.5	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	-	10	8.33	8
Total marks	10	10	50	50	120	100	100

**Lesson Plan :**

S.NO.	UNIT	DESCRIPTION	TAKING HOURS	PEDAGOGY
1.	I	<b>Introduction:</b> History, characteristics and limitations of Computer. Hardware/Anatomy of Computer: CPU, Memory, Secondary storage devices, Input Devices and Output devices. Types of Computers: PC, Workstation, Minicomputer, Main frame and Supercomputer. Software: System software and Application software. <b>Programming Languages:</b> Machine language, Assembly language, High-level language, 4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers.	6	Chalk and Talk, problem solving, Tutorials
2.	II	<b>Data:</b> Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC). <b>Structured Programming: Algorithm:</b> Features of good algorithm, Benefits and drawbacks of algorithm. <b>Flowcharts:</b> Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts. <b>Pseudocode:</b> Writing a pseudocode. Coding, documenting and testing a program: Comment lines and types of errors. <b>Program design:</b> Modular Programming.	6	Chalk and Talk, Problem Solving
3.	III	<b>Selection Structures:</b> Relational and Logical Operators -Selecting from Several Alternatives – Applications of Selection Structures. <b>Repetition Structures:</b> Counter Controlled Loops –Nested Loops– Applications of Repetition Structures.	6	Chalk and Talk, Quiz
4.	IV	<b>Data:</b> Numeric Data and Character Based Data. <b>Arrays:</b> One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters.	6	Chalk and Talk, quiz, group discussion
5.	V	<b>Data Flow Diagrams:</b> Definition, DFD symbols and types of DFDs. <b>Program Modules:</b> Subprograms-Value and Reference parameters-Scope of a variable - Functions – Recursion. <b>Files:</b> File Basics-Creating and reading a sequential file- Modifying Sequential Files.	6	Chalk and Talk, Quiz
		Total	30	

**FIRST YEAR – SECOND SEMESTER**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
<b>23U2DCCT2</b>	<b>DATA STRUCTURE AND ALGORITHMS</b>	Core	5	-	-	-	5	5	25	75	100
<b>Learning Objectives</b>											
LO1	To understand the concepts of ADTs										
LO2	To learn linear data structures-lists, stacks, queues										
LO3	To learn Tree structures and application of trees										
LO4	To learn graph structures and application of graphs										
LO5	To understand various sorting and searching										
<b>UNIT</b>	<b>Contents</b>								<b>No. of Hours</b>		
I	Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementation singly linked lists-circular linked lists-doubly-linked lists-applications of lists-Polynomial Manipulation- All operations-Insertion-Deletion-Merge-Traversal								15		
II	Stack ADT-Operations- Applications- Evaluating arithmetic expressions – Conversion of infix to postfix expression-Queue ADT-Operations-Circular Queue- Priority Queue- deQueue applications of queues.								15		
III	Tree ADT-tree traversals-Binary Tree ADT-expression trees-applications of trees-binary search tree ADT- Threaded Binary Trees-AVL Trees- B-Tree- B+ Tree – Heap-Applications of heap.								15		
IV	Definition- Representation of Graph- Types of graph-Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex- Euler circuits-Applications of graphs.								15		
V	Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-Insertion sort-Shell sort-Radix sort-Hashing-Hash functions-Separate chaining- Open Addressing-Rehashing Extendible Hashing								15		
<b>Total</b>									<b>75</b>		

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO6
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO2
CO3	Describe the hash function and concepts of collision and its resolution methods	PO2,PO4
CO4	Solve problem involving graphs, trees and heaps	PO4,PO6
CO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO5,PO6

### Text Book

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education 2014, 4th Edition.
2. Reema Thareja, “Data Structures Using C”, Oxford Universities Press 2014, 2nd Edition

### Reference Books

1. Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, “Introduction to Algorithms”, McGraw Hill 2009, 3rd Edition.
2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education 2003

### Web Resources

1. <https://www.programiz.com/dsa>
2. <https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/>

### Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	3	3
CO 3	3	3	3	2	3	2
CO 4	3	2	3	2	3	3
CO 5	3	3	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	15	14	13	13	15	14

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

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

### BLUE PRINT – CIA – I

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 1	Up to K 2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

### BLUE PRINT – CIA - II

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 3	Up to K 2	1	K1	2 (K2&K2)	1(K3)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**Components of Assessment shall be**

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

**SUMMATIVE ASSESSMENT - BLUE PRINT**

<b>S. No.</b>	<b>CLOs</b>	<b>K – Level</b>	<b>Section A</b>		<b>Section B</b>		<b>Section C (Either/or Choice)</b>	<b>Section D (Open Choice)</b>
			<b>MCQs</b>		<b>Short Answers</b>			
			<b>No. of questions</b>	<b>K – Level</b>	<b>No. of questions</b>	<b>K - Level</b>		
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**

<b>K Levels</b>	<b>Section A (No choice)</b>	<b>Section B (No choice)</b>	<b>Section C (Either/ or)</b>	<b>Section D (Open choice)</b>	<b>Total marks</b>	<b>% of marks without choice</b>	<b>Consolidated</b>
K1	5	4	-	-	09	7.50	
K2	5	6	20	10	41	34.16	41.67%
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:**

<b>Unit</b>	<b>Topics</b>	<b>Hours</b>	<b>Total</b>	<b>Mode</b>
<b>I</b>	Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementation	5	<b>15</b>	PPT, Chalk and Talk.
	singly linked lists-circular linked lists-doubly-linked lists-applications of lists-	5		
	Polynomial Manipulation- All operations-Insertion-Deletion-Merge-Traversal	5		
<b>II</b>	Stack ADT-Operations- Applications- Evaluating arithmetic expressions –	5	15	PPT, Chalk and Talk, Assignments and GD
	Conversion of infix to postfix expression-Queue ADT-Operations-	5		
	Circular Queue- Priority Queue- deQueue applications of queues.	5		
<b>III</b>	Tree ADT-tree traversals-Binary Tree ADT-expression trees-	5	<b>15</b>	PPT, Chalk and Talk, Assignments
	applications of trees-binary search tree ADT-Threaded Binary Trees-	5		
	AVL Trees- B-Tree- B+ Tree – Heap-Applications of heap.	5		
<b>IV</b>	Definition- Representation of Graph- Types of graph-Breadth first traversal —	5	<b>15</b>	PPT, Chalk and Talk, Assignments
	Depth first traversal-Topological sort- Bi-connectivity	5		
	Cut vertex- Euler circuits-Applications of graphs.	5		
<b>V</b>	Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-	5	<b>15</b>	Assignments, Seminar and GD
	Insertion sort-Shell sort-Radix sort-Hashing-Hash functions-Separate chaining-	5		
	Open Addressing-Rehashing Extendible Hashing	5		

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
<b>23U2DCCP2</b>	<b>DATA STRUCTURE AND ALGORITHMS LAB</b> [Note: Practicals may be offered through C / C++ / Python]	Core Practical	-	-	3	-	3	-	25	75	100
<b>Learning Objectives</b>											
LO1	To understand the concepts of ADTs										
LO2	To learn linear data structures-lists, stacks, queues										
LO3	To learn Tree structures and application of trees										
LO4	To learn graph structures and application of graphs										
LO5	To understand various sorting and searching										
Sl. No	Contents										No. of Hours
1.	Write a program to implement the List ADT using arrays and linked lists.										<b>60</b>
2.	Write a programs to implement the following using a singly linked list. <ul style="list-style-type: none"> <li>• Stack ADT</li> <li>• Queue ADT</li> </ul>										
3.	Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression (use stack ADT).										
4.	Write a program to implement priority queue ADT.										
5.	Write a program to perform the following operations: <ul style="list-style-type: none"> <li>• Insert an element into a binary search tree.</li> <li>• Delete an element from a binary search tree.</li> <li>• Search for a key element in a binary search tree.</li> </ul>										
6.	Write a program to perform the following operations <ul style="list-style-type: none"> <li>• Insertion into an AVL-tree</li> <li>• Deletion from an AVL-tree</li> </ul>										
7.	Write a programs for the implementation of BFS and DFS for a given graph.										
8	Write a programs for implementing the following searching methods: <ul style="list-style-type: none"> <li>• Linear search</li> <li>• Binary search.</li> </ul>										

9.	Write a programs for implementing the following sorting methods: <ul style="list-style-type: none"> <li>• Bubble sort</li> <li>• Selection sort</li> <li>• Insertion sort</li> <li>• Radix sort.</li> </ul>	
<b>Total</b>		<b>60</b>

Course Outcomes		Programmem Outcome
CO	On completion of this course, students will	
1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO4,PO5
2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO1, PO4,PO6
3	Describe the hash function and concepts of collision and its resolution methods	PO1,PO3,PO6
4	Solve problem involving graphs, trees and heaps	PO3,PO4
5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO1,PO5,PO6

### Text Book

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education 2014, 4th Edition.
2. ReemaThareja, “Data Structures Using C”, Oxford Universities Press 2014, 2nd Edition

### Reference Books

1. Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, “Introduction to Algorithms”, McGraw Hill 2009, 3rd Edition
2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education 2003

### Web Resources

1. <https://www.programiz.com/dsa>
2. <https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/>

### Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	3
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	15	15	13	15	13	15

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

<b>Title of the Course</b>		<b>Graph Theory and its Applications</b>					
<b>TANSICHE Course type</b>		<b>EC2</b>					
<b>Course Category</b>		<b>Core II</b>					
<b>Nature of Course</b>		<b>Employability / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	5	<b>Course Code</b>	<b>23U2MGET2(D)</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>
		6			-		6
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic knowledge in data and representations					
<b>Objectives of the Course</b>		<ol style="list-style-type: none"> <li>1. To understand and apply the fundamental concepts in graph theory.</li> <li>2. To apply graph theory based tools in solving practical problems.</li> <li>3. Analysing the Various Concepts of Representation of Graphs,</li> </ol>					
<b>Course Outline</b>		<b>UNIT-I : INTRODUCTION:</b> 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.					
		<b>Unit-II : CONNECTIVITY AND PLANARITY:</b> 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.					
		<b>Unit-III : COLORING AND DIRECTED GRAPH:</b> 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.					
		<b>Unit-IV : MATRIX REPRESENTATION IN GRAPH:</b> Matrix representation of graphs, Sub graphs& Quotient Graphs, Transitive Closure digraph, Euler's Path & Circuit (only definitions and examples), spanning Trees of Connected Relations, Prim's Algorithm to construct Spanning Trees, Weighted Graphs, Minimal, Spanning Trees by Prim's Algorithm & Kruskal's Algorithm.					
		<b>Unit-V: APPLICATIONS OF GRAPH:</b> Traveling Sales Person Problem with Directed and Un directed Graph, - Graph with n vertices and k colours- Shortest path from one to many Cities with directed graph- Shortest Paths with Un directed Graphs-Connected Components.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	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.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Narsingh Deo , “ Graph Theory with Application to Engineering and Computer Science” Prentice Hall of India 2010(Reprint )</li> <li>2. Rosen H “Discrete Mathematics and Its Application “ Mc Graw Hill , 2007</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Discrete Maths for Computer Scientists &amp; Mathematicians by Mott, Kandel, Baker.</li> <li>2. Clark J and Holton DA “ First look at Graph Theory” Allied Publishers 1995.</li> <li>3. Discrete Maths for Computer Scientists &amp; Mathematicians by Mott, Kandel, Baker.</li> </ol>
<b>Websites and e-Learning resources</b>	<p>Web resources from NDL Library, E-content from open source libraries</p> <ol style="list-style-type: none"> <li>1. <a href="https://d3gt.com/">https://d3gt.com/</a></li> <li>2. <a href="https://www.coursera.org/courses?query=graph%20theory">https://www.coursera.org/courses?query=graph%20theory</a></li> </ol>

**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.	Up to K3
CO2	Understanding the concepts of Circuits, Cut set and its Properties, Network Flows, Isomorphism and Combinatorial and Planar Graphs.	Up to K2
CO3	Applying the concept of Colouring with Chromatic Number, Directed Graphs, Matching, Covering Pattern and Euler Graphs.	Up to K3
CO4	Analysing the Various Concepts of Representation of Graphs, Euler Paths Circuit, Kruskals and Prims Algorithms, Connected Components.	Up to 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.	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	2	3	3	3	2	2	2	3	2	2
CLO2	3	2	3	3	3	2	2	2	3	2	1
CLO3	3	2	3	3	3	2	2	2	3	2	3
CLO4	3	2	3	3	3	2	2	2	3	2	2
CLO5	3	2	3	3	3	2	2	2	3	3	1

**BLUE PRINT – CIA – I**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 1	Up to K 2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT – CIA - II**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 3	Up to K 2	1	K1	2 (K2&K2)	1(K3)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**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	<b>INTRODUCTION:</b> Graph-mathematical definition- Introduction – sub graphs –Walks, paths, Circuits.	2	PPT, Chalk and Talk.
	Connectedness - Components- Euler Graphs- Hamiltonian paths and circuits	4	
	Trees- properties of Trees- Distance and centers in Tree- Rooted and Binary Trees.	6	
II	<b>CONNECTIVITY AND PLANARITY:</b> Introduction to circuits - cut set-properties of cut set.	4	PPT, Chalk and Talk, Assignments and GD
	All cut sets –connectivity and separability – Network Flows - 1- Isomorphism - 2-Isomorphism	4	
	Combinatorial and Geometric graphs- Planar Graphs – Different representation of planar graph.	4	
III	<b>COLORING AND DIRECTED GRAPH:</b> Basics of Colouring &Chromatic number – Chromatic partitioning.	5	PPT, Chalk and Talk, Assignments
	Graph Colouring – four colour Problem Chromatic polynomial - Matching – Covering.	3	
	Directed graphs - Types of Directed Graphs.	6	
	Diagraphs and binary relations – Directed paths- Euler Graph.	6	
IV	<b>MATRIX REPRESENTATION IN GRAPH:</b> 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,	5	
	Prim’s Algorithm to construct Spanning Trees, Weighted Graphs, Minimal, Spanning Trees by Prim’s Algorithm & Kruskal’s Algorithm.	5	
V	<b>APPLICATIONS OF GRAPH:</b> Traveling Sales Person Problem with Directed and Un directed Graph.	4	Assignments ,Seminar and GD
	Graph with n vertices and k colours.	4	
	Shortest path from one to many Cities with directed graph -Shortest Paths with Un directed Graphs-Connected Components.	7	

**Course Designer:** Dr.S.VALLIRANI, Assistant Professor, Department of Statistics, The Madura College.

Subject Code	Subject Name	Category	L	T	P	S	Inst. hours	Credits	Marks		
									CIA	External	Total
23U2DSED 2	Fundamentals of Information Technology	Skill Enha. Course (SEC-2)	2	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
<b>LO1</b>	Understand basic concepts and terminology of information technology.										
<b>LO2</b>	Have a basic understanding of personal computers and their operation										
<b>LO3</b>	Be able to identify data storage and its usage										
<b>LO4</b>	Get great knowledge of software and its functionalities										
<b>LO5</b>	Understand about operating system and their uses										
UNIT	Contents										No. of Hours
I	<b>Introduction to Computers:</b> Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer										6
II	<b>Basic Computer Organization:</b> Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.										6
III	<b>Storage Fundamentals:</b> Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives										6
IV	<b>Software:</b> Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w										6

V	<b>Operating System:</b> Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	6
<b>TOTAL HOURS</b>		<b>30</b>

	Course Outcomes	Programme Outcomes
CO	On completion of this course, students will	
CO1	Learn the basics of computer, Construct the structure of the required things in the computer, learn how to use it.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop organizational structure using for the devices present currently under input or output unit.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in storage basis.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with different software, Write program in the software and applications of software.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	PO1, PO2, PO3, PO4, PO5, PO6

### Textbooks

1. Anoop Mathew, S. Kavitha Murugesan (2009), “ Fundamental of Information Technology”, Majestic Books.
2. Alexis Leon, Mathews Leon,” Fundamental of Information Technology”, 2nd Edition.
3. S. K Bansal, “Fundamental of Information Technology”.

### Reference Books

1. Bhardwaj Sushil Puneet Kumar, “Fundamental of Information Technology”
2. GG WILKINSON, “Fundamentals of Information Technology”, Wiley-Blackwell
3. A Ravichandran , “Fundamentals of Information Technology”, Khanna Book Publishing

### Web Resources

1. <https://testbook.com/learn/computer-fundamentals>
2. <https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html>
3. <https://www.javatpoint.com/computer-fundamentals-tutorial>
4. [https://www.tutorialspoint.com/computer\\_fundamentals/index.htm](https://www.tutorialspoint.com/computer_fundamentals/index.htm)
5. <https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf>

### Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
<b>Weightage of course contributed to each PSO</b>	15	15	14	15	14	14

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

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

### Assessment Schema

#### Components of CIA

Component	Weight / Mark
Assignment	5
Quiz	5

**BLUE PRINT – CIA – I**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 1	Up to K 2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT – CIA - II**

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 3	Up to K 2	1	K1	2 (K2&K2)	1(K3)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT - 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)	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(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	K1	2( K4& K4)	1(K3)	
5	CLO 5	Up to K3	2	K1&K2	1	K2	2( K3 & K3)	1(K3)	
No. of Questions to be asked			10		5		10	5	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	6	10	-	21	17.5	50
K2	5	4	10	20	39	32.5	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	-	10	8.33	8
Total marks	10	10	50	50	120	100	100

**Lesson Plan :**

S.NO.	UNIT	DESCRIPTION	TAKING	TOTAL	PEDAGOGY
		<b>Introduction to Computers:</b>	2	6	Chalk and Talk,
		Evolution of Computer, Block Diagram Of	2		
		Generations of Computer, Classification Of	2		
2.	II	<b>Basic Computer Organization:</b>	2	6	Chalk and Talk,
		Pointing Devices, Scanners and its types,	2		
		Printers: Impact Printers and its types. Non	2		
3.	III	<b>Storage Fundamentals:</b>	3	6	Chalk and
		Secondary Storage: Magnetic Tapes,	3		
4.	IV	<b>Software:</b>	2	6	Chalk and Talk,
		Programming Language: Machine	2		
		Application S/W and its types: Word	2		
5.	V	<b>Operating System:</b>	2	6	Chalk and Talk,
		Compilers and Interpreters.Batch	2		
		Multiprogramming, Multi Tasking,	2		
		Total		30	

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
<b>23U2DS ED3</b>	<b>OFFICE AUTOMATION</b>	Skill Enhancement Course (SEC-3)	2	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
LO1	Understand the basics of computer systems and its components.										
LO2	Understand and apply the basic concepts of a word processing package.										
LO3	Understand and apply the basic concepts of electronic spreadsheet software.										
LO4	Understand and apply the basic concepts of database management system.										
LO5	Understand and create a presentation using PowerPoint tool.										
<b>UNIT</b>	<b>Contents</b>										<b>No. of Hours</b>
I	Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner.Output devices:Monitor,Printer.Introduction to Operating systems & its features:DOS– UNIX–Windows. Introduction to Programming Languages.										6
II	<b>Word Processing:</b> Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing–Preview, options, merge.										6
III	<b>Spreadsheets:</b> Excel– opening, entering text and data, formatting, navigating; Formulas– entering, handling and copying; Charts–creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.										6
IV	<b>Database Concepts:</b> The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applications in query language(MS–Access).										6
V	<b>Power point:</b> Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition–Animation effects, audio inclusion, timers.										6
<b>Total</b>										<b>30</b>	

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Possess the knowledge on the basics of computers and its components	PO1,PO2,PO3,PO6,PO8
CO2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
CO3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
CO4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
CO5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7,PO8

### Text Book

1. Peter Norton, "Introduction to Computers" –Tata Mc Graw - Hill.

### Reference Books

1. Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata Mc Graw Hill.

### Web Resources

1. <https://www.udemy.com/course/office-automation-certificate-course/>
2. <https://www.javatpoint.com/automation-tools>

### Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	14	14	15	15	15

S-Strong-3    M-Medium-2    L-Low-1

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

### Assessment Schema

#### Components of CIA

Component	Weight / Mark
Assignment	5
Quiz	5

### BLUE PRINT – CIA – I

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 1	Up to K 2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

### BLUE PRINT – CIA - II

S.No	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1.	CLO 3	Up to K 2	1	K1	2 (K2&K2)	1(K3)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2	---	4	2
No. of Questions to be answered			2	---	2	1
Marks for each Question			2.5	---	5	10
Total Marks for each Section			5	---	10	10

**BLUE PRINT - 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)	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(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	K1	2( K4& K4)	1(K3)	
5	CLO 5	Up to K3	2	K1&K2	1	K2	2( K3 & K3)	1(K3)	
No. of Questions to be asked			10		5		10	5	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	6	10	-	21	17.5	50
K2	5	4	10	20	39	32.5	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	-	10	8.33	8
Total marks	10	10	50	50	120	100	100

### Lesson Plan :

S. NO.	UNIT	DESCRIPTION	TAKING HOURS	TOTAL	PEDAGOGY
1.	I	Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner	2	6	Chalk and Talk, problem solving, Tutorials
		Output devices: Monitor, Printer. Introduction to Operating systems & its features:	2		
		DOS– UNIX–Windows. Introduction to Programming Languages.	2		
2.	II	<b>Word Processing:</b> Open, Save, and close word document; Editing text – tools, formatting, bullets;	2	6	Chalk and Talk, Problem Solving
		Spell Checker - Document formatting – Paragraph alignment, indentation,	2		
		headers and footers, numbering; printing–Preview, options, merge.	2		
3.	III	<b>Spreadsheets:</b> Excel– opening, entering text and data, formatting, navigating; Formulas– entering, handling and copying;	3	6	Chalk and Talk, Quiz
		Charts–creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.	3		
4.	IV	<b>Database Concepts:</b> The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records.	2	6	Chalk and Talk, quiz, group discussion
		Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS;	2		
		Developing menu drive applications in query language (MS–Access).	2		
5.	V	<b>Power point:</b> Introduction to Power point- Features – Understanding slide typecasting & viewing slides –	2	6	Chalk and Talk, Quiz
		creating slide shows. Applying special object – including objects & pictures – Slide transition–	2		
		Animation effects audio inclusion, timers.	2		
		Total		30	



## **THE MADURA COLLEGE (AUTONOMOUS)**

# **DEPARTMENT OF INFORMATION TECHNOLOGY**

**Revised Curriculum based on  
TAMIL NADU STATE COUNCIL FOR HIGHER EDUCATION (TANSICHE)  
(Choice Based Credit system with Outcome Based Education)**

**Academic Year 2023-2024 onwards**

**I and II semesters (B.Sc. Information Technology)  
Allied Courses  
I and II semesters of (M.Sc. Computer Science)**

## VISION

To serve the society by producing the disciplined, skilled intellectual and ethical IT professionals with potential to face the changes and challenges of the modern computing industry.

## MISSION

- To provide the strong academic foundation in theories and practical of Information Technology.
- To enhance the students knowledge in the latest technologies by organizing and participating intechanical programs.
- To encourage the students to deliver their innovative designs and become the successful ITprofessionals.

## 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 OUTCOMES (Defined By TANSICHE)

- 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-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

## PROGRAMME SPECIFIC OUTCOMES

### Aligned with Graduate Attributes

	Programme Specific Outcome	Graduate Attributes
PSO1	Think in a critical and logical based manner.	Disciplinary Knowledge
PSO2	Understand, formulate, develop programming model with logical approaches to address issues arising in social science, business and other contexts.	Critical Thinking
PSO3	Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer science and Industrial statistics.	Problem Solving & Scientific Reasoning
PSO4	Develop a range of generic skills helpful in employment, internships & societal activities.	Analytical Reasoning
PSO5	Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of computing sciences.	Self-directed & Lifelong Learning

### Qualification for Admission

A candidate must have passed their 10+2 in Science stream with Physics, Mathematics, Chemistry, and Computer Science/Biology as their core subjects, conducted by the State Board of School Examinations, Government of Tamil Nadu, CBSC & ICSE or any other examination approved by Madurai Kamaraj University as equivalent.

### Duration of the Course

The students shall undergo prescribed course of study for the period of three academic years under CBCS semester pattern with outcome based education.

**Medium of Instruction:** English.

**System:** Choice Based Credit System with Outcome Based Model.

### Evaluation (Theory)

Internal (Formative)	: 25 marks
External (Summative)	: 75 marks
Total	: 100 marks

**Continuous Internal Assessment: 25 Marks**

<b>THEORY</b>		
<b>Internal (Formative)</b>	<b>25 marks</b>	
	<b>Components of Internal Assessment</b>	<b>Marks</b>
	Test	10
	Assignment	5
	Quiz	5
Attendance/Seminar	5	
<b>External (Summative)</b>	<b>75marks</b>	

**Question paper pattern for test component of Internal Assessment (Duration 1 hour)**

<b>Pattern</b>	<b>No. of questions</b>	<b>Marks per question</b>	<b>Total marks</b>
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 - open choice – one question to be answered out of 2 question asked)	1/2	10	10
<b>Total marks</b>			<b>25</b>

**Blueprint for test component of CIA**

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

\*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.

**Question Paper Pattern for External Examination: 75 Marks**

<b>Section</b>	<b>Marks</b>
A- Multiple Choice Questions (10 X 1 mark)	10
B- Short answer type (5 X 2 marks)	10
B- Either/Or type (5 X 5 marks)	25
C- Open Choice type (3out of 5 X 10 marks)	30
<b>Total</b>	<b>75</b>

**EVALUATION (PRACTICAL)**

Internal (Formative) : 25 marks

External (Summative) : 75 marks

Total : 100 marks

**The Madura College (Autonomous), Madurai-625011  
(Self-Financed Stream)**

**Department of Information Technology  
Curriculum Structure for B.Sc. Information Technology**

Part	Course Description	Course Type	Course Title	Contact hours/ week	Credits
<b>SEMESTER I</b>					
I	Lang-I	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	Tamil-I/Sanskrit-I/Hindi-I	6	3
II	English –I	23U1NENG1	English –I	6	3
III	Core Course 1	23U1FCCT1	Programming in C	5	5
	Core Course (Practical 1)	23U1FCCP1	C Programming Lab	3	3
	Elective Course 1	23U1FGET1	Object Oriented Programming Using C++	4	4
	Elective Course 1 (Practical)	23U1FGEP1	C++ Programming Lab	2	1
IV	Foundation Course	23U1FFCT1	Fundamentals of Computers	2	2
	SEC Major	23U1FSED1	Office Automation	2	2
<b>Total</b>				<b>30</b>	<b>23</b>
<b>SEMESTER II</b>					
I	Lang-II	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	Tamil-II/Sanskrit-II/Hindi-II	6	3
II	English-II	23U2NENG2	English-II	6	3
III	Core Course 2	23U2FCCT2	JAVA Programming	5	5
	Core Course (Practical 2)	23U2FCCP2	JAVA Programming Lab	3	3
	Elective Course 2	23U2FGET2	Web Designing	4	4
	Elective Course 2 (Practical)	23U2FGEP2	Web Designing Lab	2	1
IV	SEC Major	23U2FSED2	Problem Solving Techniques	2	2
	SEC / NME	23U2FSED3	Fundamentals of Information Technology	2	2
<b>Total</b>				<b>30</b>	<b>23</b>

<b>Title of the Course</b>		<b>Programming in C</b>					
<b>TANSCHÉ Course type</b>		<b>CC1</b>					
<b>Course Category</b>		<b>Core Theory</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	<b>23U1FCCT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		1			5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Programming Skills.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To familiarize the students with the understanding of code organization.</li> <li>To improve the programming skills.</li> <li>Learning the basic programming constructs.</li> <li>To acquire knowledge on Structures and Union</li> <li>To know the concept of Files and Pointers.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Studying Concepts of Programming Languages-</b> Language Evaluation Criteria - Language design - Language Categories - Implementation Methods – Programming Environments - Overview of C: History of C- Importance of C- Basic Structure of C Programs- Executing a C Program- Constants, Variables and Data types - Operators and Expressions - Managing Input and Output Operations					
		<b>Unit II: Decision Making and Branching:</b> Decision Making and Looping - Arrays - Character Arrays and Strings					
		<b>Unit III: User Defined Functions:</b> Elements of User Defined Functions- Definition of Functions- Return Values and their Types- Function Call- Function Declaration- Categories of Functions- Nesting of Functions-Recursion					
		<b>Unit IV: Structures and Unions:</b> Introduction- Defining a Structure- Declaring Structure Variables Accessing Structure Members- Structure Initialization- Arrays of Structures- Arrays within Structures- Unions- Size of Structures.					
		<b>Unit V: Pointers:</b> Understanding Pointers- Accessing the Address of a Variable- Declaring Pointer Variables- Initializing of Pointer Variables- Accessing a Variable through its Pointer- Chain of Pointers- Pointer Expressions- Pointer and Scale Factor- Pointer and Arrays- Pointers and Character Strings- Array of Pointers- Pointer as Function Arguments- Functions Returning Pointers- Pointers to Functions- <b>File Management in C</b>					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					

<b>Skills acquired from this course</b>	Able to write programs to solve simpler and complex problems by implementing C programming concepts
<b>Justification for nature of course</b>	C is an imperative procedural language. It provides constructs that map efficiently to typical machine instructions
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Robert W. Sebesta, (2012), —Concepts of Programming Languages, Fourth Edition, Addison Wesley (Unit I : Chapter – 1)</li> <li>2. E. Balaguruswamy, (2010), —Programming in ANSI C, Fifth Edition, Tata McGraw Hill Publications</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ashok Kamthane, (2009), —Programming with ANSI &amp; Turbo C, Pearson Education.</li> <li>2. Byron Gottfried, (2010), —Programming with C, Schaums Outline Series, Tata McGraw Hill Publications.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.tutorialspoint.com/cprogramming/">http://www.tutorialspoint.com/cprogramming/</a></li> <li>2. <a href="http://www.cprogramming.com/">http://www.cprogramming.com/</a></li> <li>3. <a href="http://www.programmingsimplified.com/c-program-examples">http://www.programmingsimplified.com/c-program-examples</a></li> <li>4. <a href="http://www.programiz.com/c-programming">http://www.programiz.com/c-programming</a></li> <li>5. <a href="http://www.cs.cf.ac.uk/Dave/C/CE.html">http://www.cs.cf.ac.uk/Dave/C/CE.html</a></li> <li>6. <a href="http://fresh2refresh.com/c-programming/c-function/">http://fresh2refresh.com/c-programming/c-function/</a></li> </ol>

## COURSE OUTCOME

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

CO	COURSE OUTCOME	K-level
CO1	Outline the fundamental concepts of C programming languages, and its Features	Up to K2
CO2	Demonstrate the programming methodology.	Up to K4
CO3	Identify suitable programming constructs for problem solving.	Up to K3
CO4	Select the appropriate data representation, control structures, functions and concepts based on the problem requirement.	Up to K3
CO5	Evaluate the program performance by fixing the errors.	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	2	3	2	2	1	3	2	2	3	2
CLO2	3	2	3	1	2	1	3	3	2	3	2
CLO3	3	3	3	2	3	3	3	3	3	3	2
CLO4	3	3	3	3	3	1	3	3	2	3	2
CLO5	3	3	3	3	2	3	3	3	2	3	2

**Course Designer:** Prof. S. Brindha

**Blue Print for Summative Examination – Programming in C**  
**Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels \***

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

<b>Title of the Course</b>		<b>C Programming Lab</b>					
<b>TANSICHE Course type</b>		<b>CCP1</b>					
<b>Course Category</b>		<b>Core Practical1</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23U1FCCP1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
						3	3
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Programming Skill					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• The Course aims to provide exposure to problem-solving through C programming</li> <li>• It aims to train the student to the basic concepts of the C - Programming language</li> <li>• To implement the concept of Arrays and Functions</li> <li>• To Practice the usage of Structures and Union</li> <li>• To inculcate the concept of Files and Pointers</li> </ul>					
<b>Course Outline</b>		<ol style="list-style-type: none"> <li>1. Programs using Input/ Output functions</li> <li>2. Programs on conditional structures</li> <li>3. Command Line Arguments</li> <li>4. Programs using Arrays</li> <li>5. String Manipulations</li> <li>6. Programs using Functions</li> <li>7. Recursive Functions</li> <li>8. Programs using Pointers</li> <li>9. Files</li> <li>10. Programs using Structures &amp; Unions</li> </ol>					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					
<b>Skills acquired from this course</b>		Able to write programs to solve simpler and complex problems by implementing C programming concepts					
<b>Justification for nature of course</b>		C is an imperative procedural language. It provides constructs that map efficiently to typical machine instructions					
<b>Text Book(s)</b>		<ol style="list-style-type: none"> <li>1. Robert W. Sebesta, (2012), —Concepts of Programming Languages, Fourth Edition, Addison Wesley (Unit I : Chapter – 1)</li> <li>2. E. Balaguruswamy, (2010), —Programming in ANSI C, Fifth Edition, Tata McGraw Hill Publications</li> </ol>					

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ashok Kamthane, (2009), —Programming with ANSI &amp; Turbo C, Pearson Education.</li> <li>2. Byron Gottfried, (2010), —Programming with C, Schaums Outline Series, Tata McGraw Hill Publications.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.tutorialspoint.com/cprogramming/">http://www.tutorialspoint.com/cprogramming/</a></li> <li>2. <a href="http://www.cprogramming.com/">http://www.cprogramming.com/</a></li> <li>3. <a href="http://www.programmingsimplified.com/c-program-examples">http://www.programmingsimplified.com/c-program-examples</a></li> <li>4. <a href="http://www.programiz.com/c-programming">http://www.programiz.com/c-programming</a></li> <li>5. <a href="http://www.cs.cf.ac.uk/Dave/C/CE.html">http://www.cs.cf.ac.uk/Dave/C/CE.html</a></li> <li>6. <a href="http://fresh2refresh.com/c-programming/c-function/">http://fresh2refresh.com/c-programming/c-function/</a></li> </ol>

### COURSE OUTCOMES:

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

COs	COURSE OUTCOME	K-Level
CO1	Demonstrate the understanding of syntax and semantics of C Programs.	Up to K2
CO2	Identify the problem and solve using C programming techniques.	Up to K4
CO3	Identify suitable programming constructs for problem solving.	Up to K3
CO4	Analyze various concepts of C language to solve the problem in an efficient way.	Up to K3
CO5	Develop a C program for a given problem and test for its correctness.	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	2	3	2	2	1	3	2	2	3	2
CLO2	3	2	3	1	2	1	3	3	2	3	2
CLO3	3	3	3	2	3	3	3	3	3	3	2
CLO4	3	3	3	3	3	1	3	3	2	3	2
CLO5	3	3	3	3	2	3	3	3	2	3	3

Course Designer: Prof. N. RadhaKrishnan

<b>Title of the Course</b>		<b>Object Oriented Programming using C++</b>					
<b>TANSCHÉ Course type</b>		<b>EC1</b>					
<b>Course Category</b>		<b>Elective (Generic) Theory</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	<b>23U1FGET1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		-		-	4
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		<b>Basic Programming Skills</b>					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To inculcate knowledge on Object-oriented concepts and programming using C++.</li> <li>• Demonstrate the use of various OOPs concepts with the help of programs.</li> <li>• To learn how to implement types of Constructors and overloading.</li> <li>• To demonstrate types of inheritance and I/O operations.</li> <li>• To create &amp; process data in files and know about exception handling.</li> </ul>					
<b>Course Outline</b>		<b>Unit I:</b> OOP Paradigm – Concepts of OOP – Benefits of OOP - Object Oriented Languages – Applications of OOP – OOP Design: Using UML as a Design Tool Beginning with C++.					
		<b>Unit II:</b> Tokens, Expressions and Control Structures - Functions in ++: Function Prototyping – Call by Reference - Return by Reference – Inline Function – Default Arguments – Const Arguments – Recursion – Function Overloading – Classes and Objects.					
		<b>Unit III:</b> Constructors and Destructors: Constructors – Parameterized Constructors – Multiple Constructors – Constructor with default Arguments – Copy Constructors – Dynamic Constructor – Destructors – Operator Overloading and Type Conversions: Operator Overloading – Overloading Unary Operators – Overloading Binary operators – Rules for Operator Overloading – Type Conversions.					
		<b>Unit IV:</b> Inheritance: Introduction – Types of Inheritance – Virtual Base Classes – Abstract Classes – Pointers - Virtual Function – Polymorphism.					
		<b>Unit V:</b> Templates: Class Templates – Function Templates – Overloading of template Function – Exception Handling.					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					

<b>Skills acquired from this course</b>	Learn how to design and implement classes and objects. Helps to develop the problem solving and logical reasoning skills.
<b>Justification for nature of course</b>	Supports different ways of programming like procedural, object oriented functional and so on.
<b>Text Book(s)</b>	E. Balaguruswamy, (2013), “Object Oriented Programming using C++”, 6th Edition, Tata McGraw Hill.
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Bjarne Stroustrup, “The C++ Programming Language”, Fourth Edition, Pearson Education.</li> <li>2. Hilbert Schildt, (2009), “C++ - The Complete Reference”, 4th Edition, Tata McGrawHill.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://fahad.cprogramming.blogspot.com/p/c-simple-examples.html">http://fahad.cprogramming.blogspot.com/p/c-simple-examples.html</a></li> <li>2. <a href="http://www.sitesbay.com/cpp/cpp-polymorphism">http://www.sitesbay.com/cpp/cpp-polymorphism</a></li> <li>3. <a href="https://www.javatpoint.com/cpp-object-and-class">https://www.javatpoint.com/cpp-object-and-class</a></li> <li>4. <a href="https://www.tutorialspoint.com/cplusplus/cpp_inheritance.htm">https://www.tutorialspoint.com/cplusplus/cpp_inheritance.htm</a></li> <li>5. <a href="https://www.programiz.com/cpp-programming/exception-handling">https://www.programiz.com/cpp-programming/exception-handling</a></li> </ol>

## COURSE OUTCOMES

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

CO	Course Outcomes	K-level
CO1	Outline the C++ programming fundamentals and the concepts of object-oriented programming like object and class, Encapsulation, inheritance and polymorphism.	Up to K2
CO2	Classify the control structures, types of constructors, inheritance and different type conversion mechanisms.	Up to K4
CO3	Analyze the importance of object oriented programming features like polymorphism, reusability, generic programming, data abstraction and the usage of exception handling.	Up to K3
CO4	Determine the use of object oriented features such as classes, inheritance and templates to develop C++ programs for complex problems.	Up to K3
CO5	Create a program in C++ by implementing the concepts of object-oriented programming.	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	2	3	1	1	1	3	2	2	3	3
CLO2	3	2	3	2	1	2	3	3	2	3	3
CLO3	2	3	3	3	3	2	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	2	3	3
CLO5	2	3	3	3	2	2	3	3	2	3	3

**Course Designer:** Prof. M. Ashok Kumar

**Blue Print for Summative Examination - Object Oriented Programming using C++  
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels**

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

<b>Title of the Course</b>		<b>C++ Programming Lab</b>					
<b>TANSICHE Course type</b>		<b>ECP1</b>					
<b>Course Category</b>		<b>Elective (Generic) Practical 1</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>1</b>	<b>Course Code</b>	<b>23U1FGEP1</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		-		-		2	2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Programming Skills					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To inculcate knowledge on Object-oriented concepts and programming using C++.</li> <li>• Demonstrate the use of various OOPs concepts with the help of programs</li> <li>• To learn how to implement types of Constructors and overloading.</li> <li>• To demonstrate types of inheritance and I/O operations.</li> <li>• To create &amp; process data in files and know about exception handling.</li> </ul>					
<b>Course Outline</b>		<ol style="list-style-type: none"> <li>1. Working with Classes and Objects</li> <li>2. Using Constructors and Destructors</li> <li>3. Using Function Overloading</li> <li>4. Using Operator Overloading</li> <li>5. Using Type Conversions</li> <li>6. Using Inheritance</li> <li>7. Using Polymorphism</li> <li>8. Using Console I/O</li> <li>9. Using Templates</li> <li>10. Using Exceptions</li> </ol>					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					
<b>Skills acquired from this course</b>		Able to write programs to solve simpler and complex problems by implementing object oriented programming concepts.					
<b>Justification for nature of course</b>		Supports different ways of programming like procedural, object oriented functional and so on.					
<b>Text Book(s)</b>		E. Balaguruswamy, (2013), "Object Oriented Programming using C++", 6th Edition, Tata McGraw Hill.					

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Bjarne Stroustrup, “The C++ Programming Language”, Fourth Edition, Pearson Education.</li> <li>2. Hilbert Schildt, (2009), “C++ - The Complete Reference”, 4th Edition, Tata McGrawHill.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://fahad.cprogramming.blogspot.com/p/c-simple-examples.html">http://fahad.cprogramming.blogspot.com/p/c-simple-examples.html</a></li> <li>2. <a href="http://www.sitesbay.com/cpp/cpp-polymorphism">http://www.sitesbay.com/cpp/cpp-polymorphism</a></li> <li>3. <a href="https://www.javatpoint.com/cpp-object-and-class">https://www.javatpoint.com/cpp-object-and-class</a></li> <li>4. <a href="https://www.tutorialspoint.com/cplusplus/cpp_inheritance.htm">https://www.tutorialspoint.com/cplusplus/cpp_inheritance.htm</a></li> <li>5. <a href="https://www.programiz.com/cpp-programming/exception-handling">https://www.programiz.com/cpp-programming/exception-handling</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOMES	K - Level
CO1	Understand the fundamentals of C++ programming structure.	Up to K2
CO2	Identify the basic features of OOPS such as classes, objects, polymorphism, and inheritance.	Up to K4
CO3	Analyze the concept of inheritance with the understanding of early and late binding, usage of exception handling, constructors, destructors, generic programming and type conversions.	Up to K3
CO4	Determine the use of various data structures such as stacks, queues and lists to solve various computing problems in C++ by incorporating OOPS concepts.	Up to K3
CO5	Develop a program in C++ with the concepts of object oriented programming to solve real-world problems.	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	2	3	1	1	1	3	2	2	3	3
CLO2	3	2	3	2	1	2	3	3	2	3	3
CLO3	2	3	3	3	3	2	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	2	3	3
CLO5	2	3	3	3	2	2	3	3	2	3	3

Course Designer: Prof. M. Ashok Kumar

<b>Title of the Course</b>		<b>Fundamentals of Computers</b>					
<b>TANSCHÉ Course type</b>		<b>FC</b>					
<b>Course Category</b>		<b>Foundation Course</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	<b>23UIFFCT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		2				-	2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Knowledge in Computers					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To analyze a problem with appropriate problem solving techniques.</li> <li>To understand the main principles of imperative, functional and logic oriented programming languages.</li> <li>To increase the ability to learn new programming languages.</li> <li>To understand the basic computer organization, software, computer languages.</li> <li>To learn about various types of computer problems and examine to set up expressions and equations to solve them.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Introduction:</b> Characteristics of Computers - Evolution of Computers <b>Basic Computer Organization:</b> I/O Unit - Storage Unit - Arithmetic Logic Unit - Control Unit - Central Processing Unit.					
		<b>Unit II: Computer Software:</b> Types of Software - System Architecture <b>Computer Languages:</b> Machine Language - Assembly Language - High Level Language - Object Oriented Languages.					
		<b>Unit III: Problem Solving Concepts:</b> Problem Solving in Everyday life - Types of Problems - Problem solving with computers - Difficulties with Problem Solving.					
		<b>Unit IV: Problem Solving concepts for the computer:</b> Constant Variables - Data Types - Functions -Operators - Expressions and Equations - <b>Organizing the Solution:</b> Analyzing the problem - Algorithm - Flowchart - Pseudo code.					
		<b>Unit V: Programming Structure:</b> Structuring a solution - Modules and their function - Local and Global variables - Parameters - Return values - Sequential Logic Structure - Problem solving with Decision - Problem Solving with Loops.					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					
<b>Skills acquired from this course</b>		Problem-solving skills are the ability to identify problems, analyse, research, decision making and implement the best solutions					
<b>Justification for nature of course</b>		It enables the development of pupil's natural ability to think logically, solve puzzles and apply these skills to real-life problems.					

<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Pradeep K.Sinha and Priti Sinha, (2004) —Computer FundamentalsI, Sixth Edition, BPB Publications. (Unit I : Chapter 1 &amp; 2, Unit II : Chapter 10 &amp; 12)</li> <li>2. Maureen Sprankle and Jim Hubbard, (2009) —Problem Solving and Programming Concept, Ninth Edition, Prentice Hall. (Unit III: Chapter 1,2 &amp;3) Unit IV: Chapter 3, Unit V: Chapter 4,5 ,6,7 &amp; 8) .</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. R.G. Dromey, (2007), —How to Solve it by ComputerI, Prentice Hall International Series in Computer Science.</li> <li>2. C. S. V. Murthy, (2009), —Fundamentals of ComputersI, Third Edition, Himalaya Publishing House.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.tutorialspoint.com/computer_fundamentals/">http://www.tutorialspoint.com/computer_fundamentals/</a></li> <li>2. <a href="http://www.comptechdoc.org/basic/basictut/">http://www.comptechdoc.org/basic/basictut/</a></li> <li>3. <a href="http://www.homeandlearn.co.uk/">http://www.homeandlearn.co.uk/</a></li> <li>4. <a href="http://www.top-windows-tutorials.com/computer-basics/">http://www.top-windows-tutorials.com/computer-basics/</a></li> <li>5. <a href="https://www.programiz.com/article/flowchart-programming">https://www.programiz.com/article/flowchart-programming</a> (Algorithm and flow chart)</li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-Level
CO1	Outline the Computer fundamentals and various problem solving concepts in Computers.	Up to K2
CO2	Describe the basic computer organization, software, computer languages, software development life cycle and the need of structured programming in solving a computer problem.	Up to K3
CO3	Identify the types of computer languages, software, computer problems and examine how to set up expressions and equations to solve the problem.	Up to K3
CO4	Choose most appropriate programming languages, constructs and features to solve the problems in diversified domains.	Up to K4
CO5	Analyze the design of modules and functions in structuring the solution and various Organizing tools in problem solving.	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	1	1	-	-	2	3	2	2	2	2
CLO2	3	2	2	2	1	2	3	2	2	2	3
CLO3	3	3	3	2	2	2	3	3	3	3	2
CLO4	3	3	3	3	2	2	3	2	2	2	2
CLO5	3	2	2	3	3	2	3	3	2	2	3

Course Designer: Prof. R. TamilSelvi

**Blue Print for Summative Examination – Fundamentals of Computers  
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 Answer			
			No. of Questions	K– Level	No. of Questions	K- Level		
1	CLO1	Up to K2	2	K1 & K2	1	K2	2(K3& K3)	1(K2)
2	CLO2	Up to K3	2	K1 & K2	1	K1	2(K3& K3)	1(K3)
3	CLO3	Up to K3	2	K1 & K2	1	K2	2(K2& K2)	1(K3)
4	CLO4	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
5	CLO5	Up to K4	2	K1 & K2	1	K1	2(K1& K1)	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			<b>10</b>		<b>10</b>		<b>25</b>	<b>30</b>

- K1–Remembering and recalling facts with specific answers
- K2–Basic understanding of facts and stating main ideas with general answers
- K3–Application oriented–Solving Problems
- K4–Examining analysing , presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels**

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

<b>Title of the Course</b>		<b>Office Automation</b>					
<b>TANSICHE Course type</b>		<b>SEC-1</b>					
<b>Course Category</b>		<b>Skill Enhancement Course (Discipline)</b>					
<b>Nature of Course</b>		<b>Employability / Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	<b>23U1FSED1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		1		1		-	2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Computer Knowledge					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Understand the basics of computer systems and its components.</li> <li>• Understand and apply the basic concepts of a word processing package.</li> <li>• Understand and apply the basic concepts of electronic spreadsheet software.</li> <li>• Understand and apply the basic concepts of database management system.</li> <li>• Understand and create a presentation using PowerPoint tool.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Introductory concepts:</b> Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS– UNIX– Windows. Introduction to Programming Languages.					
		<b>Unit II: Word Processing:</b> Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing–Preview, options, merge.					
		<b>Unit III: Spreadsheets :</b> Excel–opening, entering text and data, formatting, navigating; Formulas–entering, handling and copying; Charts–creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.					
		<b>Unit IV: Database Concepts:</b> The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language (MS–Access).					
		<b>Unit V: Power point:</b> Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition–Animation effects, audio inclusion, timers.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	It is used to digitally create, store, manipulate office information and data needed for accumulation of basic tasks and goals.
<b>Text Book(s)</b>	Peter Norton, “Introduction to Computers” – Tata Mc Graw-Hill.
<b>Reference Book(s)</b>	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, “Microsoft 2003”, Tata McGrawHill.
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.udemy.com/course/office-automation-certificate-course/">https://www.udemy.com/course/office-automation-certificate-course/</a></li> <li>2. <a href="https://www.javatpoint.com/automation-tools">https://www.javatpoint.com/automation-tools</a></li> <li>3. <a href="https://www.javatpoint.com/microsoft-access">https://www.javatpoint.com/microsoft-access</a></li> <li>4. <a href="https://www.geeksforgeeks.org/introduction-to-microsoft-powerpoint/">https://www.geeksforgeeks.org/introduction-to-microsoft-powerpoint/</a></li> </ol>

## COURSE OUTCOMES

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

CLOs	Course Learning Outcomes	K-level
CO1	Possess the knowledge on the basics of computers and its components.	Up to K2
CO2	Apply knowledge on Creating Documents, spreadsheet and presentation.	Up to K3
CO3	Utilize the concepts of Database and implement the Query in Database.	Up to K3
CO4	Classify different automation tools.	Up to K4
CO5	Categorize the automation tools for documentation, calculation and presentation purpose.	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	2	3	2	-	-	2	1	-	2	-	2
CLO2	3	2	3	1	-	2	1	1	2	1	2
CLO3	2	3	3	1	2	3	2	2	2	3	3
CLO4	2	3	3	1	2	3	2	2	2	3	3
CLO5	3	3	1	2	1	3	1	1	2	1	2

**Course Designer:** Prof. K. Vairameenakshi

**Blue Print for Summative Examination – Office Automation**  
**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 Answer			
			No. of Questions	K– Level	No. of Questions	K- Level		
1	CLO1	Up to K2	2	K1 & K2	1	K2	2(K3& K3)	1(K2)
2	CLO2	Up to K3	2	K1 & K2	1	K1	2(K3& K3)	1(K3)
3	CLO3	Up to K3	2	K1 & K2	1	K2	2(K2& K2)	1(K3)
4	CLO4	Up to K4	2	K1 & K2	1	K2	2(K4&K4)	1(K3)
5	CLO5	Up to K4	2	K1 & K2	1	K1	2(K1& K1)	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			<b>10</b>		<b>10</b>		<b>25</b>	<b>30</b>

- K1–Remembering and recalling facts with specific answers
- K2–Basic understanding of facts and stating main ideas with general answers
- K3–Application oriented–Solving Problems
- K4–Examining analysing , presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels**

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

<b>Title of the Course</b>		<b>Java Programming</b>					
<b>TANSICHE Course type</b>		<b>CC2</b>					
<b>Course Category</b>		<b>Core Theory</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	<b>23U2FCCT2</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		1		-	5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Programming Skill					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To provide knowledge on fundamentals of object-oriented programming.</li> <li>• To learn problem solving strategies to develop a high-level application.</li> <li>• To familiarize in the use of constructors and inheritance.</li> <li>• To demonstrate skills in writing programs using multithreading.</li> <li>• To have the ability to use the SDK environment to create, debug and run servlet programs.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Fundamentals of Object- Oriented Programming:</b> Introduction – Object Oriented Paradigm – Concepts of Object – Oriented Programming – Benefits of OOP – Evolution: Java History- Java Features - Differs from C and C++ - Overview of Java Language: Java Program- Structure – Tokens – Java Statements – Java Virtual Machine – Command Line Arguments.					
		<b>Unit II:</b> Constants, Variables and Data Types – Operators and Expressions – Decision making and Branching – Looping – Arrays - Strings – Collection Interfaces and classes.					
		<b>Unit III: Classes objects and methods:</b> Introduction – Defining a class – Method Declaration – Constructors - Method Overloading – Static Members – Nesting of methods – Inheritance – Overriding – Final variables and methods – Abstract methods and classes.					
		<b>Unit IV:</b> Multiple Inheritance: Defining Interfaces – Extending Interfaces – Implementing Interfaces – Packages: Creating Packages – Accessing Packages – Using a Package – Managing Errors and Exceptions - Multithreaded Programming.					
		<b>Unit V:</b> Layout Managers - JDBC – Java Servlet: - Servlet Environment Role – Servlet API – Servlet Life Cycle – Servlet Context – HTTP Support – HTML to Servlet Communication.					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					
<b>Skills acquired from this course</b>		Able to create applications using Core Java, AWT, Event Handling and Swing.					

<b>Justification for nature of course</b>	Helps to construct real time application without necessarily knowing their inside implementation.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. E Balagurusamy(2010), “Programming with Java”, Tata McGraw Hill Edition India Private Ltd, 4th Edition.</li> <li>2. C Xavier,”Java Programming – A Practical Approach”, Tata McGraw Hill Edition Private Ltd.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. P.Naughton and H.Schildt (1999), “Java 2 The Complete Reference”, TMH, 3rd Edition.</li> <li>2. Jaison Hunder &amp; William Crawford (2002),”Java Servlet Programming”, O’Reilly.</li> <li>3. Jim Keogh (2002), “J2EE: The Complete Reference”, Tata McGraw Hill Edition.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://javabeginnerstutorial.com/core-java/">http://javabeginnerstutorial.com/core-java/</a></li> <li>2. <a href="http://www.tutorialspoint.com/java/">http://www.tutorialspoint.com/java/</a></li> <li>3. <a href="http://beginnersbook.com/java-tutorial-for-beginners-with-examples/">http://beginnersbook.com/java-tutorial-for-beginners-with-examples/</a></li> <li>4. <a href="http://www.homeandlearn.co.uk/java/java.html">http://www.homeandlearn.co.uk/java/java.html</a></li> <li>5. <a href="http://www.journaldev.com/1877/servlet-tutorial-java">http://www.journaldev.com/1877/servlet-tutorial-java</a> (Unit V : Servlet API)</li> </ol>

## COURSE OUTCOMES

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

CO	COURSE OUTCOMES	K-level
CO1	Outline the basic terminologies of OOP, programming language techniques, JDBC and Internet programming concepts	Up to K2
CO2	Solve problems using basic constructs, mechanisms, techniques and technologies of Java.	Up to K4
CO3	Analyze and explain the behavior of simple programs involving different techniques such as Inheritance, Packages, Interfaces, Exception Handling and Thread and technologies such as JDBC and Servlets.	Up to K3
CO4	Assess various problem-solving strategies involved in Java to develop a high-level application.	Up to K3
CO5	Design GUI based JDBC applications and able to develop Servlets using suitable OOP concepts and techniques.	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	1	1	-	-	2	3	2	2	2	2
CLO2	3	2	3	3	2	2	2	3	2	2	2
CLO3	3	3	3	3	3	3	2	3	3	3	2
CLO4	3	3	3	2	3	2	2	3	2	2	2
CLO5	2	3	3	3	3	3	3	3	2	2	2

Course Designer: Prof. S. Saranya

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

S.No	CLOs	K- Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			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	UptoK4	2	K1&K2	1	K1	2(K4& K4)	1(K3)
3	CLO3	UptoK3	2	K1& K2	1	K2	2(K3& K3)	1(K3)
4	CLO4	UptoK3	2	K1& K2	1	K2	2(K2&K2)	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 Marks for each section			<b>10</b>		<b>10</b>		<b>25</b>	<b>30</b>

- K1–Remembering and recalling facts with specific answers
- K2–Basic understanding of facts and stating main ideas with general answers
- K3–Application oriented–Solving Problems
- K4–Examining analyzing, presentation and make inferences with evidences

**Distribution of Section –wise Marks with K Levels**

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

<b>Title of the Course</b>		<b>Java Programming Lab</b>					
<b>TANSICHE Course type</b>		<b>CCP2</b>					
<b>Course Category</b>		<b>Core Practical 2</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23U2FCCP2</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
				-		3	3
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Programming skills					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To become proficient in the basic concepts and collections.</li> <li>To impart knowledge on the concept of inheritance, packages and interfaces.</li> <li>Be familiar with programming environment with Multithreading.</li> <li>To become proficient in the use of database connectivity.</li> <li>To design and develop applications using different Java programming language techniques, JDBC &amp; Servlets.</li> </ul>					
<b>Course Outline</b>		<ol style="list-style-type: none"> <li>Basic Programs</li> <li>Arrays</li> <li>Strings</li> <li>Array List, Hash Set and Vector collection classes</li> <li>Classes and Objects</li> <li>Interfaces</li> <li>Inheritance</li> <li>Packages</li> <li>Exception Handling-1</li> <li>Exception Handling-2</li> <li>Threads-1</li> <li>Threads-2</li> <li>Sorting</li> <li>Working with Database using JDBC</li> <li>Web application using Servlet</li> </ol>					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					
<b>Skills acquired from this course</b>		Able to write programs to solve simpler and complex problems by implementing java programming concepts.					
<b>Justification for nature of course</b>		Java is object-oriented. This allows you to create modular programs and reusable code and to provide efficient solutions for real time problems.					

<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. The Complete Reference, Herbert Schildt, Tata McGraw Hill, New Delhi, 7th Edition, 2010.</li> <li>2. Gary Cornell, Core Java 2 Volume I – Fundamentals, Addison Wesley, 1999</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. O'Reilly Publications, Head First Java,</li> <li>2. Introduction to Java Programming, Y. Daniel Liang, 7th Edition, Pearson Education India, 2010</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.javatpoint.com/awt-program-in-java">www.javatpoint.com/awt-program-in-java</a></li> <li>2. <a href="http://www.w3schools.com/java">www.w3schools.com/java</a></li> <li>3. <a href="https://www.geeksforgeeks.org/java-swing-jpanel-with-examples/">https://www.geeksforgeeks.org/java-swing-jpanel-with-examples/</a></li> </ol>

## COURSE OUTCOMES

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

COS	COURSE OUTCOMES	K-Level
CO1	Identify and explain the way of solving the simple problems.	Up to K2
CO2	Use appropriate software development environment to write, compile and execute object-oriented Java programs.	Up to K4
CO3	Analyze and identify necessary mechanisms of Java needed to solve real-world problem.	Up to K3
CO4	Test for defects and validate a Java program with different inputs.	Up to K3
CO5	Design, develop and compile Core Java , GUI , JDBC and servlet applications that utilize OOP and data structure concepts.	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	1	1	-	-	2	3	2	3	3	2
CLO2	3	2	3	3	2	2	3	3	3	3	2
CLO3	3	3	3	3	3	3	3	3	3	2	2
CLO4	3	3	3	2	3	2	3	3	3	3	3
CLO5	2	3	3	3	3	3	3	3	2	3	2

Course Designer: Prof. S. Saranya

<b>Title of the Course</b>		<b>Web Designing</b>					
<b>TANSICHE Course type</b>		<b>EC2</b>					
<b>Course Category</b>		<b>Elective (Generic)</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	<b>23U2FGET2</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		-		-	4
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic knowledge in Internet Applications.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Understand the basics of HTML and its components.</li> <li>• To study about the Graphics in HTML.</li> <li>• Understand and apply the concepts of XML and DHTML.</li> <li>• Understand the concept of JavaScript.</li> <li>• To identify and understand the goals and objectives of the Ajax.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: HTML:</b> HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size, face and color-alignment links-tables-frames.					
		<b>Unit II: Forms &amp; Images Using Html:</b> Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page.					
		<b>Unit III: XML &amp; DHTML:</b> Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML).					
		<b>Unit IV: Dynamic HTML:</b> Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding. <b>JavaScript:</b> Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition.					
		<b>Unit V:</b> Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations.					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					
<b>Skills acquired from this course</b>		To develop web pages using various tools and techniques that are utilized in the process of communication between different types of applications over the Internet.					

<b>Justification for nature of course</b>	Web Technology facilitates retrieval and computing and other applications.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Pankaj Sharma, “Web Technology”, SkKataria&amp; Sons Bangalore 2011.</li> <li>2. Mike Mcgrath, “Java Script”, Dream Tech Press 2006, 1st Edition.</li> <li>3. Achyut S Godbole &amp; Atul Kahate, “Web Technologies”, 2002, 2nd Edition.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Laura Lemay, Rafe Colburn , Jennifer Kyrnin, “Mastering HTML, CSS &amp; Javascript Web Publishing”,2016.</li> <li>2. DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Paperback 2016, 2nd Edition.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.tutorialspoint.com/html/htmlbasictags.htm">https://www.tutorialspoint.com/html/htmlbasictags.htm</a></li> <li>2. <a href="https://www.geeksforgeeks.org">https://www.geeksforgeeks.org</a></li> <li>3. <a href="https://javascript.info/">https://javascript.info/</a></li> <li>4. NPTEL &amp; MOOC courses titled Web Design and Development.</li> </ol>

## COURSE OUTCOMES

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

CO	COURSE OUTCOME	K-level
CO1	Develop working knowledge of HTML.	Up to K2
CO2	Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).	Up to K4
CO3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).	Up to K3
CO4	Ability to develop a java script.	Up to K4
CO5	An ability to develop web application using Ajax.	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	2	1	1	2	2	2	3	2	2
CLO2	3	3	3	2	2	2	2	2	2	3	3
CLO3	3	2	3	2	3	3	3	2	2	3	2
CLO4	3	2	2	1	3	3	3	3	2	2	3
CLO5	3	1	2	1	3	3	3	3	3	2	3

**Course Designer:** Prof. K.R. Ramadevi

**Blue Print for Summative Examination – Web Designing**  
**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 Answer			
			No. of Questions	K – Level	No. of Questions	K - Level		
1	CLO1	Up to K2	2	K1 & K2	1	K1	2 (K1& K1)	1(K2)
2	CLO2	Up to K4	2	K1& K2	1	K1	2 (K3& K3)	1(K4)
3	CLO3	Up to K3	2	K1 & K2	1	K2	2 (K2& K2)	1(K3)
4	CLO4	Up to K4	2	K1 & K2	1	K2	2 (K4& K4)	1(K3)
5	CLO5	Up to K3	2	K1 & K2	1	K2	2 (K3& K3)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels**

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

<b>Title of the Course</b>		<b>Web Designing Lab</b>					
<b>TANSICHE Course type</b>		<b>ECP2</b>					
<b>Course Category</b>		<b>Elective (Generic) Practical</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	1	<b>Course Code</b>	<b>23U2FGEP2</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		-		-		2	2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic knowledge in Internet Applications					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To learn the basic web concepts</li> <li>• To learn the basics of HTML, DHTML, XML, CSS.</li> <li>• To create rich internet applications that use most recent client-side programming technologies.</li> <li>• To familiarize Java Script and implement in web pages.</li> <li>• To utilize Java Script for validating forms.</li> </ul>					
<b>Course Outline</b>		<ol style="list-style-type: none"> <li>1. Tables</li> <li>2. Forms</li> <li>3. Frames</li> <li>4. Lists</li> <li>5. Links</li> <li>6. Inline CSS</li> <li>7. Basic programs in Java script</li> <li>8. Images</li> <li>9. Animation</li> <li>10. Validation using Java script</li> </ol>					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					
<b>Skills acquired from this course</b>		To develop web pages using various tools and techniques that are utilized in the process of communication between different types of applications over the Internet.					
<b>Justification for nature of course</b>		Web Technology facilitates retrieval and computing and other applications.					
<b>Text Book(s)</b>		<ol style="list-style-type: none"> <li>1. Pankaj Sharma, “Web Technology”, SkKataria&amp; Sons Bangalore 2011.</li> <li>2. Mike Mcgrath, “Java Script”, Dream Tech Press 2006, 1st Edition.</li> <li>3. Achyut S Godbole&amp;AtulKahate, “Web Technologies”, 2002, 2nd Edition.</li> </ol>					

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Laura Lemay, Rafe Colburn , Jennifer Kyrnin, “Mastering HTML, CSS &amp; Javascript Web Publishing”,2016.</li> <li>2. DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Paperback 2016, 2nd Edition.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.tutorialspoint.com/html/htmlbasictags.htm">https://www.tutorialspoint.com/html/htmlbasictags.htm</a></li> <li>2. <a href="https://www.geeksforgeeks.org">https://www.geeksforgeeks.org</a></li> <li>3. <a href="https://javascript.info/">https://javascript.info/</a></li> <li>4. NPTEL &amp; MOOC courses titled Web Design and Development.</li> </ol>

### COURSE OUTCOMES

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

CO	COURSE OUTCOME	K-level
CO1	Develop and publish Web pages using Hypertext Markup Language (HTML).	Up to K2
CO2	Optimize page styles and layout with Cascading Style Sheets (CSS).	Up to K3
CO3	Analyze and apply the role of languages to create a capstone	Up to K4
CO4	Develop website using client-side web programming languages like HTML, DHTML, CSS, XML and JavaScript.	Up to K3
CO5	Create web applications using forms and validation of form fields	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	2	1	1	2	2	2	3	2	2
CLO2	3	3	3	2	2	2	2	2	2	3	3
CLO3	3	2	3	2	3	3	3	2	2	3	2
CLO4	3	2	2	1	3	3	3	3	2	2	3
CLO5	3	1	2	1	3	3	3	3	3	2	3

Course Designer: Prof. K.R. Ramadevi

<b>Title of the Course</b>		<b>Problem Solving Techniques</b>					
<b>TANSICHE Course type</b>		<b>SEC-2</b>					
<b>Course Category</b>		<b>Skill Enhancement Course (Discipline)</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	<b>23U2FSED2</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		2		-			2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic knowledge in numerical ability					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Understand the systematic approach to problem solving.</li> <li>• Know the approach and algorithms to solve specific fundamental problems.</li> <li>• Understand the efficient approach to solve specific factoring-related problems.</li> <li>• Understand the efficient array-related techniques to solve specific problems.</li> <li>• Understand the efficient methods to solve specific problems related to text processing. Understand how recursion works.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Introduction:</b> Notion of algorithms and programs – Requirements for solving problems by computer – The problem-solving aspect: Problem definition phase, Getting started on a problem, The use of specific examples, Similarities among problems, Working backwards from the solution – General problem-solving strategies - Problem solving using top-down design – Implementation of algorithms – The concept of Recursion.					
		<b>Unit II: Fundamental Algorithms:</b> Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion.					
		<b>Unit III: Factoring Methods:</b> Finding the square root of a number – The smallest divisor of an integer – Greatest common divisor of two integers - Generating prime numbers – Computing the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the $n$ th Fibonacci number.					
		<b>Unit IV: Array Techniques:</b> Array order reversal – Array counting or histogramming – Finding the maximum number in a set - Removal of duplicates from an ordered array - Partitioning an array – Finding the $k^{\text{th}}$ smallest element – Longest monotone subsequence.					
		<b>Unit V: Text Processing and Pattern Searching:</b> Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search. <b>Recursive algorithms:</b> Towers of Hanoi – Permutation generation.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency.
<b>Justification for nature of course</b>	Assess the candidate's problem-solving skills by making them utilize their rational thinking and quick decision-making ability to solve complex and time-constrained problems.
<b>Text Book(s)</b>	R. G. Dromey, How to Solve it by Computer, Pearson India, 2007
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>George Polya, Jeremy Kilpatrick, The Stanford Mathematics Problem Book: With Hints and Solutions, Dover Publications, 2009 (Kindle Edition 2013).</li> <li>Greg W. Scragg, Problem Solving with Computers, Jones &amp; Bartlett 1st edition, 1996.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li><a href="https://www.studytonight.com/">https://www.studytonight.com/</a></li> <li><a href="https://www.w3schools.com/">https://www.w3schools.com/</a></li> <li><a href="https://www.ics.uci.edu/~goodrich/teach/cs262P/">https://www.ics.uci.edu/~goodrich/teach/cs262P/</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-level
CO1	Understand the logic of problem and analyses implementation of algorithm and Top Down approach and concept of Recursion.	Up to K2
CO2	Able to understand the Sequence of Numbers and Series Fibonacci, Reversing, Base Conversion.	Up to K3
CO3	Able to do Algebraic operations.	Up to K3
CO4	Coverage of Arrays and its Logics.	Up to K4
CO5	Text Processing and Pattern Searching Approach.	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	2	2	1	-	3	2	1	-	2	2
CLO2	3	2	2	2	-	3	2	1	-	2	2
CLO3	3	3	2	3	-	3	3	2	-	2	3
CLO4	3	3	3	3	2	3	2	2	1	2	3
CLO5	3	3	3	2	3	3	3	3	2	3	3

Course Designer: Prof. R. Tamilselvi

**Blue Print for Summative Examination – Problem Solving Techniques  
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels \***

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

<b>Title of the Course</b>		<b>Fundamentals of Information Technology</b>					
<b>TANSICHE Course type</b>		<b>SEC3</b>					
<b>Course Category</b>		<b>Skill Enhancement Course (Discipline)</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	<b>23U2FSED3</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		2		-		-	2
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>			<b>Total</b>	
		25	75			100	
<b>Pre-requisite(s)</b>		Basic idea about computers					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Understand basic concepts and terminology of information technology.</li> <li>• Have a basic understanding of personal computers and their operation.</li> <li>• Be able to identify data storage and its usage.</li> <li>• Get great knowledge of software and its functionalities.</li> <li>• Understand about operating system and their uses.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: Introduction to Computers:</b> Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer.					
		<b>Unit II: Basic Computer Organization:</b> Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.					
		<b>Unit III: Storage Fundamentals:</b> Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives.					
		<b>Unit IV: Software:</b> Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w.					

	<b>Unit V: Operating System:</b> Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Familiarity in physical computers and Software
<b>Justification for nature of course</b>	Provide students sufficient knowledge and skills that would require to channelize their learning in a practical sense.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Anoop Mathew, S. Kavitha Murugesan (2009), “ Fundamental of Information Technology”, Majestic Books.</li> <li>2. Alexis Leon, Mathews Leon,” Fundamental of Information Technology”, 2<sup>nd</sup> Edition.</li> <li>3. S. K Bansal, “Fundamental of Information Technology”.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Bhardwaj Sushil Puneet Kumar, “Fundamental of Information Technology”</li> <li>2. GG WILKINSON, “Fundamentals of Information Technology”, Wiley-Blackwell</li> <li>3. A Ravichandran, “Fundamentals of Information Technology”, Khanna Book Publishing</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://testbook.com/learn/computer-fundamentals">https://testbook.com/learn/computer-fundamentals</a></li> <li>2. <a href="https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html">https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html</a></li> <li>3. <a href="https://www.javatpoint.com/computer-fundamentals-tutorial">https://www.javatpoint.com/computer-fundamentals-tutorial</a></li> <li>4. <a href="https://www.tutorialspoint.com/computer_fundamentals/index.htm">https://www.tutorialspoint.com/computer_fundamentals/index.htm</a></li> <li>5. <a href="https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf">https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf</a></li> </ol>

## COURSE OUTCOMES

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

CO	COURSE OUTCOME	K-level
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	Up to K2
CO2	Develop organizational structure using for the devices present currently under input or output unit.	Up to K3
CO3	Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in storage basis.	Up to K4
CO4	Work with different software, Write program in the software and applications of software.	Up to K3
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	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	1	1	1	1	2	1	1	1	2	2
CLO2	3	1	1	2	2	2	1	1	1	2	2
CLO3	3	3	1	2	3	3	2	2	2	3	3
CLO4	3	2	1	2	2	3	2	2	2	3	3
CLO5	3	2	1	2	1	3	2	2	2	3	3

Course Designer: Prof. S.Rajalakshmi

**Blue Print for Summative Examination – Fundamentals of Information Technology  
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels \***

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



**THE MADURA COLLEGE (AUTONOMOUS)**  
**PG DEPARTMENT OF COMPUTER SCIENCE**

**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 OUTCOMES:**

- **PO1: Ethical Value:** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.
- **PO2: Decision Making Skill:** Foster analytical and critical thinking abilities for data-based decision-making.
- **PO3: Problem Solving Skill:** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.
- **PO4: Communication Skill:** Ability to develop communication, managerial and interpersonal skills.
- **PO5: Employability Skill:** Inculcate contemporary business practices to enhance employability skills in the competitive environment.
- **PO6: Individual and Team Leadership Skill:** Capability to lead themselves and the team to achieve organizational goals.

**PROGRAMME SPECIFIC OUTCOMES Aligned with Graduate Attributes**

- **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.

### Qualification for Admission

A candidate must have passed their B.Sc. (CS/IT)/BCA with Mathematics in +2 or any other examination approved by Madurai Kamaraj University as equivalent.

### Duration of the Course

The students shall undergo prescribed course of study for the period of two academic years under CBCS semester pattern with outcome based education.

**Medium of Instruction:** English.

**System:** Choice Based Credit System with Outcome Based Model.

### Evaluation (Theory)

Internal (Formative)	: 25 marks
External (Summative)	: 75 marks
Total	: 100 marks

### Continuous Internal Assessment: 25 Marks

THEORY			
	25 marks		
Internal (Formative)	Components of Internal Assessment		Marks
	Test		10
	Assignment		5
	Quiz		5
	Attendance/Seminar		5
External (Summative)	75marks		

### 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 - open choice – one question to be answered out of 2 question asked)	1/2	10	10
<b>Total marks</b>			<b>25</b>

### Blueprint for test component of CIA

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

\*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.

#### Question Paper Pattern for External Examination: 75 Marks

<b>Section</b>	<b>Marks</b>
A- Multiple Choice Questions (10 X 1 mark)	10
B- Short answer type (5 X 2 marks)	10
B- Either/Or type (5 X 5 marks)	25
C- Open Choice type (3out of 5 X 10 marks)	30
<b>Total</b>	<b>75</b>

#### EVALUATION (PRACTICAL)

Internal (Formative) : 25 marks

External (Summative): 75 marks

Total : 100 marks



The Madura College (Autonomous), Madurai – 625 011

(Self-Financed Stream)

PG Department of Computer Science

Curriculum Structure for M.Sc. Computer Science

0.

Part	Course Description	Course Code	Course Title	Contact Hours/ Week	Credits
<b>SEMESTER I</b>					
A	Core Course - I	23P1DCCT1	Analysis & Design of Algorithms	6	5
	Core Course – II	23P1DCCT2	Object Oriented Analysis and Design & C++	6	5
	Core Course – III	23P1DCCP1	Practical I: Algorithm And OOPS Lab	6	4
	Elective Course- I	23P1DECT1	Python Programming/Web Services	5	3
	Elective Course – II	23P1DECT2	Advanced Software Engineering / Critical Thinking, Design Thinking And Problem solving	5	3
B	Skill Enhancement Course	23P1DSED1	R Programming	2	2
<b>Total</b>				<b>30</b>	<b>22</b>
<b>SEMESTER II</b>					
A	Core Course - IV	23P2DCCT3	Data Mining And Warehousing	6	5
	Core Course – V	23P2DCCT4	Advanced Java Programming	6	5
	Core Course - VI	23P2DCCP2	Practical :Advanced Java & Data Mining Lab using R	6	4
	Elective Course – III	23P2DECT3	Artificial Intelligence & Machine Learning / Internet of Things	5	3
	Elective Course –IV	23P2DECT4	Advanced Operating Systems / Mobile Computing	5	3
B	Skill Enhancement Course	23P2DSEN1	Multimedia And Its Applications	2	2
<b>Total</b>				<b>30</b>	<b>22</b>

<b>Title of the Course</b>		<b>ANALYSIS &amp; DESIGN OF ALGORITHMS</b>					
<b>TANSICHE Course type</b>		<b>CC1</b>					
<b>Course Category</b>		<b>Core</b>					
<b>Nature of Course</b>		<b>Employability / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23P1DCCT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		3		3			6
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Data Structures & Algorithms					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Enable the students to learn the Elementary Data Structures and algorithms.</li> <li>• Presents an introduction to the algorithms, their analysis and design</li> <li>• Discuss various methods like Basic Traversal And Search Techniques, divide and conquer method, Dynamic programming, backtracking</li> <li>• Understood the various design and analysis of the algorithms.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: INTRODUCTION:</b> - Algorithm Definition and Specification – Space complexity-Time Complexity- Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heap sort- Graph.					
		<b>Unit II: TRAVERSAL AND SEARCH TECHNIQUES:</b> Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs - Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.					
		<b>Unit III: GREEDY METHOD:</b> The Greedy Method:-General Method–Knapsack Problem–Minimum Cost Spanning Tree– Single Source Shortest Path.					
		<b>Unit IV: DYNAMIC PROGRAMMING:</b> Dynamic Programming –General Method –Multistage Graphs –All Pair Shortest Path– Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.					
		<b>Unit V: BACKTRACKING:</b> Backtracking:-General Method–8-Queens Problem–Sum of Subsets–Graph Coloring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Developing logic and structured program, organizing data in software development.
<b>Justification for nature of course</b>	Discover the algorithm characteristics in order to evaluate its suitability for various applications or compare it with other algorithms for the same application.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ellis Horowitz, “Computer Algorithms”, Galgotia Publications.</li> <li>2. Alfred V. Aho, John E. Hopcroft, Jeffrey Ullman , "Data Structures and Algorithms".</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Goodrich,“ Data Structures &amp; Algorithms in Java”,Wiley3rd edition</li> <li>2. Skiena, ” The Algorithm Design Manual”, Second Edition, Springer, 2008</li> <li>3. Anany Levith , ” Introduction to the Design and Analysis of algorithm ”, Pearson Education Asia, 2003</li> <li>4. Robert Sedgewick ,Phillipe Flajolet , ”An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company, 1996..</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/106/106/106106131/">https://nptel.ac.in/courses/106/106/106106131/</a></li> <li>2. <a href="https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm">https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm</a></li> <li>3. <a href="https://www.javatpoint.com/daa-tutorial">https://www.javatpoint.com/daa-tutorial</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-level
CO1	Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique	Up to K2
CO2	Gain good understanding of Greedy method and its algorithm.	Up to K4
CO3	Able to describe about graphs using dynamic programming technique.	Up to K3
CO4	Demonstrate the concept of backtracking & branch and bound technique.	Up to K3
CO5	Explore the traversal and searching technique and apply it for trees and graphs.	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	2	3	2	3	1	2	2	2	2	1
CLO2	3	3	3	3	3	2	3	3	2	3	1
CLO3	3	3	3	3	3	2	3	3	2	3	3
CLO4	3	3	3	3	3	2	3	2	2	3	1
CLO5	3	3	3	3	3	2	3	3	3	3	3

Course Designer: Prof. K. RajaSaravanaKumar

### Summative - Blue Print –Analysis & Design of Algorithms 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	CLO1	Up to K2	2	K1& K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K4	2	K3& K4	1	K2	2(K4&K4)	1(K4)
3	CLO3	Up to K3	2	K2& K3	1	K1	2(K2&K2)	1(K3)
4	CLO4	Up to K3	2	K2& K3	1	K2	2(K3&K3)	1(K3)
5	CLO5	Up to K4	2	K3& K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

### Distribution of Section – wise Marks with K Levels \*

K Level	Section A(No Choice)	Section B (No Choice)	Section C (Either/or)	SectionD(Open Choice)	Total Marks	% of Marks	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
Total Marks	10	10	50	50	120	100	100

<b>Title of the Course</b>		<b>OBJECT ORIENTED ANALYSIS AND DESIGN &amp; C++</b>					
<b>TANSICHE Course type</b>		<b>CC2</b>					
<b>Course Category</b>		<b>Core</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	<b>23P1DCCT2</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		2		-	6
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basics of C++ and Object Oriented Concepts					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Present the object model, classes and objects, object orientation, machine view and model management view.</li> <li>• Enable the students to understand C++ with respect to OOAD</li> <li>• Enables the students to learn the basic functions, principles and concepts of object oriented analysis and design</li> <li>• To develop robust object-based models for Systems.</li> <li>• To gain knowledge about virtual functions and Files.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: OBJECT MODEL:</b> The Object Model: The Evolution of the Object Model – Elements of the Object Model – Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship among Objects.					
		<b>Unit II: CLASSES AND OBJECTS:</b> Classes and Object: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification –identifying classes and objects –Key Abstractions and Mechanism.					
		<b>Unit III: C++ INTRODUCTION:</b> Introduction to C++ - Input and output statements in C++- Declarations - control structures – Functions in C++.					
		<b>Unit IV: INHERITANCE AND OVERLOADING:</b> Classes and Objects– Constructors and Destructors–operators overloading–Type Conversion–Inheritance – Pointers and Arrays.					
		<b>Unit V: POLYMORPHISM AND FILES:</b> Memory Management Operators–Polymorphism–Virtual functions–Files–Exception Handling – String Handling –Templates.					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		<p>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)</p>					

<b>Skills acquired from this course</b>	Help the students to learn C++ Programming language along with deep knowledge about object and classes along with their relationship
<b>Justification for nature of course</b>	Aim is to improve the quality and productivity of system analysis of design by making it more usable.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. “Object Oriented Analysis and Design with Applications”, Grady Booch, Second Edition, Pearson Education.</li> <li>2. “Object-Oriented Programming with ANSI &amp; Turbo C++”, Ashok N. Kamthane ,First Indian Print -2003, Pearson Education.</li> </ol>
<b>Reference Book(s)</b>	Balagurusamy “ Object Oriented Programming with C++”,TMH,SecondEdition,2003.
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://online.courses.nptel.ac.in/noc19_cs48/preview">https://online.courses.nptel.ac.in/noc19_cs48/preview</a></li> <li>2. <a href="https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/">https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/</a></li> <li>3. <a href="https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm">https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm</a></li> </ol>

## COURSE OUTCOMES

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

CO	COURSE OUTCOME	K-level
CO1	Understand the concept of Object-Oriented development and modeling techniques	Up to K2
CO2	Gain knowledge about the various steps performed during object design	Up to K3
CO3	Abstract object-based views for generic software systems	Up to K3
CO4	Link OOAD with C++ language	Up to K4
CO5	Apply the basic concept of OOPs and familiarize to write C++ program	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	2	3	2	3	3	1	2	2
CLO2	3	3	3	2	3	2	3	2	1	2	2
CLO3	3	3	3	2	3	2	3	2	1	2	2
CLO4	3	3	3	2	3	2	3	2	1	2	2
CLO5	3	3	3	2	3	2	2	3	1	2	2

**Course Designer:** Prof. M Ashok Kumar

**Blue Print for Summative Examination – Object Oriented Analysis and Design & C++  
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels**

K Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D(Open Choice)	Total Marks	% of Marks	Consolidated %
K1	2	4	10	-	16	13.33	<b>13</b>
K2	2	4	10	10	26	21.67	<b>22</b>
K3	4	2	10	20	36	30	<b>30</b>
K4	2	-	20	20	42	35	<b>35</b>
Total Marks	10	10	50	50	120	100	<b>100</b>

<b>Title of the Course</b>		<b>ALGORITHM AND OOPS LAB</b>					
<b>TANSICHE Course type</b>		<b>CCP</b>					
<b>Course Category</b>		<b>Core Practical 1</b>					
<b>Nature of Course</b>		<b>Employability / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	<b>4</b>	<b>Course Code</b>	<b>23P1DCCP1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
				2		4	6
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basic Programming of C++ language					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• This course covers the basic data structures like Stack, Queue, Tree, List.</li> <li>• This course enables the students to learn the applications of the data structures using various techniques.</li> <li>• It also enable the students to understand C++ language with respect to OOAD concepts.</li> <li>• Application of OOPS concepts.</li> </ul>					
<b>Course Outline</b>		<ol style="list-style-type: none"> <li>1. Write a program to solve the tower of Hanoi using recursion.</li> <li>2. Write a program to traverse through binary search tree using traversals.</li> <li>3. Write a program to perform various operations on stack using linked list.</li> <li>4. Write a program to perform various operation in circular queue.</li> <li>5. Write a program to sort an array of an elements using quick sort.</li> <li>6. Write a program to solve number of elements in ascending order using heap sort.</li> <li>7. Write a program to solve the knapsack problem using greedy method</li> <li>8. Write a program to search for an element in a tree using divide &amp; conquer strategy.</li> <li>9. Write a program to place the 8 queens on an 8X8 matrix so that no two queens Attack.</li> <li>10. Write a C++ program to perform Virtual Function</li> <li>11. Write a C++ program to perform Parameterized constructor</li> <li>12. Write a C++ program to perform Friend Function</li> <li>13. Write a C++ program to perform Function Overloading</li> <li>14. Write a C++ program to perform Single Inheritance</li> <li>15. Write a C++ program to perform Employee Details using files.</li> </ol>					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		<p>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)</p>					

<b>Skills acquired from this course</b>	Developing logic and structured program, organizing data in software development.
<b>Justification for nature of course</b>	Discover the algorithm characteristics in order to evaluate its suitability for various applications or compare it with other algorithms for the same application.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Goodrich, "Data Structures &amp; Algorithms in Java", Wiley 3rd edition.</li> <li>2. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Anany Levith, "Introduction to the Design and Analysis of algorithm", Pearson Education Asia, 2003.</li> <li>2. Robert Sedgewick, Philippe Flajolet, "An Introduction to the Analysis of Algorithms", Addison-Wesley Publishing Company, 1996.</li> <li>3. Introduction to design and Analysis of Algorithms - S.E. Goodman, ST. Hedetniem- TMH.</li> <li>4. Carlos A. Coello Coello, Gary B. Lamont, David A. Van Veldhuizen, "Evolutionary Algorithms for Solving Multi-Objective Problems", Springer 2nd Edition, 2007.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://onlinecourses.nptel.ac.in/noc19_cs48/preview">https://onlinecourses.nptel.ac.in/noc19_cs48/preview</a></li> <li>2. <a href="https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/">https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/</a></li> <li>3. <a href="https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm">https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOMES	K-level
CO1	Understand the concepts of object oriented with respect to C++	Up to K2
CO2	Understand the concepts of object oriented with respect to C++	Up to K4
CO3	Able to understand and implement OOPS concepts	Up to K3
CO4	Implementation of data structures like Stack, Queue, Tree, List using C++	Up to K3
CO5	Application of the data structures for Sorting, Searching using different techniques.	Up to K4

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

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

**Course Designer:** Prof. K. Rajasaravanakumar

<b>Title of the Course</b>		<b>PYTHON PROGRAMMING</b>					
<b>TANSCHÉ Course type</b>		<b>EC1(A)</b>					
<b>Course Category</b>		<b>Elective</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>3</b>	<b>Course Code</b>	<b>23P1DECT1</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		3		2		-	5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basics of any OOPs Programming Language					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Presents an introduction to Python, creation of web applications,</li> <li>• network applications and working in the clouds.</li> <li>• Use functions for structuring Python programs.</li> <li>• Understand different Data Structures of Python.</li> <li>• Represent compound data using Python lists, tuples and dictionaries.</li> <li>• To learn how to create applications using Web Services and APIs</li> <li>• Socket Programs and Remote Processing.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: INTRODUCTION: Python:</b> Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets– Comparison.					
		<b>Unit II: CODE STRUCTURES: Code Structures:</b> if, elif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.					
		<b>Unit III: MODULES, PACKAGES AND CLASSES: Modules, Packages, and Programs:</b> Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. <b>Objects and Classes:</b> Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent with super–In self Defense –Get and Set Attribute Values with Properties –Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.					
		<b>Unit IV: DATA TYPES AND WEB: Data Types:</b> Text Strings– Binary Data. <b>Storing and Retrieving Data:</b> File Input/Output– Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores. <b>Web:</b> Web Clients –Web Servers–Web Services and Automation					

	<b>Unit V: SYSTEMS AND NETWORKS: Systems:</b> Files–Directories–Programs and Processes–Calendars and Clocks. <b>Concurrency:</b> Queues– Processes–Threads–Green Threads and g event–twisted–Redis. <b>Networks:</b> Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – Zero MQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and Map Reduce – Working in the Clouds.
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Expertise in core python, sound knowledge of web frameworks.
<b>Justification for nature of course</b>	Develop wide variety of applications including web applications, software and Game development, Network programming, GUI, Scientific and Numeric applications.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Bill Lubanovic, “Introducing Python”, O’Reilly, First Edition-Second Release, 2014.</li> <li>2. Mark Lutz, “Learning Python”, O’Reilly, Fifth Edition, 2013.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. David M. Beazley, “Python Essential Reference”, Developers Library, Fourth Edition, 2009.</li> <li>2. Sheetal Taneja, Naveen Kumar, “Python Programming – A Modular Approach”, Pearson Publications.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.programiz.com/python-programming/">https://www.programiz.com/python-programming/</a></li> <li>2. <a href="https://www.tutorialspoint.com/python/index.htm">https://www.tutorialspoint.com/python/index.htm</a></li> <li>3. <a href="https://onlinecourses.swayam2.ac.in/aic20_sp33/preview">https://onlinecourses.swayam2.ac.in/aic20_sp33/preview</a></li> </ol>

## COURSE OUTCOME

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

CO	COURSE OUTCOME	K-level
CO1	Understand the basic concepts of Python Programming	Up to K2
CO2	Understand File operations, Classes and Objects	Up to K3
CO3	Acquire Object Oriented Skills in Python	Up to K3
CO4	Develop web applications using Python	Up to K4
CO5	Develop Client Server Networking applications	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	4	5
<b>CLO1</b>	3	3	2	3	3	3	3	2	2	2	3
<b>CLO2</b>	3	3	3	3	3	3	3	2	2	2	3
<b>CLO3</b>	3	3	3	3	3	3	3	2	2	2	3
<b>CLO4</b>	3	3	3	3	3	3	3	2	2	2	3
<b>CLO5</b>	3	3	3	3	3	3	3	2	2	2	3

**Course Designer:** Prof. S. Sasikala

### Blue Print for Summative Examination – Python Programming Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S.No	CLOs	K - Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K - Level		
1	CLO1	Up to K2	2	K1 & K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
3	CLO3	Up to K3	2	K2 & K3	1	K2	2(K3&K3)	1(K3)
4	CLO4	Up to K4	2	K3 & K4	1	K2	2(K4&K4)	1(K4)
5	CLO5	Up to 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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

### Distribution of Section – wise Marks with K Levels

K – Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or Choice)	Section D ( Open Choice )	Total Marks	% of Marks without choice	Consolidated %
<b>K1</b>	2	4	10	-	<b>16</b>	13.33	<b>13</b>
<b>K2</b>	2	4	10	10	<b>26</b>	21.67	<b>22</b>
<b>K3</b>	4	2	10	20	<b>36</b>	30	<b>30</b>
<b>K4</b>	2	-	20	10	<b>32</b>	26.67	<b>27</b>
<b>K5</b>	-	-	-	10	<b>10</b>	8.33	<b>8</b>
<b>Total Marks</b>	10	10	50	50	<b>120</b>	100	<b>100%</b>

<b>Title of the Course</b>		<b>WEB SERVICES</b>					
<b>TANSICHE Course type</b>		<b>EC1(B)</b>					
<b>Course Category</b>		<b>Elective</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P1DECT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		3		2		-	5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basics of Distributed Computing					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Present the Web Services, Building real world Enterprise applications using Web Services with Technologies XML, SOAP , WSDL , UDDI</li> <li>• Get overview of Distributed Computing, XML, and its technologies</li> <li>• Update with QoS and its features</li> <li>• Develop Standards and future of Web Services.</li> <li>• Create web applications that invoke web service methods.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: INTRODUCTION:</b> Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.					
		<b>Unit II: XML FUNDAMENTALS:</b> XML Fundamentals–XML documents-XML Namespaces-XML Schema–Processing XML.					
		<b>Unit III: SOAP MODEL:</b> SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure- interface definitions-bindings-services-Using SOAP and WSDL. <b>UDDI:</b> About UDDI- UDDI registry Specification- Core data structures-Accessing UDDI.					
		<b>Unit IV: TECHNOLOGIES AND STANDARDS:</b> Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. <b>Workflow:</b> business process management- workflows and workflow management systems Security: Basics-data handling and forwarding- data storage-errors-Web services security issues.					
		<b>Unit V: QUALITY OF SERVICE:</b> Quality of Service: Importance of QoS for web services - QoS metrics-holes-design patterns - QoS enabled web services - QoS enabled applications. Web services management-web services standards and future trends.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	To Develop Standards and future of Web Services
<b>Justification for nature of course</b>	Develop wide variety of applications including web applications, software and Game development, GUI.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services: An Architects Guide”, Prentice Hall, Nov 2003.</li> <li>2. Keith Ballinger, “NET Web services: Architecture and Implementation with .Net”, Pearson Education, First Edition, Feb 2003.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. RameshNagappan, “DevelopingJavaWebServices:Architectinganddevelopingsecure Web Services Using Java”, John Wiley and Sons, first Edition Feb 2003.</li> <li>2. EricAMarksandMarkJWerrell, “ExecutiveGuidetoWebservices”, John Wileyand sons, March 2003.</li> <li>3. AnneThomas Manes, “Web Services : Amanagers Guide”, Addison Wesley, June 2003.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.tutorialspoint.com/webservices/index.htm">https://www.tutorialspoint.com/webservices/index.htm</a></li> <li>2. <a href="https://www.javatpoint.com/web-services-tutorial">https://www.javatpoint.com/web-services-tutorial</a></li> <li>3. <a href="https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html">https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html</a></li> </ol>

## COURSE OUTCOME

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

CO	COURSE OUTCOME	K-level
CO1	Understand web services and its related technologies	Up to K2
CO2	Understand XML concepts	Up to K3
CO3	Analyze on SOAP and UDDI model	Up to K3
CO4	Demonstrate the road map for the standards and future of web services	Up to K4
CO5	Analyze QoS enabled applications in web services	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	4	5
CLO1	3	3	3	2	2	3	3	2	2	2	3
CLO2	3	3	3	2	2	3	3	2	2	2	3
CLO3	3	3	3	3	3	3	3	2	2	2	3
CLO4	3	3	3	3	3	3	3	2	2	2	3
CLO5	3	3	3	3	3	3	3	2	2	2	3

Course Designer: Prof. K. Vairameenakshi

### Blue Print for Summative Examination – Web Seivces

#### 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 Answer			
			No. of Questions	K – Level	No. of Questions	K - Level		
1	CLO1	Up to K2	2	K1& K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
3	CLO3	Up to K3	2	K2 & K3	1	K2	2(K3&K3)	1(K3)
4	CLO4	Up to K4	2	K3 & K4	1	K2	2(K4&K4)	1(K4)
5	CLO5	Up to 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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

#### Distribution of Section – wise Marks with K Levels

K – Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or Choice)	Section D ( Open Choice )	Total Marks	% of Marks without choice	Consolidated %
<b>K1</b>	2	4	10	-	<b>16</b>	13.33	<b>13</b>
<b>K2</b>	2	4	10	10	<b>26</b>	21.67	<b>22</b>
<b>K3</b>	4	2	10	20	<b>36</b>	30	<b>30</b>
<b>K4</b>	2	-	20	10	<b>32</b>	26.67	<b>27</b>
<b>K5</b>	-	-	-	10	<b>10</b>	8.33	<b>8</b>
<b>Total Marks</b>	10	10	50	50	<b>120</b>	100	<b>100%</b>

<b>Title of the Course</b>		<b>ADVANCED SOFTWARE ENGINEERING</b>					
<b>TANSICHE Course type</b>		<b>EC2(A)</b>					
<b>Course Category</b>		<b>Elective</b>					
<b>Nature of Course</b>		<b>Employability, Skill Development</b>					
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P1DECT2</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		1		-	5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Basics of Software Engineering & SPM					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Introduce to Software Engineering, Design, Testing and Maintenance.</li> <li>• To apply simplex methods and its variants to solve the variety of Complex problems.</li> <li>• To acquire the benefits of allocating works using Transportation &amp; Assignment problems.</li> <li>• Acquire skills and knowledge to support professional pathway, communication, analytic and technical skill.</li> <li>• Capable of diverse team and organizational leadership in computing project settings.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I: INTRODUCTION:</b> Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.</p>					
		<p><b>Unit II: SOFTWARE REQUIREMENTS:</b> Software Requirements Analysis and Specification : Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management –Software Quality, Software Quality Management System, ISO 9000, SEI CMM.</p>					
		<p><b>Unit III: PROJECT MANAGEMENT:</b> Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead’s software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.</p>					

	<p><b>Unit IV: SOFTWARE DESIGN:</b> Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.</p> <p><b>Unit V: SOFTWARE TESTING:</b> Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging–Testing tools-Metrics-Reliability Estimation. Software Maintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Ability to function effectively on a team whose members together provide leadership and create a collaborative an inclusive environment establish goals, plan tasks and meet objectives.
<b>Justification for nature of course</b>	Ability to use the techniques, skills and modern engineering tools and processes necessary for software engineering practices.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. An Integrated Approach to Software Engineering–Pankaj Jalote, Narosa Publishing House, Delhi, 3rd Edition.</li> <li>2. Fundamentals of Software Engineering –Rajib Mall, PHI Publication,3<sup>rd</sup> Edition.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Software Engineering–K.K. Aggarwaland Yogesh Singh, New Age International Publishers, 3rd edition.</li> <li>2. A Practitioners Approach-Software Engineering,-R.S.Pressman, McGraw Hill.</li> <li>3. Fundamentals of Software Engineering Carlo Ghezzi,</li> <li>4. M. Jarayeri, D. Manodrioli, PHI Publication.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.javatpoint.com/software-engineering-tutorial">https://www.javatpoint.com/software-engineering-tutorial</a></li> <li>2. <a href="https://www.geeksforgeeks.org/software-engineering/">https://www.geeksforgeeks.org/software-engineering/</a></li> <li>3. <a href="https://www.tutorialspoint.com/software_engineering/index.htm">https://www.tutorialspoint.com/software_engineering/index.htm</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-level
CO1	Understand about Software Engineering process	Up to K2
CO2	Understand about Software project management skills, design and quality management	Up to K3
CO3	Analyze on Software Requirements and Specification	Up to K4
CO4	Analyze on Software Testing, Maintenance and Software Re-Engineering	Up to K3
CO5	Design and conduct various types and levels of software quality for a software project	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	2	3	3	3	3	2	2	2	3
CLO2	3	3	3	3	3	3	3	2	2	2	3
CLO3	3	3	3	3	3	3	3	2	2	2	3
CLO4	3	3	3	3	3	3	3	2	2	2	3
CLO5	3	3	3	3	3	3	3	2	2	2	3

Course Designer: Prof. K. Imaya

**Blue Print for Summative Examination - ADVANCED SOFTWARE ENGINEERING  
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

S.No	CLOs	K - Level	Section A		Section B		Section C (Either / or Choice)	SectionD (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K - Level		
1	CLO1	Up to K2	2	K1& K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
3	CLO3	Up to K3	2	K2 & K4	1	K2	2(K4&K4)	1(K4)
4	CLO4	Up to K4	2	K3 & K3	1	K2	2(K3&K3)	1(K3)
5	CLO5	Up to K5	2	K3 & K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels**

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated
<b>K1</b>	2	4	10	-	<b>16</b>	13.33	<b>13</b>
<b>K2</b>	2	4	10	10	<b>26</b>	21.67	<b>22</b>
<b>K3</b>	4	2	10	20	<b>36</b>	30.00	<b>30</b>
<b>K4</b>	2	-	20	20	<b>42</b>	35	<b>35</b>
<b>Total Marks</b>	10	10	50	50	<b>120</b>	100	<b>100%</b>

<b>Title of the Course</b>		<b>CRITICAL THINKING, DESIGN THINKING AND PROBLEM SOLVING</b>					
<b>TANSICHE Course type</b>		<b>EC2(B)</b>					
<b>Course Category</b>		<b>Skill Enhancement Course</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P1DECT2</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		1		-	5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basics of Logical & Reasoning Skills					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Learn critical thinking and its related concepts</li> <li>• Learn design thinking and its related concepts</li> <li>• Develop Thinking patterns, Problem solving &amp; Reasoning</li> <li>• To understand the concept of Team Management</li> <li>• To understand and to know of the basic problem solving strategies.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I: CRITICAL THINKING:</b> Critical Thinking: Definition, Conclusions and Decisions, Beliefs and Claims, Evidence –finding, evaluation, Inferences, Facts – opinion, probable truth, probably false, Venn diagram. Applied critical thinking: Inference, Explanation, Evidence, Credibility, Two Case Studies, critical thinking and science, critical evaluation, self assessment.</p> <p><b>Unit II: DESIGN THINKING:</b> Design Thinking: Introduction, Need of Design Thinking, problem to question - design thinking process, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, problem exploration, Stake holder assessment, design thinking for manufacturers, smart Idea to implementation</p> <p><b>Unit III: CASE STUDY:</b> Thinking to confidence, fear management, duty Vs passion, Team management, Tools for Thinking, prototype design, Relevance of Design and Design Thinking in engineering, human centered design, case study: apply design thinking in problem.</p>					
		<p><b>Unit IV: PROBLEM SOLVING:</b> Problem solving: problem definition, problem solving methods, selecting and using information, data processing, solution methods, solving problems by searching, recognizing patterns, spatial reasoning, necessity and sufficiency, choosing and using models, making choices and decisions.</p>					
		<p><b>Unit V: REASONING:</b> Reasoning: Deductive and hypothetical reasoning, computational problem solving; generating, implementing, and evaluating solutions, interpersonal problem solving. Advanced problem solving: Combining skills – using imagination, developing models, Carrying out investigations, Data analysis and inference. Graphical methods of solution, Probability, tree diagrams and decision trees</p>					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Problem-solving skills are the ability to identify problems, analyse, research, decision making and implement the best solutions
<b>Justification for nature of course</b>	It enables the development of pupil's natural ability to think logically, solve puzzles and apply these skills to real-life problems.
<b>Text Book</b>	<ol style="list-style-type: none"> <li>1. John Butter worth and Geoff Thwaites, Thinking skills: Critical Thinking and Problem Solving, Cambridge University Press, 2013.</li> <li>2. H.S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, 2<sup>nd</sup> edition, Pearson, Upper Saddle River, NJ, 2008.</li> </ol>
<b>Reference Book</b>	<ol style="list-style-type: none"> <li>1. A Whimbey and J. Lochhead, Problem Solving &amp; Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.</li> <li>2. M. Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994.</li> <li>3. Michael Baker, The Basic of Critical Thinking, The Critical Thinking Copress, 2015.</li> <li>4. David Kelley and Tom Kelley, Creative Confidence, 2013.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.tutorialspoint.com/critical_thinking/index.htm">https://www.tutorialspoint.com/critical_thinking/index.htm</a></li> <li>2. <a href="https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm">https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm</a></li> <li>3. <a href="https://nptel.ac.in/courses/109/104/109104109/">https://nptel.ac.in/courses/109/104/109104109/</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-Level
CO1	Understand the concepts of Critical thinking and its related technology	Up to K2
CO2	Focus on the explicit development of critical thinking and problem solving skills	Up to K3
CO3	Apply design thinking in problems	Up to K3
CO4	Make a decision and take actions based on analysis	Up to K4
CO5	Analyze the concepts of Thinking patterns, Problem solving & Reasoning in real time applications	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
<b>CLO1</b>	3	3	2	3	3	3	3	1	1	1	1
<b>CLO2</b>	3	3	2	3	3	3	2	2	1	2	2
<b>CLO3</b>	3	3	2	3	3	3	2	2	1	1	2
<b>CLO4</b>	3	3	3	3	3	3	3	3	2	2	2
<b>CLO5</b>	3	3	3	3	3	3	3	3	2	2	2

**Course Designer:** Prof. R. Tamil Selvi

### Blue Print for Summative Examination – Critical Thinking, Design Thinking And Problem Solving 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 Answer			
			No. of Questions	K – Level	No. of Questions	K - Level		
1	CLO1	Up to K2	2	K1 & K2	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
3	CLO3	Up to K3	2	K2 & K3	1	K2	2(K3&K3)	1(K3)
4	CLO4	Up to K4	2	K3 & K4	1	K2	2(K4&K4)	1(K4)
5	CLO5	Up to K4	2	K3 & K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

### Distribution of Section – wise Marks with K Levels

K – Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or Choice)	Section D ( Open Choice )	Total Marks	% of Marks without choice	Consolidated %
<b>K1</b>	2	4	10	-	16	13.33	<b>13</b>
<b>K2</b>	2	4	10	10	26	21.67	<b>22</b>
<b>K3</b>	4	2	10	20	36	30	<b>30</b>
<b>K4</b>	2	-	20	20	42	35	<b>35</b>
<b>K5</b>	-	-	-	-	-	-	<b>-</b>
<b>Total Marks</b>	10	10	50	50	120	100	<b>100%</b>

<b>Title of the Course</b>		<b>R PROGRAMMING</b>					
<b>TANSICHE Course type</b>		<b>SEC1</b>					
<b>Course Category</b>		<b>Skill Enhancement Course</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	<b>23P1DSED1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		1		1		-	2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Knowledge in Basic Programming					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To understand the basics in R programming in terms of constructs, control statements, string functions.</li> <li>• To familiar with the concepts of Matrices, Arrays and Lists.</li> <li>• To learn to apply R programming for Text processing.</li> <li>• To understand the use of R Big Data analytics.</li> <li>• To able to appreciate and apply the R programming from a statistical perspective.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: INTRODUCING TO R:</b> R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorized if-then else – Vector Equality – Vector Element names.					
		<b>Unit II: MATRICES, ARRAYS AND LISTS:</b> Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.					
		<b>Unit III: DATA FRAMES:</b> Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions					
		<b>Unit IV: CONTROL STATEMENTS, FUNCTIONS, R GRAHS:</b> Control statements – Arithmetic and Boolean operators and values – Default values for arguments -Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs – Recursion – Replacement functions – Tools for composing function code – Math and Simulations in RCreating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots.					
		<b>Unit V: INTERFACING:</b> Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linearmodels – Non-linear models – Time Series and Auto-correlation – Clustering.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Build & Work With Functions in R. Explain why we should divide programs into small, single-purpose functions.
<b>Justification for nature of course</b>	R is mainly used when the data analysis tasks require standalone computing or analysis on individual servers. The language is pretty handy for data analysis due to its high number of packages and readily usable tests.
<b>Text Book(s)</b>	1. Norman Matoff, “The Art of R Programming: A Tour of Statistical Software Design”, NoStarch Press, 2011.
<b>Reference Book(s)</b>	1. Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Addison-Wesley Data & Analytics Series, 2013. 2. Mark Gardener, “Beginning R – The Statistical Programming Language”, Wiley, 2013. 3. Robert I. Kabacoff, “Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R”, Amazon Digital South Asia Services Inc, 2013.
<b>Websites and e-Learning resources</b>	1. <a href="https://elearningindustry.com/applications-r-programming">https://elearningindustry.com/applications-r-programming</a> 2. <a href="https://www.tutorialspoint.com/r/index.htm">https://www.tutorialspoint.com/r/index.htm</a> 3. <a href="https://www.tutorialspoint.com/r/r_basic_syntax.htm">https://www.tutorialspoint.com/r/r_basic_syntax.htm</a>

## COURSE OUTCOMES

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

CO	COURSE OUTCOME	K-level
CO1	Outline artful graphs to visualize complex data sets and functions	Up to K2
CO2	Construct more efficient code using parallel R and vectorization	Up to K3
CO3	Experiment with R with C/C++ and Python for increased speed or functionality.	Up to K3
CO4	Classify new packages for text analysis, image manipulation, and perform statistical analysis of the same	Up to K4
CO5	Correlate interfacing R to other Languages	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	1	2	1	1	1	2	1	2	2	2
CLO2	3	3	2	3	1	1	2	1	3	2	2
CLO3	2	2	2	3	2	2	3	2	3	3	3
CLO4	2	2	3	3	2	3	3	2	3	3	3
CLO5	2	2	3	3	2	2	3	2	3	3	3

Course Designer: Prof. S. Rajalakshmi

**Blue Print for Summative Examination – R Programming**  
**Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels**

K – Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or Choice)	Section D ( Open Choice )	Total Marks	% of Marks without choice	Consolidated %
<b>K1</b>	2	4	10	-	16	13.33	<b>13</b>
<b>K2</b>	2	4	10	10	26	21.67	<b>22</b>
<b>K3</b>	4	2	10	20	36	30	<b>30</b>
<b>K4</b>	2	-	20	20	42	35	<b>35</b>
<b>K5</b>	-	-	-	-	-	-	-
<b>Total Marks</b>	10	10	50	50	120	100	<b>100%</b>

<b>Title of the Course</b>		<b>DATA MINING AND WAREHOUSING</b>					
<b>TANSICHE Course type</b>		<b>CC3</b>					
<b>Course Category</b>		<b>Core</b>					
<b>Nature of Course</b>		<b>Employability, Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23P2DCCT3</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		2			6
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basics of RDBMS & Algorithms					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.</li> <li>• Develop skills of using recent data mining software for solving practical problems.</li> <li>• Develop and apply critical thinking, problem-solving, and decision-making skills.</li> <li>• Develop Skill in selecting the appropriate data mining algorithms for solving Practical Problems.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I: BASICS AND TECHNIQUES:</b> Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective. Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.</p> <p><b>Unit II: ALGORITHMS Classification :</b> Introduction –Statistical –based algorithms -distance–based algorithms-decision tree-based algorithms-neural network–based algorithms–rule-based algorithms–combining techniques.</p> <p><b>Unit III: CLUSTERING AND ASSOCIATION</b> Clustering: Introduction– Similarity and Distance Measures–Outliers–Hierarchical Algorithms-Partitional Algorithms. <b>Association rules:</b> Introduction - large item sets - basic algorithms – parallel &amp; distributed algorithms – comparing approaches-incremental rules – advanced association rules techniques – measuring the quality of rules.</p>					
		<p><b>Unit IV: DATAWARE HOUSING AND MODELING:</b> Data ware housing: introduction –characteristics of a data ware house–data marts–other aspects of data mart. Online analytical processing: Introduction –OLTP &amp; OLAP systems Data modeling –star schema for multidimensional view –data modeling – multifact star schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.</p>					

	<p><b>Unit V: APPLICATIONS OF DATA WAREHOUSE:</b> Developing a data WAREHOUSE: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse.</p> <p>Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	<p>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)</p>
<b>Skills acquired from this course</b>	To understand the functionality of the various data mining and data warehousing Component.
<b>Justification for nature of course</b>	Describe the designing of data warehousing so that it can be able to solve the root problems
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Margaret H.Dunham,“Data Mining:Introductory and Advanced Topics”, Pearson education,2003.</li> <li>2. C.S.R. Prabhu, “Data Warehousing Concepts, Techniques, Products and Applications”, PHI, Second Edition.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Arun K. Pujari , “Data Mining Techniques”, Universities Press(India)Pvt. Ltd</li> <li>2. Alex Berson , Stephen J . Smith,“ Data Warehousing, Data Mining and OLAP”, TMCH, 2001.</li> <li>3. Jiawei Han &amp; Micheline Kamber, “Data Mining Concept &amp; Techniques”. Academic press.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.javatpoint.com/data-warehouse">https://www.javatpoint.com/data-warehouse</a></li> <li>2. <a href="https://www.geeksforgeeks.org/data-mining/">https://www.geeksforgeeks.org/data-mining/</a></li> <li>3. <a href="https://www.tutorialspoint.com/data_mining/dm_cluster_analysis.htm">https://www.tutorialspoint.com/data_mining/dm_cluster_analysis.htm</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-level
CO1	Understand the basic data mining techniques and algorithms	Up to K2
CO2	Understand the Association rules, Clustering techniques and Data warehousing contents	Up to K4
CO3	Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining	Up to K3
CO4	Design data warehouse with dimensional modeling and apply OLAP operations	Up to K3
CO5	Identify appropriate data mining algorithms to solve real world problems	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	2	3	3	3	3	3	2	2	2	3
CLO2	3	3	3	3	3	3	3	2	2	2	3
CLO3	3	3	3	3	3	3	3	2	2	2	3
CLO4	3	3	3	3	3	3	3	2	2	2	3
CLO5	3	3	3	3	3	3	3	2	2	2	3

Course Designer: Prof. S. Sasikala

**Summative - Blue Print – Model for DATA MINING AND WAREHOUSING  
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	CLO1	Up to K2	2	K1& K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K4	2	K3& K4	1	K2	2(K4&K4)	1(K4)
3	CLO3	Up to K3	2	K2& K3	1	K1	2(K2&K2)	1(K3)
4	CLO4	Up to K3	2	K2& K3	1	K2	2(K3&K3)	1(K3)
5	CLO5	Up to K4	2	K3& K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels \***

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	SectionD(Open Choice)	Total Marks	% of Marks	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
Total Marks	10	10	50	50	120	100	100

<b>Title of the Course</b>		<b>ADVANCED JAVA PROGRAMMING</b>					
<b>TANSICHE Course type</b>		<b>CC4</b>					
<b>Course Category</b>		<b>Core</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	<b>23P2DCCT4</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		2			6
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Knowledge required in various programming languages					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Enable the students to learn the basic functions, principles and concepts of advanced java programming.</li> <li>• Provide knowledge on concepts needed for distributed Application Architecture.</li> <li>• Learn JDBC, Servlet packages, JQuery, Java Server Pages and JAR file format.</li> <li>• Develop error-free, well-documented Java programs.</li> <li>• Develop and test Java network, search engine, and web framework programs.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: BASICS OF JAVA:</b> Java Basics Review :Components and event handling– Threading concepts–Networking features – Media techniques					
		<b>Unit II: REMOTE METHOD INVOCATION :</b> Remote Method Invocation-Distributed Application Architecture- Creating stubs and skeletons- Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces					
		<b>Unit III: DATABASE:</b> Java in Databases-JDBC principles–database access-Interacting–database search–Creating multimedia databases – Database support in web applications.					
		<b>Unit IV: SERVLETS:</b> Java Servlets : Java Servlet and CGI programming- A simple java Servlet -Anatomy of a java Servlet – Reading data from a client-Reading http request header-sending data to a client and writing the http response header-working with cookies. Java Server Pages: JSP Overview-Installation-JSP tags-Components of a JSP page-Expressions- Scriptlets-Directives-Declarations-A complete example					
		<b>Unit V: ADVANCED TECHNIQUES:</b> JAR file format creation– Internationalization–Swing Programming–Advanced java					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					

<b>Skills acquired from this course</b>	Learn how to write, test, and debug advanced-level Object-Oriented programs using Java.
<b>Justification for nature of course</b>	This course is designed to teach the student how to write, test, and debug advanced-level Object-Oriented programs using Java with a heavy emphasis toward network and web programming..
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Jamie Jaworski, "Java Unleashed", SAMS Techmedia Publications, 1999.</li> <li>2. Campione, Walrath and Huml, "The Java Tutorial", Addison Wesley, 1999</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. A Jim Keogh, "The Complete Reference J2EE", Tata Mc Graw Hill Publishing Company Ltd, 2010.</li> <li>2. David Sawyer McFarland, "Java Script And J Query-The Missing Manual", O'Reilly Publications, 3rd Edition, 2011.</li> <li>3. Deitel and Deitel, "Java How to Program ", Third Edition, PHI/ Pearson Education Asia.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.javatpoint.com/servlet-tutorial">https://www.javatpoint.com/servlet-tutorial</a></li> <li>2. <a href="https://www.tutorialspoint.com/java/index.htm">https://www.tutorialspoint.com/java/index.htm</a></li> <li>3. <a href="https://onlinecourses.nptel.ac.in/noc19_cs84/preview">https://onlinecourses.nptel.ac.in/noc19_cs84/preview</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-level
CO1	Understand the advanced concepts of Java Programming	Up to K2
CO2	Understand JDBC and RMI concepts	Up to K4
CO3	Apply and analyze Java in Database	Up to K3
CO4	Handle different event in java using the delegation event model, event listener and class	Up to K3
CO5	Design interactive applications using Java Servlet, JSP and JDBC	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	2	2	2	1	1
CLO2	3	3	3	3	3	3	3	3	2	2	2
CLO3	3	3	3	3	3	3	2	2	2	2	2
CLO4	3	3	3	3	3	3	2	2	2	1	1
CLO5	3	3	3	3	3	3	3	3	2	2	2

Course Designer: Prof. S. Rajalakshmi

**Summative - Blue Print – Model for Advanced Java Programming  
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels \***

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	SectionD(Open Choice)	Total Marks	% of Marks	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
Total Marks	10	10	50	50	120	100	100

<b>Title of the Course</b>		<b>Advanced Java &amp; Data mining Lab Using R</b>					
<b>TANSCHÉ Course type</b>		<b>CCP</b>					
<b>Course Category</b>		<b>Core Practical 2</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	<b>23P2DCCP2</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
				2		4	6
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		50		50			100
<b>Pre-requisite(s)</b>		Basics of DM Algorithms & R Programming & Basics in Java Programming					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To introduce JDBC and navigation of records</li> <li>• To understand RMI &amp; its implementation</li> <li>• To enable the students to learn the concepts of Data Mining algorithms namely classification, clustering, regression.</li> <li>• To understand &amp; write programs using the DM algorithms.</li> <li>• To apply statistical interpretations for the solutions.</li> </ul>					
<b>Course Outline</b>		<ol style="list-style-type: none"> <li>1. Display a welcome message using Servlet.</li> <li>2. Design a Purchase Order form using Html form and Servlet.</li> <li>3. Develop a program for calculating the percentage of marks of a student using JSP.</li> <li>4. Design a Purchase Order form using Html form and JSP.</li> <li>5. Prepare a Employee pay slip using JSP.</li> <li>6. Write a program using JDBC for creating a table, Inserting, Deleting records and list out the records.</li> <li>7. Write a program using Java servlet to handle form data.</li> <li>8. Write a simple Servlet program to create table of all the header si t receives along with their associated values.</li> <li>9. Write a program in JSP by using session object.</li> <li>10. Write a program to build a simple Client Server application using RMI.</li> <li>11. Create an applet for a calculator application.</li> <li>12. Program to send a text message to another system and receive the text message from the system (use socket programming).</li> <li>13. Implement Apriori algorithm to extract association rule of data mining.</li> <li>14. Implement k-means clustering technique.</li> <li>15. Implement any one Hierarchal Clustering.</li> <li>16. Implement Classification algorithm.</li> <li>17. Implement Decision Tree.</li> <li>18. Linear Regression.</li> <li>19. Data Visualization</li> </ol>					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	<ul style="list-style-type: none"> <li>• To Design and Develop Program using R and Advanced JAVA</li> </ul>
<b>Justification for nature of course</b>	<ol style="list-style-type: none"> <li>1. This course is designed to teach the student how to write, test, and debug advanced-level Object-Oriented programs using Java with a heavy emphasis toward network and web programming</li> <li>2. R is a popular programming language for data analysis and statistical computing and is well-suited for data mining tasks.</li> </ol>
<b>Text Book</b>	<ol style="list-style-type: none"> <li>1. Jamie Jaworski,“Java Unleashed”,SAMS Tech media Publications,1999</li> <li>2. Campione,Walrath and Huml,“The Java Tutoria l”,Addison Wesley,1999</li> <li>3. Margaret H.Dunham,“ Data Mining: Introductory and Advanced Topics”, Pearson education,2003.</li> <li>4. C.S.R. Prabhu, “Data Warehousing Concepts, Techniques, Products and Applications”, PHI, Second Edition.</li> </ol>
<b>Reference Book</b>	<ol style="list-style-type: none"> <li>1. A Jim Keogh, ”The Complete Reference J2EE”,Tata Mc Graw Hill Publishing Company Ltd, 2010.</li> <li>2. David Sawyer McFarland, “Java Script And J Query-The Missing Manual”, Oreilly Publications, 3rd Edition,2011.</li> <li>3. Deitel and Deitel, “Java How to Program ”,Third Edition, PHI/ Pearson Education Asia.</li> <li>4. Arun K. Pujari , “Data Mining Techniques”, Universities Press(India)Pvt. Ltd</li> <li>5. Alex Berson , Stephen J . Smith,“ Data Warehousing, Data Mining and OLAP”, TMCH, 2001.</li> <li>6. Jiawei Han &amp; Micheline Kamber, “Data Mining Concept &amp; Techniques”. Academic press.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.javatpoint.com/servlet-tutorial">https://www.javatpoint.com/servlet-tutorial</a></li> <li>2. <a href="https://www.tutorialspoint.com/java/index.htm">https://www.tutorialspoint.com/java/index.htm</a></li> <li>3. <a href="https://onlinecourses.nptel.ac.in/noc19_cs84/preview">https://onlinecourses.nptel.ac.in/noc19_cs84/preview</a></li> <li>4. <a href="https://www.javatpoint.com/data-warehouse">https://www.javatpoint.com/data-warehouse</a></li> <li>5. <a href="https://www.geeksforgeeks.org/data-mining/">https://www.geeksforgeeks.org/data-mining/</a></li> <li>6. <a href="https://www.tutorialspoint.com/data_mining/dm_cluster_analysiss.htm">https://www.tutorialspoint.com/data_mining/dm_cluster_analysiss.htm</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-Level
CO1	Understand to the implement concepts of Java using HTML forms , JSP & JAR	Up to K2
CO2	Must be capable of implementing JDBC and RMI concepts	Up to K4
CO3	Able to write programs using R for Association rules, Clustering techniques	Up to K4
CO4	To implement data mining techniques like classification, prediction	Up to K3
CO5	Able to use different visualizations techniques using R	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						PSO				
	1	2	3	4	5	6	1	2	3	4	5
CLO1	3	3	2	3	3	3	1	2	2	2	2
CLO2	3	3	3	3	3	3	1	2	2	3	2
CLO3	3	3	3	3	3	3	2	3	2	2	2
CLO4	3	3	2	3	3	3	2	3	2	3	1
CLO5	3	3	3	3	3	3	2	3	2	3	1

Course Designer: Prof. M. Ashok Kumar

<b>Title of the Course</b>		<b>ARTIFICIAL INTELLIGENCE &amp; MACHINE LEARNING</b>					
<b>TANSICHE Course type</b>		<b>EC3(A)</b>					
<b>Course Category</b>		<b>Elective</b>					
<b>Nature of Course</b>		<b>Employability, Skill Development</b>					
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P2DECT3</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		3		2		-	5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basics of AI & an Introduction about ML					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Enable the students to learn the basic functions of AI, Heuristic Search Techniques</li> <li>• Provide knowledge on concepts of Representations and Mappings and Predicate Logic.</li> <li>• Introduce Machine Learning with respect Data Mining, Big Data and Cloud.</li> <li>• Study about Applications &amp; Impact of ML To simplify the development work / project by planning with the help of Networking.</li> <li>• To program computers to use example data or experience to solve a given problem.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: INTRODUCTION</b> Introduction: AI Problems - AI techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.					
		<b>Unit II: SEARCH TECHNIQUES:</b> Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.					
		<b>Unit III: PREDICATE:</b> Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge- Logic programming –Forward Vs Backward reasoning - Matching-Control knowledge.					
		<b>Unit IV:MACHINE LEARNING:</b> Understanding Machine Learning: What Is Machine Learning?-Defining Big Data – Big Data in Context with Machine Learning-The Importance of the Hybrid Cloud-Leveraging the Powerof Machine Learning-The Roles of Statistics and Data Mining with Machine Learning-Putting Machine Learning in Context-Approaches to Machine Learning..					

	<b>Unit V: APPLICATIONS OF MACHINE LEARNING:</b> Looking Inside Machine Learning: The Impact of Machine Learning on Applications-Data Preparation-The Machine Learning Cycle.
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	To demonstrate technical skills, competency in AI and Machine Learning and promote collaborative learning and team work spirit through multi -disciplinary projects and diverse professional activities.
<b>Justification for nature of course</b>	Artificial Intelligence and machine Learning (AI&ML) is a new, emerging field which consists of a set of tools and techniques used to extract useful information from data. AI&ML is a fast growing discipline and is full of rigorous practical analysis.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Elaine Richand Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.</li> <li>2. George FLuger," Artificial Intelligence", 4<sup>th</sup> Edition, Pearson Education Publ, 2002.</li> </ol>
<b>Reference Book(s)</b>	Machine Learning For Dummies ®,IBM Limited Editionby Judith Hurwitz ,Daniel Kirsch.
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.ibm.com/downloads/cas/GB8ZMQZ3">https://www.ibm.com/downloads/cas/GB8ZMQZ3</a></li> <li>2. <a href="https://www.javatpoint.com/artificial-intelligence-tutorial">https://www.javatpoint.com/artificial-intelligence-tutorial</a></li> <li>3. <a href="https://nptel.ac.in/courses/106/105/106105077/">https://nptel.ac.in/courses/106/105/106105077/</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-level
CO1	Demonstrate AI problems and techniques	Up to K2
CO2	Understand machine learning concepts	Up to K3
CO3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning	Up to K4
CO4	Analyze the impact of machine learning on applications	Up to K3
CO5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system	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	2	3	3	3
CLO2	3	3	3	3	3	3	3	2	3	3	3
CLO3	3	3	3	3	3	3	3	2	3	3	3
CLO4	3	3	3	3	3	3	3	2	3	3	3
CLO5	3	3	3	3	3	3	3	2	3	3	3

Course Designer: Prof. R. Laksha Priya

### Blue Print for Summative Examination - Artificial Intelligence & Machine Learning 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	CLO1	Up to K2	2	K1& K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
3	CLO3	Up to K4	2	K2 & K4	1	K2	2(K4&K4)	1(K4)
4	CLO4	Up to K3	2	K3 & K3	1	K2	2(K3&K3)	1(K3)
5	CLO5	Up to K4	2	K3 & K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

### Distribution of Section – wise Marks with K Levels

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30.00	30
K4	2	-	20	20	42	35	35
<b>Total Marks</b>	10	10	50	50	120	100	100%

<b>Title of the Course</b>		<b>INTERNET OF THINGS</b>					
<b>TANSICHE Course type</b>		<b>EC3(B)</b>					
<b>Course Category</b>		<b>Elective</b>					
<b>Nature of Course</b>		<b>Employability, Skill Development</b>					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P2DECT3</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		3		2		-	5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basics of Sensors & its Applications					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.</li> <li>• Enable students to learn the Architecture of IoT and IoT Technologies</li> <li>• Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE, Sensors and Actuators Programming NODEMCU using Arduino IDE.</li> <li>• To give students reliable access to everything from learning materials to communication channels to good understanding, and the ability to measure student learning progress in real-time.</li> <li>• To automate supply chains based on current demand, prevent disasters and inconveniences by detecting failure ahead of time, allow access to remote areas.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: INTRODUCTION:</b> Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT– Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT					
		<b>Unit II: BASIC ELECTRONICS FOR IoT:</b> Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation..					

	<p><b>Unit III: PROGRAMMING USING ARDUINO:</b> Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.</p> <p><b>Unit IV: SENSORS AND ACTUATORS:</b> Sensors and Actuators: Analog and Digital Sensors–Interfacing temperature sensor, ultrasound sensor and infrared(IR)sensor with Arduino– Interfacing LED and Buzzer with Arduino.</p> <p><b>Unit V: SENSOR DATA IN INTERNET:</b> Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (Thing Speak).</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	To enables the shift in teaching methodology from traditional to digital with several additional benefits and increased efficiency. .
<b>Justification for nature of course</b>	The Internet of Things (IoT) is a changing dynamic in the field of education. The adaptation of the digital tools is not just making education omnipresent but also it is making traditional systems of education more efficient and inclusive.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Arshdeep Bahga,Vijay Madiseti ,“ Internet of Things:AHands-OnApproach”,2014. ISBN: 978-0996025515</li> <li>2. Boris Adryan, Dominik Obermaier, Paul Fremantle, “The Technical Foundations of IoT”, Artech Houser Publishers, 2017.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. MichaelMargolis,“ArduinoCookbook”,O“Reilly,2011</li> <li>2. Marco Schwartz, “Internet of Things with ESP8266” ,Packt Publishing, 2016.</li> <li>3. DhivyaBala,“ESP8266:Step by Step Tutorial for ESP8266 IoT, Arduino NODEMCU Dev. Kit”, 2018.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://onlinecourses.nptel.ac.in/noc20_cs66/preview">https://onlinecourses.nptel.ac.in/noc20_cs66/preview</a></li> <li>2. <a href="https://www.javatpoint.com/iot-internet-of-things">https://www.javatpoint.com/iot-internet-of-things</a></li> <li>3. <a href="https://www.tutorialspoint.com/internet_of_things/index.htm">https://www.tutorialspoint.com/internet_of_things/index.htm</a></li> </ol>

## COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-level
CO1	Understand about IoT, its Architecture and its Applications	Up to K2
CO2	Understand basic electronics used in IoT & its role	Up to K3
CO3	Develop applications with C using Arduino IDE	Up to K4
CO4	Analyze about sensors and actuators	Up to K3
CO5	Design IoT in real time applications using today's internet & wireless technologies	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	2	2	2	3	2	3	3	2	3	3	3
CLO2	2	3	2	3	2	3	3	2	3	3	3
CLO3	3	3	3	3	2	3	3	2	3	3	3
CLO4	3	3	3	3	3	3	3	2	3	3	3
CLO5	3	3	3	3	3	3	3	2	3	3	3

Course Designer: Prof. S. Rajalakshmi

**Blue Print for Summative Examination - INTERNET OF THINGS**  
**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	CLO1	Up to K2	2	K1& K1	1	K1	2(K1&K1)	1(K2)
2	CLO2	Up to K3	2	K2 & K3	1	K1	2(K2&K2)	1(K3)
3	CLO3	Up to K4	2	K2 & K4	1	K2	2(K4&K4)	1(K4)
4	CLO4	Up to K3	2	K3 & K3	1	K2	2(K3&K3)	1(K3)
5	CLO5	Up to K4	2	K3 & K4	1	K3	2(K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining, analyzing, presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels**

K Levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of Marks without choice	Consolidated
<b>K1</b>	2	4	10	-	<b>16</b>	13.33	<b>13</b>
<b>K2</b>	2	4	10	10	<b>26</b>	21.67	<b>22</b>
<b>K3</b>	4	2	10	20	<b>36</b>	30.00	<b>30</b>
<b>K4</b>	2	-	20	20	<b>42</b>	35	<b>35</b>
<b>Total Marks</b>	10	10	50	50	<b>120</b>	100	<b>100%</b>

<b>Title of the Course</b>		<b>ADVANCED OPERATING SYSTEMS</b>					
<b>TANSICHE Course type</b>		<b>EC4(A)</b>					
<b>Course Category</b>		<b>Elective</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P2DECT4</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		3		2		-	5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basics of OS & its functioning					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Enable the students to learn the different types of operating systems and their functioning.</li> <li>• Gain knowledge on Distributed Operating Systems</li> <li>• Gain insight into the components and management aspects of real time and mobile operating systems.</li> <li>• Learn case studies in Linux Operating Systems</li> <li>• To provide students with a deep understanding of modern operating system technology, implementation techniques and research issues.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: BASICS OF OPERATING SYSTEMS:</b> Basics of Operating Systems: What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention – Avoidance – Detection – Recovery.					
		<b>Unit II: DISTRIBUTED OPERATING SYSTEMS :</b> Distributed Operating Systems: Issues – Communication Primitives – Lamport’s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.					
		<b>Unit III: REAL TIME OPERATING SYSTEM:</b> Real time Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling.					
		<b>Unit IV: HANDHELD SYSTEM</b> Operating Systems for Handheld Systems: Requirements–Technology Overview–Handheld Operating Systems–PalmOS- Symbian Operating System-Android–Architecture of android– Securing handheld systems					
		<b>Unit V: CASE STUDIES:</b> Case Studies : Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	Able to construct a small and efficient operating system from a minimal microkernel.
<b>Justification for nature of course</b>	Operating System can be defined as an interface between user and the hardware. It provides an environment to the user so that, the user can perform its task in convenient and efficient way.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts”, Seventh Edition, John Wiley &amp; Sons, 2004</li> <li>2. Mukesh Singhal and Niranjan G. Shivaratri, “Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Rajib Mall, “ Real-Time Systems: Theory and Practice” ,Pearson Education India,2006.</li> <li>2. “Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.</li> <li>3. Daniel.P.Bovet&amp;MarcoCesati, “UnderstandingtheLinuxkernel”, 3<sup>rd</sup> edition, O’Reilly, 2005</li> <li>4. NeilSmyth, “iPhoneiOS4 Development Essentials–Xcode”, Fourth Edition, Payload media, 2011.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://onlinecourses.nptel.ac.in/noc20_cs04/preview">https://onlinecourses.nptel.ac.in/noc20_cs04/preview</a></li> <li>2. <a href="https://www.udacity.com/course/advanced-operating-systems--ud189">https://www.udacity.com/course/advanced-operating-systems--ud189</a></li> <li>3. <a href="https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf">https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf</a></li> </ol>

## COURSE OUTCOMES

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

CO	COURSE OUTCOME	K-level
CO1	Understand the design issues associated with operating systems.	Up to K2
CO2	Master various process management concepts including scheduling, deadlocks and distributed file systems.	Up to K3
CO3	Prepare Real Time Task Scheduling.	Up to K3
CO4	Analyze Operating Systems for Handheld Systems.	Up to K4
CO5	Analyze Operating Systems like LINUX and iOS.	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	2	3	3	3	3	2	2	1	3	1
CLO2	3	2	3	3	3	3	2	2	2	3	2
CLO3	3	2	3	3	3	3	2	2	2	3	2
CLO4	3	2	3	3	3	3	2	2	2	3	1
CLO5	3	2	3	3	3	3	2	2	2	3	2

Course Designer: Prof. S. Saranya

**Blue Print for Summative Examination – Advanced Operating System  
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

**Distribution of Section – wise Marks with K Levels**

K – Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or Choice)	Section D ( Open Choice )	Total Marks	% of Marks without choice	Consolidated %
<b>K1</b>	2	4	10	-	16	13.33	<b>13</b>
<b>K2</b>	2	4	10	10	26	21.67	<b>22</b>
<b>K3</b>	4	2	10	20	36	30	<b>30</b>
<b>K4</b>	2	-	20	20	42	35	<b>35</b>
<b>K5</b>	-	-	-	-	-	-	<b>-</b>
<b>Total Marks</b>	10	10	50	50	120	100	<b>100%</b>

<b>Title of the Course</b>		<b>MOBILE COMPUTING</b>					
<b>TANSICHE Course type</b>		<b>EC4(B)</b>					
<b>Course Category</b>		<b>Elective</b>					
<b>Nature of Course</b>		<b>Skill Development, Employability</b>					
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P2DECT4</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		4		1		-	5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Basics of OS & its functioning					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Present the overview of Mobile computing, Applications and Architectures.</li> <li>• Describe the futuristic computing challenges.</li> <li>• Enable the students to learn the concept of mobile computing.</li> <li>• To develop system and application level software for small, battery powered terminals equipped with the wireless network connection</li> <li>• To gain knowledge about different mobile platforms and application development.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: INTRODUCTION:</b> Introduction - Advantages of Digital Information - Introduction to Telephone Systems –Mobile communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.					
		<b>Unit II: MOBILE COMMUNICATION :</b> Introduction to Cellular Mobile Communication – Mobile Communication Standards –Mobility Management – Frequency Management – Cordless Mobile Communication Systems.					
		<b>Unit III: MOBILE COMPUTING:</b> Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other – Global Mobile Communication – Interferences in Cellular Mobile Communication.					
		<b>Unit IV: MOBILE COMMUNICATION SYSTEM:</b> Important Parameters of Mobile Communication System – Mobile Internet: Working of Mobile IP – Wireless Network Security – Wireless Local Loop Architecture: Components in WLL – Problems in WLL – Modern Wireless Local Loop – Local Multipoint Distribution Service – Wireless Application Protocol.					
		<b>Unit V: COMMUNICATION TECHNOLOGY:</b> WCDMA Technology and Fiber Optic Microcellular Mobile Communication – Ad hoc Network and Bluetooth technology – Intelligent Mobile Communication system – Fourth Generation Mobile Communication systems.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	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)
<b>Skills acquired from this course</b>	students should be able to develop mobile apps applying algorithmic and programming concepts that are cross platform beyond Android and iOS
<b>Justification for nature of course</b>	Mobile Computing includes learning the technology that is used to perform a wide variety of tasks on devices that are portable. Portable devices include Smart Phones, Tablets, Laptops, wearable devices, vehicles etc.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. T.G.Palanivelu, R.Nakkeeran, “Wireless and Mobile Communication”, PHI Limited, 2009.</li> <li>2. Jochen Schiller, “ Mobile Communications”, Second Edition, Pearson Education, 2007.</li> <li>3. Pearson Education, 2007.</li> </ol>
<b>Reference Book(s)</b>	Asoke K Talukder, Hasan Ahmed, Roopa Yavagal, “Mobile Computing”, TMH, 2010.
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.tutorialspoint.com/mobile_computing/index.htm">https://www.tutorialspoint.com/mobile_computing/index.htm</a></li> <li>2. <a href="https://www.javatpoint.com/mobile-computing">https://www.javatpoint.com/mobile-computing</a></li> <li>3. <a href="https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/">https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/</a></li> </ol>

## COURSE OUTCOMES

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

CO	COURSE OUTCOME	K-level
CO1	Understand the need and requirements of mobile communication	Up to K2
CO2	Focus on mobile computing applications and techniques	Up to K3
CO3	Demonstrate satellite communication in mobile computing	Up to K3
CO4	Analyze about wireless local loop architecture	Up to K4
CO5	Analyze various mobile communication technologies	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	1	2	1	1	2	3	2	2	1	3	1
CLO2	3	3	3	2	2	3	2	2	2	3	2
CLO3	3	3	3	3	2	3	2	2	2	3	2
CLO4	3	3	3	3	3	3	2	2	2	3	1
CLO5	3	3	3	3	3	3	2	2	2	3	2

Course Designer: Prof. N. Radha Krishnan

### Blue Print for Summative Examination – Mobile Computing Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

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

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- K4 – Examining analyzing , presentation and make inferences with evidences

### Distribution of Section – wise Marks with K Levels

K – Level	Section A (No Choice)	Section B (No Choice)	Section C (Either/or Choice)	Section D ( Open Choice )	Total Marks	% of Marks without choice	Consolidated %
K1	2	4	10	-	16	13.33	13
K2	2	4	10	10	26	21.67	22
K3	4	2	10	20	36	30	30
K4	2	-	20	20	42	35	35
K5	-	-	-	-	-	-	-
<b>Total Marks</b>	10	10	50	50	120	100	<b>100%</b>

<b>Title of the Course</b>		<b>MULTIMEDIA AND ITS APPLICATIONS</b>					
<b>TANSICHE Course type</b>		<b>SBE/NME</b>					
<b>Course Category</b>		<b>Elective</b>					
<b>Nature of Course</b>		<b>Employability, Skill Development</b>					
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	<b>23P2DSEN1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		1		1		-	2
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basics of Multimedia					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To introduce the students the concepts of Multimedia, Images &amp; Animation.</li> <li>To introduce Multimedia authoring tools.</li> <li>To understand the role of Multimedia in Internet.</li> <li>To know about High Definition Television and Desktop Computing Knowledge based Multimedia systems.</li> <li>To learn representation perceptions and applications of multimedia.</li> </ul>					
<b>Course Outline</b>		<b>Unit I: INTRODUCTION:</b> What is Multimedia? – Introduction to making Multimedia – Macintosh and Windows Production platforms – Basic Software tools.					
		<b>Unit II: MULTIMEDIA TOOLS:</b> Making Instant Multimedia – Multimedia authoring tools – Multimedia building blocks –Text – Sound.					
		<b>Unit III: ANIMATION:</b> Images – Animation – Video.					
		<b>Unit IV: INTERNET:</b> Multimedia and the Internet –The Internet and how it works – Tools for World Wide Web – Designing for the World Wide Web.					
		<b>Unit V: MULTIMEDIASYSTEMS:</b> High Definition Television and Desktop Computing – Knowledge based Multimedia systems.					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		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)					
<b>Skills acquired from this course</b>		Ability to identify the current and future issues related to Multimedia Technology.					
<b>Justification for nature of course</b>		To identify the range of concepts, techniques and tools for creating and editing the interactive multimedia applications.					
<b>Text Book(s)</b>		<ol style="list-style-type: none"> <li>Tay Vaughan, “Multimedia making it work”, Fifth Edition, Tata Mc Graw Hill.</li> <li>John F.Koegel Bufford, “Multimedia Systems”, Pearson Education.</li> </ol>					

<b>Reference Book(s)</b>	Judith Jeffloat, “Multimedia in Practice (Technology and Applications)”, PHI, 2003.
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li><a href="https://www.tutorialspoint.com/multimedia/index.htm">https://www.tutorialspoint.com/multimedia/index.htm</a></li> <li><a href="https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm">https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm</a></li> <li><a href="https://nptel.ac.in/courses/117/105/117105083/">https://nptel.ac.in/courses/117/105/117105083/</a></li> </ol>

### COURSE OUTCOMES

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

COs	COURSE OUTCOME	K-level
CO1	Understand the basic concepts of Multimedia	Up to K2
CO2	Demonstrate Multimedia authoring tools	Up to K2
CO3	Analyze the concepts of Sound, Images, Video & Animation	Up to K2
CO4	Apply and Analyze the role of Multimedia in Internet and real time applications	Up to K2
CO5	Analyze multimedia applications using HDTV	Up to 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	2	3	3	2	2	2	3
CLO2	3	3	3	3	2	3	3	2	2	2	3
CLO3	3	3	3	3	3	3	3	2	2	2	3
CLO4	3	3	3	3	3	3	3	2	2	2	3
CLO5	3	3	3	3	3	3	3	2	2	2	3

Course Designer: Prof. N.Radhakrishnan

**Blue Print for Summative Examination - Multimedia and Its Applications  
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

S.No	CLOs	K - Level	Section A		Section B		Section C (Open Choice)
			Short Answer		(Either/Or Choice)		
			No. of Questions	K – Level	No. of Questions	K - Level	
1	CLO1	Up to K2	1	K1	1	K2 & K2	1(K1)
2	CLO2	Up to K2	1	K1	1	K2 & K2	1(K1)
3	CLO3	Up to K2	1	K1	1	K2 & K2	1(K1)
4	CLO4	Up to K2	1	K1	1	K2 & K2	1(K1)
5	CLO5	Up to K2	1	K1	1	K2 & K2	1(K1)
No. of Questions to be asked			5		10		5
No. of Questions to be answered			5		5		3
Marks for each Question			2		7		10
Total Marks for each section			10		35		30

- K1 – Remembering and recalling facts with specific answers
- K2 – Basic understanding of facts and stating main ideas with general answers
- K3 – Application oriented – Solving Problems
- 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 (Either/or)	Section C (Open choice)	Total Marks	% of Marks without choice	Consolidated
<b>K1</b>	10	-	50	<b>60</b>	46.16	<b>46%</b>
<b>K2</b>	-	70	-	<b>70</b>	53.84	<b>54%</b>
<b>Total Marks</b>	10	70	50	<b>130</b>	100	<b>100%</b>



# **DEPARTMENT OF MICROBIOLOGY**

## **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. Microbiology)  
I and II semesters (M.Sc. Microbiology)**

**The Madura College, Madurai**  
**Department of Microbiology, B.Sc., Microbiology**

Semester	Part	Subject code	Course	Title of the Course	H	C
<b>I</b>	Part I	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	Language -I	Tamil / Hindi / Sanskrit	6	3
	Part II	23U1NENG1	Language - II	English	6	3
	Part III	23U1RCCT1	Core Theory 1	Fundamentals of Microbiology and Microbial Diversity	5	5
		23U1RCCP1	Core Practical 1	Major Practical - I	3	3
		23U1LGET1	Allied Theory -1	Basic and clinical biochemistry	4	4
	Part IV	23U1LGEPI	Allied Practical - 1	Allied Practical - 1	2	1
		23U1RSED1	Skill Enhancement Course SEC – 1	Social and Preventive Medicine	2	2
		23U1RFCT1	Foundation Course	Introduction to Microbial World	2	2
				<b>30</b>	<b>23</b>	

Semester	Part	Subject code	Course	Title of the Course	H	C
<b>II</b>	Part I	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	Language -I	Tamil / Hindi / Sanskrit	6	3
	Part II	23U2NENG2	Language - II	English	6	3
	Part III	23U2RCCT2	Core Theory - 2	Microbial Physiology and Metabolism	5	5
		23U2RCCP2	Core Practical - 2	Major Practical - II	3	3
		23U2LGET2	Allied Theory -2	Bioinstrumentation	4	4
		23U2LGEP2	Allied Practical - 2	Allied Practical - II	2	1
	Part IV	23U2RSED2	Skill Enhancement Course SEC - 2	Nutrition & Health Hygiene	2	2
		23U2RSED3	Skill Enhancement Course -SEC-3	Sericulture	2	2
				<b>30</b>	<b>23</b>	

### Credit Distribution for UG MICROBIOLOGY

S.No	Part	Course Details	Credit
1	III	Core	60
2		Elective Generic/ Discipline Specific Elective(4x5=20)	20
3	I & II	Language & English (Lang - 4x3=12 Eng - 4x3=12)	24
4	IV	SEC(7x2)	14
5		EVS(1x2)	2
6		Value Education(1x2)	2
7		Extension Activity(1x1)	1
8		DEC	10
		Foundation course	2
		Professional Competency Skill	2
	Industrial visit	2	
		Project	2
			<b>141</b>

Programme :	B.Sc. MICROBIOLOGY
Programme code :	22UGMB
Duration :	3 years [UG]
Programme Outcomes	<p><b>PO1: Disciplinary Knowledge:</b> Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.</p> <p><b>PO2: Critical Thinking:</b> 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.</p> <p><b>PO3: Problem Solving:</b> 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.</p> <p><b>PO4: Analytical Reasoning:</b> 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.</p> <p><b>PO5: Scientific Reasoning:</b> 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.</p> <p><b>PO6: Self-directed &amp; Lifelong Learning:</b> 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.</p>
Programme Specific Outcome	<p><b>PSO-1: Placement</b> Prepare the students in all disciplines like agriculture, industry-medical, pharma, dairy, hotel, food and food processing, immunologicals, cosmetics, vermitechnology and water treatment for effective and respectful placement.</p> <p><b>PSO-2: Entrepreneur</b> To create effective entrepreneur by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.</p>

	<p><b>PSO-3:Research and Development</b> Design and implement HR systems that comply with good laboratory practices, following ethical values, leading the organization towards growth and development.</p> <p><b>PSO-4:Contribution to society</b> To contribute to the development of society and produce microbiological products, by collaborating with stake holders, related to the betterment of environment and mankind at the national and global level.</p> <p><b>PSO 5 Communication skills</b> To acquire and demonstrate proficiency in good laboratory practices in a Microbiological laboratory and Develop strong oral and written communication skills through the effective presentation of experimental results as well as through seminars.</p>
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#### Assessment Scheme

<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, Short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations.

<b>Title of the Course</b>		<b>FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY</b>					
<b>TANSICHE Course type</b>		<b>CC1</b>					
<b>Course Category</b>		<b>Core Theory 1</b>					
<b>Nature of Course</b>		<b>Employability /Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23U1RCCT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		5	-		-		5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		<b>Basic introduction about various microorganisms</b>					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Learn the fundamental principles about different aspects of Microbiology including recent developments in the area.</li> <li>• Describe the structural organization, morphology and reproduction of microbes.</li> <li>• Explain the methods of cultivation of microbes and measurement of growth.</li> <li>• Understand the microscopy and other basic laboratory techniques – culturing, disinfection and sterilization in microbiology.</li> <li>• Compare and contrast the different methods of sterilization.</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT I:</b> History and Evolution of Microbiology, Classification – Three kingdom, five kingdom, six kingdom and eight kingdom. Microbial biodiversity: Introduction to microbial biodiversity- ecological niche. Basic concepts of Eubacteria, Archaeobacteria and Eucarya. Conservation of Biodiversity.</p> <p><b>UNIT II:</b> General characteristics of cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) and acellular microorganisms - (Viruses, Viroids, Prions), Differences between prokaryotic and eukaryotic microorganisms. Structure of Bacterial cell wall, cell membrane, capsule, flagella, pili, mesosomes, chlorosomes, phycobilisomes, spores, and gas vesicles. Structure of fungi (Mold and Yeast), Structure of microalgae.</p> <p><b>UNIT III:</b> Bacterial culture media and pure culture techniques. Mode of cell division, Quantitative measurement of growth. Anaerobic culture techniques.</p> <p><b>UNIT IV:</b> Microscopy – Simple, bright field, dark field, phase contrast, fluorescent, electron microscope – TEM &amp; SEM, Confocal microscopy, and Atomic Force Microscopy. Stains and staining methods.</p> <p><b>UNIT V:</b> Sterilization–moist heat - autoclaving, dry heat – Hot air oven, radiation – UV, Ionization, filtration – membrane filter and disinfection, antiseptic; Antimicrobial agents.</p>					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Practical methods, presentation, model making
<b>Skills acquired from this course</b>	Knowledge to categorize microorganisms, handling microscope, sterilization procedure for various components
<b>Justification for nature of course</b>	It will give basics of Microbiology for skills and employment
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7<sup>th</sup> Edition.,McGraw –Hill, New York.</li> <li>2. Willey J., Sherwood L., and Woolverton C. J., (2017). Prescott’s Microbiology. 10<sup>th</sup> Edition., McGraw-Hill International edition.</li> <li>3. Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11<sup>th</sup> Edition., A La Carte Pearson.</li> <li>4. Salle. AJ (1992). Fundamental Principles of Bacteriology. 7<sup>th</sup> Edition., McGraw Hill Inc.New York.</li> <li>5. Boyd, R.F.(1998).General Microbiology,2<sup>nd</sup> Edition., Times Mirror, Mosby College Publishing, St Louis.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Jeffrey C. Pommerville., Alcamo’s Fundamentals of Microbiology (9<sup>th</sup> Edition). Jones &amp; Bartlett learning 2010.</li> <li>2. Stanier R.Y, Ingraham J. L., Wheelis M. L., and Painter R. R. (2010). General Microbiology, 5<sup>th</sup> Edition., MacMillan Press Ltd</li> <li>3. Tortora, G.J., Funke, B.R. and, Case, C.L (2013). Microbiology-An Introduction, 11<sup>th</sup> Edition., Benjamin Cummings.</li> <li>4. Nester E., Anderson D., Roberts C. E., and Nester M. (2006). Microbiology-A Human Perspective, 5<sup>th</sup> Edition., McGraw Hill Publications.</li> <li>5. Madigan M.T., Martinko J.M., Stahl D.A, and Clark D. P. (2010). Brock - Biology of Microorganisms, 13<sup>th</sup> Edition Benjamin-Cummings Pub Co.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology">https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology</a></li> <li>2. <a href="https://www.keyence.com/ss/products/microscope/bzx/study/principle/structure.jsp">https://www.keyence.com/ss/products/microscope/bzx/study/principle/structure.jsp</a></li> <li>3. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/#">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/#</a></li> <li>4. <a href="https://bio.libretexts.org/@go/page/9188">https://bio.libretexts.org/@go/page/9188</a></li> <li>5. <a href="https://courses.lumenlearning.com/boundlessmicrobiology/chapter/microbial-nutrition/">https://courses.lumenlearning.com/boundlessmicrobiology/chapter/microbial-nutrition/</a></li> </ol>

**COURSE OUTCOMES:**

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

	<b>Course Outcomes</b>	<b>K-level</b>
<b>CO1</b>	Study the historical events that led to the discoveries and inventions and understand the classification of Microorganisms.	Up to K-2
<b>CO2</b>	Gain Knowledge of detailed structure and functions of prokaryotic cell organelles.	Up to K-3
<b>CO3</b>	Understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms.	Up to K-3
<b>CO4</b>	Explain the principles and working mechanism of different microscopes. Microscope, their function and scope of application.	Up to K-3
<b>CO5</b>	Understand the concept of asepsis and modes of sterilization and disinfectants.	Up to K-3

**MAPPING WITH PROGRAMME OUTCOMES**

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	2	1	1	2	2	2	2	2	1	1	1
<b>CLO2</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO3</b>	3	1	1	2	2	2	2	2	2	1	1
<b>CLO4</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO5</b>	3	1	1	2	3	2	2	2	2	1	1

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

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 1	Up to K 2	1	K2	2 (K2&K2)	1(K2)
	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	10	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	30	40	<b>70</b>	58.33	<b>58%</b>
K4	-	-	-	-	-	-	-
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>PRACTICAL I - FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY</b>					
<b>TANSICHE Course type</b>		<b>CC2</b>					
<b>Course Category</b>		<b>Core Practical - 1</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>3</b>	<b>Course Code</b>	<b>23U1RCCP1</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
				3		3	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>							
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Acquire knowledge on Cleaning of glass wares, GLP and sterilization.</li> <li>• Gain knowledge on media preparation and cultural characteristics.</li> <li>• Learn the pure culture technique</li> <li>• Learn the microscopic techniques and staining methods.</li> <li>• Acquire knowledge on stain and staining methods</li> </ul>					
<b>Course Outline</b>		<b>Unit I:</b>					
		<ul style="list-style-type: none"> <li>• Cleaning of glass wares</li> <li>• Microbiological good laboratory practice and safety.</li> <li>• Sterilization and assessment of sterility– Autoclave, hot air oven, and membrane filtration.</li> </ul>					
		<b>Unit II:</b>					
		<ul style="list-style-type: none"> <li>• Media preparation: liquid media, solid media, semi-solid media, agar slants, agar deeps, agar plates.</li> </ul>					
		<b>Unit III:</b>					
<ul style="list-style-type: none"> <li>• Preparation of basal, differential, enriched, enrichment, transport, and selective media preparation- quality control of media, growth supporting properties, sterility check of media.</li> <li>• Pure culture techniques: streak plate, pour plate, decimal dilution.</li> </ul>							
<b>Unit IV:</b>							
<ul style="list-style-type: none"> <li>• Culture characteristics of microorganisms: growth on different media, growth characteristics, and description.</li> <li>• Demonstration of pigment production.</li> <li>• Microscopy: light microscopy and bright field microscopy.</li> </ul>							
<b>Unit V:</b>							
<ul style="list-style-type: none"> <li>• Staining techniques: smear preparation, Simple staining, Gram's staining and Endospore staining.</li> <li>• Study on Microbial Diversity using Hay Infusion Broth</li> <li>• Wet mount to show different types of microbes -Hanging drop method</li> </ul>							

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Practical methods, Presentation, Demo
<b>Skills acquired from this course</b>	Knowledge to categorize microorganisms, handling microscope, sterilization methods
<b>Justification for nature of course</b>	It will give basics of Microbiology for skills and employment
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. James G Cappucino and N. Sherman MB(1996). A lab manual Benjamin Cummins, New York 1996.</li> <li>2. Kannan. N (1996). Laboratory manual in General Microbiology. Palani Publications.</li> <li>3. Sundararaj T (2005). Microbiology Lab Manual (1<sup>st</sup> edition) publications.</li> <li>4. Gunasekaran, P. (1996). Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi.</li> <li>5. R C Dubey and D K Maheswari (2002). Practical Microbiology. S. Chand Publishing.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Atlas.R (1997). Principles of Microbiology, 2<sup>nd</sup> Edition, Wm.C.Brown publishers.</li> <li>2. Amita J, Jyotsna A and Vimala V (2018). Microbiology Practical Manual. (1<sup>st</sup> Edition). Elsevier India</li> <li>3. Talib VH (2019). Handbook Medical Laboratory Technology. (2<sup>nd</sup> Edition). CBS</li> <li>4. Wheelis M, (2010). Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.</li> <li>5. Lim D. (1998). Microbiology, 2<sup>nd</sup> Edition, WCB McGraw Hill Publications.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection- methods-and-principles-microbiology/24403">http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection- methods-and-principles-microbiology/24403</a>.</li> <li>2. <a href="https://www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635">https://www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635</a></li> <li>3. <a href="https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf">https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf</a></li> <li>4. <a href="https://microbiologyinfo.com/top-and-best-microbiology-books/">https://microbiologyinfo.com/top-and-best-microbiology-books/</a></li> <li>5. <a href="https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology">https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology</a></li> <li>6. <a href="https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology">microbiology/a-brief-history-of-microbiology</a></li> </ol>

**COURSE OUTCOMES:**

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

<b>CO1</b>	Practice sterilization methods; learn to prepare media and their quality control.	<b>K1</b>
<b>CO2</b>	Learn streak plate, pour plate and serial dilution and pigment production of microbes.	<b>K2</b>
<b>CO3</b>	Understand Microscopy methods, different Staining techniques and motility test.	<b>K2</b>
<b>CO4</b>	Observe culture characteristics of microorganisms.	<b>K2</b>
<b>CO5</b>	Study on Microbial Diversity using Hay Infusion Broth-Wet mount	<b>K2</b>

**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
<b>CLO1</b>	1	1	1	2	1	1	1	1	1
<b>CLO2</b>	2	1	1	3	2	1	1	1	2
<b>CLO3</b>	1	1	1	3	1	1	2	1	2
<b>CLO4</b>	2	1	2	3	2	2	1	2	1
<b>CLO5</b>	1	2	1	2	1	2	1	1	1

**Assessment Scheme****Components of CIA**

Component	Weight / Mark
Continuous Internal Assessment Test, Attendance and Class Participation	25
End Semester Examination	75

<b>Title of the Course</b>		<b>BASIC AND CLINICAL BIOCHEMISTRY</b>					
<b>TANSICHE Course type</b>		<b>Allied Theory -1</b>					
<b>Course Category</b>		<b>Allied Theory -1</b>					
<b>Nature of Course</b>		<b>Employability /Skill Development</b>					
<b>Category</b>	<b>Allied</b>	<b>Year</b>	I	<b>Credits</b>	<b>4</b>	<b>Course Code</b>	23U1LGET1
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		4	-	-		4	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		<b>Basic knowledge on biomolecules</b>					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Attain thorough knowledge on carbohydrates and lipids, their characteristic properties and organization in carrying out all the living functions which constitute the life.</li> <li>• Explain the biological activity of amino acids and proteins.</li> <li>• Identify the metabolic errors in enzymes of carbohydrates and lipids.</li> <li>• Describe the disorders in amino acid metabolism.</li> <li>• Interpret the consequences, biochemical, clinical features, diagnosis and treatment of metabolic diseases of day today life.</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT I:</b> Biomolecules -Carbohydrate – General properties, function, structure, classification– monosaccharides (Glucose, Fructose, Galactose), Oligoaccharides (Sucrose, Maltose, Lactose) and polysaccharides (Starch, Glycogen,) and biological significance. Lipids – General properties, functions, structure, classification (Simple, Derived and Complex), Cholesterol, LDL, HDL – biological significance.</p> <p><b>UNIT II:</b> Biomolecules - Amino acids – General properties, functions, structure, classification and biological significance. Proteins– General structure, Properties, functions, classification and biological significance.</p> <p><b>UNIT III:</b> Disorders of Metabolism: Disorders of carbohydrate metabolism: diabetes mellitus,ketoacidosis, hypoglycemia, glycogen storage diseases, galactosemia and lactose intolerance. Disorders of lipid metabolism: hyperlipidemia, hyperlipoproteinemia, hypercholesterolemia, hypertriglyceridemia,sphingolipidosis.</p> <p><b>UNIT IV:</b> Disorders of Metabolism: Disorders of amino acid metabolism:alkaptonuria, phenylketonuria, phenylalaninemia, homocystineuria, tyrosinemia, aminoacidurias.</p> <p><b>UNIT V:</b> Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase.</p>					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Practical methods, presentation, model making
<b>Skills acquired from this course</b>	Knowledge on biomolecules, disorders of metabolism and evaluation of organ function tests based on enzymes
<b>Justification for nature of course</b>	It will give basics of clinical biochemistry
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Satyanarayana, U. and Chakrapani, U(2014).Biochemistry,4th Edition, Made Simple Publisher.</li> <li>2. Jain J L, Sunjay Jain and Nitin Jain (2016).Fundamentals of Biochemistry, 7th Edition, S Chand Company.</li> <li>3. AmbikaShanmugam's (2016). Fundamentals of Biochemistry for Medical Students, 8th Edition. Wolters Kluwer India Pvt Ltd.</li> <li>4. Vasudevan. D.M.Sreekumari.S, Kannan Vaidyanathan (2019). Textbook Of Biochemistry For Medical Students. Kindle edition, Jaypee Brothers Medical Publishers</li> <li>5. Jeremy M. Berg,LubertStryer, John L. Tymoczko, Gregory J. Gatto (2015). Biochemistry, 8th edition. WH Freeman publisher.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. AmitKessel&amp;Nir Ben-Tal (2018). Introduction to Proteins: structure, function and motion. 2ndEdition, Chapman and Hall.</li> <li>2. David L. Nelson and Michael M. Cox (2017).Lehninger Principles of Biochemistry, 7thEdition W.H. Freeman and Co., NY.</li> <li>3. LupertStryer, Jeremy M. Berg, John L. Tymaczko, Gatto Jr., Gregory J (2019). Biochemistry. 9thEdition ,W.H.Freeman&amp; Co. New York.</li> <li>4. Donald Voet, Judith Voet, Charlotte Pratt (2016). Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, Wiley.</li> <li>5. Joy PP, Surya S. and AswathyC (2015). Laboratory Manual of Biochemistry, Edition 1.,Publisher:Kerala agricultural university.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.abebooks.com">https://www.abebooks.com</a> › plp</li> <li>2. <a href="https://kau.in/document/laboratory-manual-biochemistry">https://kau.in/document/laboratory-manual-biochemistry</a></li> <li>3. <a href="https://metacyc.org">https://metacyc.org</a></li> <li>4. <a href="https://www.medicalnewstoday.com">https://www.medicalnewstoday.com</a></li> <li>6. <a href="https://journals.indexcopernicus.com">https://journals.indexcopernicus.com</a></li> </ol>

**COURSE OUTCOMES:**

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

	<b>Course Outcomes</b>	<b>K-level</b>
<b>CO1</b>	Explain the structure, classification, biochemical functions and significance of carbohydrates and lipids	Up to K-2
<b>CO2</b>	Differentiate essential and non-essential amino acids, biologically important modified amino acids and their functions, Illustrate the role, classification of Proteins and recognize the structural level organization of proteins, its functions and denaturation.	Up to K-3
<b>CO3</b>	Assess defective enzymes and Inborn errors. Recognize diseases related to carbohydrate and lipid metabolism.	Up to K-3
<b>CO4</b>	Discuss and evaluate the pathology of amino acid metabolic disorders.	Up to K-3
<b>CO5</b>	Appraise the imbalances of enzymes in organ function and relate the role of Clinical Biochemistry in screening and diagnosis.	Up to K-3

**MAPPING WITH PROGRAMME OUTCOMES**

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	2	1	1	2	2	2	2	2	1	1	1
<b>CLO2</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO3</b>	3	1	1	2	2	2	2	2	2	1	1
<b>CLO4</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO5</b>	3	1	1	2	3	2	2	2	2	1	1

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

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 1	Up to K 2	1	K2	2 (K2&K2)	1(K2)
	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	10	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	30	40	<b>70</b>	58.33	<b>58%</b>
K4	-	-	-	-	-	-	-
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>Allied Practical I – BASIC AND CLINICAL BIOCHEMISTRY</b>						
<b>TANSICHE Course type</b>		<b>Allied Practical - 1</b>						
<b>Course Category</b>		<b>Allied Practical - 1</b>						
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>						
<b>Category</b>	<b>Allied</b>	<b>Year</b>	I	<b>Credits</b>	1	<b>Course Code</b>	23U1LGEP1	
		<b>Semester</b>	I					
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
						2		2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>			<b>Total</b>
		25			75			100
<b>Pre-requisite(s)</b>								
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Utilize the basics ideas on biochemical tests</li> <li>• Perform and determine the biochemical nature of the given substances</li> <li>• Quantitatively estimate the macromolecular composition of the given samples</li> <li>• Acquire knowledge on relationship between biomolecules and metabolic disorders</li> <li>• To apply the acquired skills in clinical laboratories</li> </ul>						
<b>Course Outline</b>		<ul style="list-style-type: none"> <li>• Qualitative analysis of carbohydrates</li> <li>• Qualitative analysis of proteins</li> <li>• Qualitative analysis of lipids</li> <li>• Qualitative estimation of Glucose</li> <li>• Qualitative estimation of proteins</li> <li>• Estimation of Blood Glucose</li> <li>• Assay of SGOT/SGPT</li> </ul>						
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		Practical methods, Presentation, Demo						
<b>Skills acquired from this course</b>		Knowledge to biomolecules and its estimation						
<b>Justification for nature of course</b>		It will give basics idea on biochemistry and its clinical relevance						

<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, Cambridge University press, Britain, 1995, 4th edition.</li> <li>2. J.Jayaraman, (2011). Laboratory manual in Biochemistry. New Age International Pvt. Ltd. Publishers.</li> <li>3. Satyanarayana, U. and Chakrapani, U (2014). Biochemistry, 4th Edition, Made Simple Publisher.</li> <li>4. Jain J L, Sunjay Jain and Nitin Jain (2016).Fundamentals of Biochemistry, 7th Edition, S Chand Company.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Oser BL Hawks, Physiological Chemistry, TATA Mc Graw Hill, 1965. Shawn O' Farrell and Ryan T Ranallo, Experiments in Biochemistry: A Hands on Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc., Australia, 2000.</li> <li>2. David L. Nelson and Michael M. Cox (2017).Lehninger Principles of Biochemistry, 7thEdition W.H. Freeman and Co., NY.</li> <li>3. LupertStyrer, Jeremy M. Berg, John L. Tymaczko, Gatto Jr., Gregory J (2019). Biochemistry. 9thEdition , W.H.Freeman&amp; Co. New York.</li> <li>4. Donald Voet, Judith Voet, Charlotte Pratt (2016). Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, Wiley.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.abebooks.com">https://www.abebooks.com</a> › plp</li> <li>2. <a href="https://kau.in/document/laboratory-manual-biochemistry">https://kau.in/document/laboratory-manual-biochemistry</a></li> <li>3. <a href="https://metacyc.org">https://metacyc.org</a></li> <li>4. <a href="https://www.medicalnewstoday.com">https://www.medicalnewstoday.com</a></li> <li>5. <a href="https://journals.indexcopernicus.com">https://journals.indexcopernicus.com</a></li> </ol>

### **COURSE OUTCOMES:**

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

<b>CO1</b>	Knowledge on the basics of biochemical tests	<b>K1</b>
<b>CO2</b>	Analyse the biochemical nature of the given substances	<b>K2</b>
<b>CO3</b>	Determine the macromolecular composition of the given samples	<b>K2</b>
<b>CO4</b>	Relate biomolecular composition and metabolic disorders	<b>K2</b>
<b>CO5</b>	To apply the acquired skills in clinical laboratories	<b>K2</b>

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

**Assessment Scheme****Components of CIA**

Component	Weight / Mark
Continuous Internal Assessment Test, Attendance and Class Participation	25
End Semester Examination	75

<b>Title of the Course</b>		<b>SOCIAL AND PREVENTIVE MEDICINE</b>					
<b>TANSICHE Course type</b>		<b>SEC – 1</b>					
<b>Course Category</b>		<b>Skill Enhancement Course - 1</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship /Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	<b>23U1RSED1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		2	-	-		2	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		<b>Fundamental knowledge on health, disease and medicines</b>					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Describe the concepts of health and disease and their social determinants</li> <li>• Summarize the health management system</li> <li>• Know about the various health care services</li> <li>• Outline the goals of preventive medicine</li> <li>• Gain knowledge about alternate medicine</li> </ul>					
<b>Course Outline</b>		<b>UNIT I: Introduction to social medicine:</b> History of social medicine- concepts of health and disease- social determinants of health and disease- Health and quality of life-Health information system- measures of population health-health policies.					
		<b>UNIT II: Health management:</b> Applications of behavioral sciences and psychology in health management- nutritional programs for health management- water and sanitation in human health-national programs for communicable and non-communicable diseases-environmental and occupational hazards and their control.					
		<b>UNIT III: Health care and services:</b> Health care of the community- information, education, communication and training in health-maternal & child health-school health services- Geriatrics-care and welfare of the aged- mental health-health services through general practitioners.					
		<b>UNIT IV: Preventive medicine:</b> Introduction- role of preventive medicine- levels of prevention-Risk assessment in communities and vulnerable population –surveillance, monitoring and reporting of disease outbreaks - forecasting and control measures in community setting – early detection methods.					

	<b>UNIT V: Prevention through alternate medicine:</b> Unani, Ayurveda, Homeopathy, Naturopathy systems in epidemic and pandemic outbreaks. International health regulations. Infectious disease outbreak case studies and precautionary response during SARS and MERS coronavirus, Ebola and novel SARS-COV2 outbreaks.
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Case study report
<b>Skills acquired from this course</b>	Social and Personal awareness on preventive medicines
<b>Justification for nature of course</b>	Conventional medicines for social well-being
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Park.K (2021). Textbook of preventive and social medicine, 26<sup>th</sup> edition.Banarsidas Bhanot publishers.</li> <li>2. Mahajan&amp; Gupta (2013). Text book of preventive and social medicine, 4<sup>th</sup> edition.Jaypeebrothers medical publishers.</li> <li>3. Chun-Su Yuan, Eric J. Bieber, Brent Bauer (2006). Textbook of Complementary and Alternative Medicine. Second Edition. Routledge publishers.</li> <li>4. Vivek Jain (2020). Review of Preventive and Social Medicine: Including Biostatics.12<sup>th</sup> edition, Jaypee Brothers Medical Publishers.</li> <li>5. Lal Adarsh Pankaj Sunder (2011). Textbook of Community Medicine: Preventive andSocial Medicine, CBS publisher.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Howard Waitzkin, Alina Pérez, Matt Anderson (2021). Social Medicine and the coming Transformation. First Edition. Routledge publishers.</li> <li>2. GN Prabhakara (2010). Short Textbook of Preventive and Social Medicine. SecondEdition. Jaypee publishers.</li> <li>3. Jerry M. Suls, Karina W. Davidson, Robert M. Kaplan (2010). Handbook of Health Psychology and Behavioral Medicine. Guilford Press.</li> <li>4. Marie Eloïse Muller, Marie Muller, Marthie Bezuidenhout, Karien Jooste (2006).HealthCare Service Management. Juta and Company Ltd.</li> <li>5. Geoffrey Rose (2008).Rose's Strategy of Preventive Medicine: The Complete.OUP Oxford.</li> </ol>

<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.omicsonline.org/scholarly/social--preventive-medicine-journals-articles-ppts-list.php">https://www.omicsonline.org/scholarly/social--preventive-medicine-journals-articles-ppts-list.php</a></li> <li>2. <a href="https://www.teacheron.com/onlinemd_preventive_and_social_medicine-tutors">https://www.teacheron.com/onlinemd_preventive_and_social_medicine-tutors</a></li> <li>3. <a href="https://www.futurelearn.com">https://www.futurelearn.com</a></li> <li>4. <a href="https://www.healthcare-management-degree.net">https://www.healthcare-management-degree.net</a></li> <li>5. <a href="https://www.conestogac.on.health-care-administration-and-service-management">https://www.conestogac.on.health-care-administration-and-service-management</a></li> </ol>
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### **COURSE OUTCOMES:**

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

<b>COURSE OUTCOMES</b>		<b>K-level</b>
<b>CO1</b>	Identify the health information system	Up to K-2
<b>CO2</b>	Associate various factors with health management system	Up to K-3
<b>CO3</b>	Choose the appropriate health care services	Up to K-3
<b>CO4</b>	Appraise the role of preventive medicine in community setting	Up to K-3
<b>CO5</b>	Recommend the usage of alternate medicine during outbreaks	Up to K-3

## MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO2</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO3</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO4</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO5</b>	3	1	1	2	3	2	2	2	2	1	1

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

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUEPRINT FOR TEST COMPONENT OF CIA

#### BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 1	Up to K 2	1	K2	2 (K2&K2)	1(K2)
	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	10	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	30	40	<b>70</b>	58.33	<b>58%</b>
K4	-	-	-	-	-	-	-
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

Title of the Course		INTRODUCTION TO MICROBIAL WORLD					
TANSCHE Course type		FC					
Course Category		Foundation Course					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	2	Course Code	23U1RFCT1
		Semester	I				
Instructional Hours per week		Lecture		Tutorial		Practical	
		2		--		--	
Marks		CIA			Semester		Total
		25			75		100
Pre-requisite(s)		Knowledge on microorganisms.					
Objectives of the Course		<ul style="list-style-type: none"> <li>To emphasize economic importance of bacteria.</li> <li>To gain knowledge on beneficial and harmful aspects of fungi.</li> <li>To explore the role of algae in various sectors.</li> <li>To acquire basic insight on significance of viruses.</li> <li>To impart importance of protozoa in day-to-day life</li> </ul>					
Course Outline		<p><b>Unit I: General features and economic importance of bacteria-</b> General characteristics and morphology of bacteria, mycoplasma, and archaebacteria. Economic importance of bacteria with examples in antibiotic production (<i>Streptomyces</i>), biofertilizer (<i>Rhizobium</i>), superbugs (<i>Pseudomonas</i>), fermentation (<i>Lactobacillus</i>). Harmful aspects such as food spoilage (<i>Clostridium</i>) and diseases (<i>Xanthomonas</i>, <i>Salmonella</i>, <i>Vibrio</i>).</p>					
		<p><b>Unit II: General features and economic importance of fungi-</b> General characteristics and morphology of fungi, Economic importance of fungi with examples in biopesticide (<i>Beauveria</i>), industry (<i>Saccharomyces</i>), medicine (<i>Penicillium</i>). Harmful aspects-food spoilage (mold), diseases in crops (<i>Fusarium</i>), humans (<i>Aspergillus</i>), allergic reactions (<i>Mucor</i>).</p>					
		<p><b>Unit III: General features and economic importance of algae-</b> General characteristics and morphology of algae. Beneficial aspects of algae with examples in single cell protein (<i>Spirulina</i>), soil fertility (<i>Anabaena</i>), environment (Phytoplanktons). Harmful aspects-Eutrophication and phycotoxins.</p>					
		<p><b>Unit IV: General features and economic importance of virus-</b> General characteristics of virus. Economic importance of virus with examples in vaccine production (Rubella virus), gene therapy (Adenovirus), biopesticides (Cauliflower mosaic virus). Harmful aspects - diseases (plant-TMV, human-Influenza virus).</p>					
		<p><b>Unit V: General features and economic importance of protozoa-</b> General characteristics of protozoa. Beneficial applications of protozoa with examples – Biocontrol (<i>Haemogregarina</i>), sanitation (<i>Amoeba</i>), oil exploration (<i>Radiolaria</i>). Harmful aspects –diseases (<i>Entamoeba</i>, <i>Giardia</i>).</p>					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Case study
<b>Skills acquired from this course</b>	Determination of the morphological characteristic of microorganisms. Categorize beneficial and harmful effects of microbes in daily life.
<b>Justification for nature of course</b>	This course is offered as a foundation course to provide every undergraduate student with basic knowledge and strong fundamentals about microbiology.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Pelczar, M.J., Chan, E. C. S. and Kreig, N. R. (2006). Microbiology. 5<sup>th</sup> edition, Tata Mc Grow Hill Inc, New York.</li> <li>2. Dubey, R.C. and Maheswari, D.K. (2005). A Text book of Microbiology. S.Chand &amp; Company Ltd, New Delhi.</li> <li>3. Subba Rao, N.S. (1995). Soil microorganisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.</li> <li>4. Stanier, R.Y., Doudoroff, M., and Adelberg, E. A. (1957). The Microbial World. ACS publication. US.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Hurst, C.J., Crawford, R.L., Garland, J.L., Lipson, D.A. and Mills, A.L. (2002). Manual of Environmental Microbiology, 2nd Edition. A. SM Press, New Delhi.</li> <li>2. Atlas, R.A. (1995). Principles of Microbiology. Mosby Publications, USA.</li> <li>3. Madigan, M.T. and Martinko, J.M. (2014). Brock Biology of Microorganisms. 14th Edition. Prentice Hall International Inc., USA</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://microbiologyinfo.com/category/basic-microbiology/">https://microbiologyinfo.com/category/basic-microbiology/</a></li> <li>2. <a href="https://microbiologyinfo.com/category/basic-microbiology/">https://microbiologyinfo.com/category/basic-microbiology/</a></li> <li>3. <a href="https://www.britannica.com/science/microbiology">https://www.britannica.com/science/microbiology</a></li> </ol>

### COURSE OUTCOMES:

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

<b>CO1</b>	Discuss various economic importance of bacteria.	Up to K2
<b>CO2</b>	Analyze beneficial and harmful aspects of fungi.	Up to K3
<b>CO3</b>	Explore the characteristics of algae in various sectors.	Up to K3
<b>CO4</b>	Develop basic knowledge on significance of viruses.	Up to K3
<b>CO5</b>	Impart various applications of protozoa in day-to-day life	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	2	2	2	2	3	2	2	2	2	3
CLO2	3	2	2	2	2	3	2	2	2	2	3
CLO3	3	2	2	2	2	3	2	2	2	2	3
CLO4	3	2	2	2	2	3	2	2	2	2	3
CLO5	3	2	2	2	2	3	2	2	2	2	3

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 1	Up to K 2	1	K2	2 (K2&K2)	1(K2)
	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	10	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	30	40	<b>70</b>	58.33	<b>58%</b>
K4	-	-	-	-	-	-	-
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>MICROBIAL PHYSIOLOGY AND METABOLISM</b>					
<b>TANSICHE Course type</b>		<b>CC3</b>					
<b>Course Category</b>		<b>Core Theory - 2</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship /Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23U2RCCT2</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	
		5		-		-	
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		<b>Basic introduction about various microorganisms</b>					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Study the basic principles of microbial growth.</li> <li>• Understand the basic concepts of aerobic and anaerobic metabolic pathways.</li> <li>• Analyze the role of individual components in overall cell function.</li> <li>• Provide information on sources of energy and its utilization by microorganisms.</li> <li>• Study the different types of metabolic strategies.</li> </ul>					
<b>Course Outline</b>		<b>UNIT I:</b> Physiology of microbial growth: Batch – continuous - synchronous cultures; Growth Curve and measurement method (turbidity, biomass, and cell count). Control of microbial growth.					
		<b>UNIT II:</b> Nutrition requirements - Photoautotrophs, Photoorganotrophs, Chemolithotrophs (Ammonia, Nitrite, Sulfur, Hydrogen, Iron oxidizing Bacteria), Chemoorganotrophs. Nutrition transport mechanisms – Passive diffusion and Active transport. Factors affecting microbial growth.					
		<b>UNIT III:</b> An overview of Metabolism - Embden Meyerhof Pathway, Entner-Doudoroff Pathway, Pentose Phosphate Pathway, Tricarboxylic Acid Cycle. Electron Transport Chain and Oxidative Phosphorylation. ATP synthesis. Fermentation-Homolactic Fermentation, Heterolactic Fermentation, Mixed Acid Fermentation, Butanediol Fermentation.					
		<b>UNIT IV:</b> Photosynthesis - An Overview of chloroplast structure. Photosynthetic Pigments, Light Reaction-Cyclic and non-cyclic Photophosphorylation. Dark Reaction - Calvin Cycle.					
		<b>UNIT V:</b> Bacterial reproduction - Binary fission, Budding, Reproduction through conidia, cyst formation, endospore formation. Fungi asexual and sexual reproduction, Microalgae reproduction. Asexual and sexual reproduction of protozoa.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Practical methods, presentation, model making
<b>Skills acquired from this course</b>	Knowledge to categorize nutritional classification of microbes
<b>Justification for nature of course</b>	To explore microbial growth
<b>Text Book</b>	<ol style="list-style-type: none"> <li>1. (s) Schlegel, H.G. (1993). General Microbiology. 7<sup>th</sup> Edition, Press syndicate of the University of Cambridge.</li> <li>2. RajapandianK. (2010). Microbial Physiology, Chennai: PBS Book Enterprises India.</li> <li>3. MeenaKumari. S. Microbial Physiology, Chennai 1<sup>st</sup> Edition MJP Publishers 2006.</li> <li>4. Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand &amp; Co.</li> <li>5. S. Ram Reddy, S.M. Reddy (2008). Microbial Physiology. Anmol Publications Pvt Ltd.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49.</li> <li>2. Kim B.H., Gadd G.M. (2008). Bacterial Physiology and Metabolism. Cambridge University Press, Cambridge.</li> <li>3. Daniel R. Caldwell. (1995). Microbial Physiology &amp; Metabolism Wm.C. Brown Communications, Inc. USA.</li> <li>4. Moat, A.G and J.W Foaster (1995). Microbial Physiology, 3<sup>rd</sup> edition. Wiley – LISS, A John Wiley &amp; Sons. Inc. Publications.</li> <li>5. BhanuShrivastava. (2011). Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism. Lambert academic Publication.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://sites.google.com/site/microbial%20physiology%20odd%20sem/">https://sites.google.com/site/microbial physiology odd sem / teaching-contents</a></li> <li>2. <a href="https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/">https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition</a></li> <li>3. <a href="https://onlinecourses.swayam2.ac.in/cec20_bt14/preview">https://onlinecourses.swayam2.ac.in/cec20_bt14/preview</a></li> <li>4. <a href="http://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf">http://web.iitd.ac.in/~amittal/2007_Addy Enzymes Chapter.pdf</a></li> <li>5. <a href="https://www.frontiersin.org/microbial-physiology-and-metabolism">https://www..frontiersin.org.microbial-physiology-and-metabolism</a></li> </ol>

**COURSE OUTCOMES:**

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

	<b>Course Outcomes</b>	<b>K-level</b>
<b>CO1</b>	Describe microorganisms based on nutrition.	Up to K-3
<b>CO2</b>	Know the concept of microbial growth and identify the factors affecting bacterial growth.	Up to K-4
<b>CO3</b>	Explain the methods of nutrient uptake.	Up to K-3
<b>CO4</b>	Describe anaerobic and aerobic energy production.	Up to K-4
<b>CO5</b>	Elaborate on the process of bacterial photosynthesis and reproduction.	Up to K-2

**MAPPING WITH PROGRAMME OUTCOMES**

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	1	3	1	3	3	2	1	1	1	2	2
<b>CLO2</b>	3	1	1	1	3	2	2	2	1	2	2
<b>CLO3</b>		1		3	3	2	2	3	2	1	3
<b>CLO4</b>	1	1	1	1	3	2	2	1	2	3	1
<b>CLO5</b>	3		1	1	3	2		1	3	1	3

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

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 1	Up to K 3	1	K2	2 (K2&K2)	1(K3)
	CLO 2	Up to K 4	1	K2	2 (K2&K2)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
	CLO 4	Up to K 4	1	K2	2 (K2&K2)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

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

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>MICROBIAL PHYSIOLOGY AND METABOLISM</b>					
<b>TANSICHE Course type</b>		<b>CC IV</b>					
<b>Course Category</b>		<b>Core Practical - 2</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	23U2RCCP2
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
						3	3
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic knowledge on microbial growth					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Understand the principles of motility test.</li> <li>• Understand the basic concepts of staining methods.</li> <li>• Learn the bacterial count using different methods and anaerobic culture.</li> <li>• Study the morphological demonstration of microorganisms and identification.</li> <li>• Study the biochemical identification of the bacteria.</li> </ul>					
<b>Course Outline</b>		<b>Unit I:</b> <ol style="list-style-type: none"> <li>1. Morphological methods of bacterial identification- Motility demonstration Wet mount preparation - Hanging drop method Semi-solid agar method Craigie's tube method.</li> <li>2. Staining techniques Smear preparation Permanent specimen preparation Capsular staining Acid-fast staining.</li> </ol>					
		<b>Unit II:</b> <ol style="list-style-type: none"> <li>3. Direct counts <ul style="list-style-type: none"> <li>• Direct cell count (Petroff-Hausser counting chamber)</li> <li>• Turbidimetry.</li> </ul> </li> <li>4. Viable count <ul style="list-style-type: none"> <li>• Pour plate technique</li> <li>• Spread plate technique.</li> </ul> </li> <li>5. Bacterial growth curve.</li> </ol>					
		<b>Unit III:</b> <ol style="list-style-type: none"> <li>6. Anaerobic culture methods Special Anaerobic Culture Media (Pre-reduced Media) Anaerobic Bags or Pouches.</li> <li>7. Antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains.</li> </ol>					

	<p><b>Unit IV:</b></p> <p>8. Morphological variations in algae, fungi and protozoa.</p> <p>9. Micrometry: Demonstration of the size of yeast, fungal filaments and protozoa.</p>
	<p><b>Unit V:</b></p> <p>10. Methods of bacterial identification- Physiological, and Biochemical methods</p> <ul style="list-style-type: none"> <li>• IMViC test</li> <li>• H<sub>2</sub>S production test</li> <li>• TSI agar test</li> <li>• Oxidase test</li> <li>• Catalase test</li> <li>• Urease test.</li> </ul> <p>11. Carbohydrate fermentation test.</p> <p>12. Maintenance of pure culture</p> <ul style="list-style-type: none"> <li>• Paraffin method</li> <li>• Stab culture method</li> <li>• Maintenance of mold culture.</li> </ul>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Internship</p>
<p><b>Skills acquired from this course</b></p>	<p>Learn to pursue experimental procedures. Extend skills to create answerable questions/hypotheses, forecast expected results. Find out how to make careful observations, collect and analyze data, and depict appropriate conclusions. Utilize hands on training in Microbial Physiology And Metabolism in the laboratory.</p>
<p><b>Justification for nature of course</b></p>	<p>Microbiology is one of the most significant fields in biology. The progress of microbiology has been seen in the fields of Agriculture, Environmental management, Medicine, Clinical research, Pharmacy, Microbial Genetics and Molecular Biology, Food and Dairy Industry, etc.</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. James G Cappucino and N. Sherman MB (1996). A lab manual Benjamin Cummins, New York.</li> <li>2. Kannan. N (1996).Laboratory manual in General Microbiology. Palani Publications.</li> </ol>

	<ol style="list-style-type: none"> <li>3. Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications.</li> <li>4. Gunasekaran. P (2007). Laboratory manual in Microbiology. New age international publisher.</li> <li>5. Elsa Cooper (2018). Microbial Physiology: A Practical Approach. Callisto Reference publisher.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. David White., James Drummond., Clay Fuqua (2012) Physiology and Biochemistry of Prokaryotes. 4th Ed. Oxford University Press, New York.</li> <li>2. Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49.</li> <li>3. Kim B.H., Gadd G.M. (2008). Bacterial Physiology and Metabolism. Cambridge University Press, Cambridge.</li> <li>4. Dawes, I.W and Sutherland L.W (1992). Microbial Physiology (2nd edition), Oxford Blackwell Scientific Publications.</li> <li>5. Moat, A.G and J.W Foaster, (1995). Microbial Physiology, 3rd edition. Wiley – LISS, A John Wiley &amp; Sons. Inc. Publications.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition">https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition</a></li> <li>2. <a href="https://onlinecourses.swayam2.ac.in/cec20_bt14/preview">https://onlinecourses.swayam2.ac.in/cec20_bt14/preview</a></li> <li>3. <a href="https://www.studocu.com/microbial-physiology-practicals">https://www.studocu.com/microbial-physiology-practicals</a></li> <li>4. <a href="https://www.agr.hokudai.ac.jp/microbial-physiology">https://www.agr.hokudai.ac.jp/microbial-physiology</a></li> </ol>

### COURSE OUTCOMES:

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

#	CLOs	K-level
CO1	Describe hanging drop, wet mount preparation, semi-solid agar, Craigie's tube method.	Up to K-3
CO2	Demonstrate Smear preparation, permanent specimen preparation, Capsular, and Acid-fast staining.	Up to K-3
CO3	Explain antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains.	Up to K-4
CO4	Describe demonstration of the size of yeast, fungal filaments and protozoa.	Up to K-2
CO5	Elaborate on the bacterial identification- morphological, physiological, and biochemical methods.	Up to K-4

**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	1	3	4	5
<b>CLO1</b>	2	1	2	2	3	2	1	2	1	1	2
<b>CLO2</b>	3	2	1	1	1	2	2	1	2	3	1
<b>CLO3</b>	1	1	1	1	3	1	2	2	1	1	2
<b>CLO4</b>	1	1	1	2	1	1	2	2	2	2	2
<b>CLO5</b>	3	2	2	1	3	2	2	2	2	3	2

**Blueprint for Test component of CIA**

Component	Mark
<b>Major question</b>	<b>10</b>
<b>Minor question</b>	<b>5</b>
<b>Spotters</b>	<b>5</b>
<b>Record</b>	<b>5</b>
<b>Total</b>	<b>25</b>

**Blueprint for Semester Examination**

Component	Mark
<b>Major question</b>	<b>30</b>
<b>Minor question</b>	<b>20</b>
<b>Spotters</b>	<b>20</b>
<b>Record</b>	<b>5</b>
<b>Total</b>	<b>75</b>

<b>Title of the Course</b>		<b>BIOINSTRUMENTATION</b>					
<b>TANSICHE Course type</b>		<b>Allied Theory - 2</b>					
<b>Course Category</b>		<b>Allied Theory - 2</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship /Skill Development</b>					
<b>Category</b>	<b>Allied</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>4</b>	<b>Course Code</b>	<b>23U2LGET2</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		4	-		-		4
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		<b>Basic knowledge of laboratory instruments</b>					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Understand the analytical instruments and study the basic principles in the field of sciences.</li> <li>• To gain knowledge about principles of spectroscopy</li> <li>• Understand the analytical techniques of Chromatography and electrophoresis</li> <li>• To understand the principle of different types of scans used in medical diagnosis</li> <li>• To gain information about the principles of radioactivity and its measurements</li> </ul>					
<b>Course Outline</b>		<b>UNIT I:</b> Basic instruments: pH meter, Buffer of biological importance, Centrifuge- Preparative, Analytical and Ultra, Laminar Air Flow, Autoclave, Hot Air Oven and Incubator. Biochemical calculations-preparations of Molar solutions - Buffers- Phosphate, Acetate, TE, TAE- calculation of Normality ,PPM- Ammonium sulphate precipitation.					
		<b>UNIT II:</b> Spectroscopic Techniques: Spectroscopic Techniques: Colorimeter, Ultraviolet and visible, Infra red and Mass Spectroscopy.					
		<b>UNIT III:</b> Chromatographic and Electrophoresis Techniques: Chromatographic Techniques: Paper, Thin Layer, Column, HPLC and GC. Electrophoresis Techniques: Starch Gel, AGE, PAGE.					
		<b>UNIT IV:</b> Imaging techniques:Principle, Instrumentation and application of ECG, EEG, EMG, MRI, CT and PET scan radioisotopes.					
		<b>UNIT V:</b> Fluorescence and radiation based techniques:Spectrofluorimeter, Flame photometer, Scintillation counter, Geiger Muller counter, Autoradiography.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Practical methods, presentation, model making
<b>Skills acquired from this course</b>	Knowledge to handle laboratory instruments
<b>Justification for nature of course</b>	To explore the basics and working mechanism of instruments
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Jayaraman J (2011). Laboratory Manual in Biochemistry, 2nd Edition. Wiley Eastern Ltd., New Delhi .</li> <li>2. Ponmurugan. P and Gangathara PB (2012). Biotechniques.1stEdition. MJP publishers.</li> <li>3. Veerakumari, L (2009).Bioinstrumentation- 5 thEdition -.MJP publishers.</li> <li>4. Upadhyay, Upadhyay and Nath (2002). Biophysical chemistry – Principles and techniques 3rd Edition. Himalaya publishing home.</li> <li>5. Chatwal G and Anand (1989). Instrumental Methods of Chemical Analysis. S.Himalaya Publishing House, Mumbai.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Rodney.F.Boyer (2000). Modern Experimental Biochemistry, 3rd Edition. Pearson Publication.</li> <li>2. SkoogA.,WestM (2014). Principles of Instrumental Analysis – 14th Edition W.B.SaundersCo.,Philadephia.</li> <li>3. N.Gurumani. (2006). Research Methodology for biological sciences- 1st Edition – MJP Publishers .</li> <li>4. Wilson K, and Walker J (2010). Principles and Techniques of Biochemistry and Molecular Biology.7thEdition. Cambridge University Press .</li> <li>6. Webster, J.G. (2004). Bioinstrumentation- 4th Edition - John Wiley &amp; Sons (Asia) Pvt.Ltd,Singapore.</li> </ol>

<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.biologydiscussion.com/biochemistry/centrifugation/centrifuge-introduction-types-uses-and-other-details-with-diagram/12489">http://www.biologydiscussion.com/biochemistry/centrifugation/centrifuge-introduction-types-uses-and-other-details-with-diagram/12489</a></li> <li>2. <a href="https://www.watelectrical.com/biosensors-types-its-working-and-applications/">https://www.watelectrical.com/biosensors-types-its-working-and-applications/</a></li> <li>3. <a href="http://www.wikiscales.com/articles/electronic-analytical-balance/">http://www.wikiscales.com/articles/electronic-analytical-balance/</a> Page 24 of 75</li> <li>4. <a href="https://study.com/academy/lesson/what-is-chromatography-definition-types-uses.html">https://study.com/academy/lesson/what-is-chromatography-definition-types-uses.html</a></li> <li>5. <a href="http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction">http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction</a></li> </ol>
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### **COURSE OUTCOMES:**

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

	<b>Course Outcomes</b>	<b>K-level</b>
<b>CO1</b>	Gain knowledge about the basics of instrumentation.	Up to K-3
<b>CO2</b>	Exemplify the structure of atoms and molecules by using the principles of spectroscopy.	Up to K-4
<b>CO3</b>	Evaluate by separating and purifying the components.	Up to K-3
<b>CO4</b>	Understand the need and applications of imaging techniques.	Up to K-4
<b>CO5</b>	Categorize the working principle and applications of fluorescence and radiation.	Up to K-2

## MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	1	3	1	3	3	2	1	1	1	2	2
<b>CLO2</b>	3	1	1	1	3	2	2	2	1	2	2
<b>CLO3</b>		1		3	3	2	2	3	2	1	3
<b>CLO4</b>	1	1	1	1	3	2	2	1	2	3	1
<b>CLO5</b>	3		1	1	3	2		1	3	1	3

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

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

### **BLUEPRINT FOR TEST COMPONENT OF CIA** **BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
3.	CLO 1	Up to K 3	1	K2	2 (K2&K2)	1(K3)
4.	CLO 2	Up to K 4	1	K2	2 (K2&K2)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
	CLO 4	Up to K 4	1	K2	2 (K2&K2)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

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

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>Allied Practical II – BIOINSTRUMENTATION</b>					
<b>TANSICHE Course type</b>		<b>Allied Practical - 2</b>					
<b>Course Category</b>		<b>Allied Practical - 2</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Allied</b>	<b>Year</b>	I	<b>Credits</b>	1	<b>Course Code</b>	23U2LGEP2
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>	<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
					2		2
<b>Marks</b>	<b>CIA</b>			<b>Semester</b>			<b>Total</b>
	25			75			100
<b>Pre-requisite(s)</b>							
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Utilize the basics ideas on instrumentation</li> <li>• Apply and handle the various instruments for the routine laboratory work.</li> <li>• To demonstrate the separation of macromolecules</li> <li>• To characterize the nature of compounds using laboratory equipments</li> <li>• To apply the acquired skills in various laboratories and research</li> </ul>					
<b>Course Outline</b>		<ul style="list-style-type: none"> <li>• Colorimetric measurement of microbial growth</li> <li>• Chromatographic separation of photosynthetic pigments</li> <li>• Separation of molecules using density gradient centrifugation technique-Demo</li> <li>• Measurement of pH of various biological samples using pH meter</li> <li>• Counting of microbial colonies with Quebec colony counter</li> <li>• Measurement of algal cell using micrometry technique</li> <li>• Agarose Gel Electrophoresis (DNA)-Demo</li> </ul>					
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>		Practical methods, Presentation, Demo					

<b>Skills acquired from this course</b>	Knowledge to handling laboratory instruments
<b>Justification for nature of course</b>	It will imply basic skills in operating laboratory equipment.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Kannan, N. (1996). Laboratory Manual in General Microbiology. 1<sup>st</sup> Edition. Palani Paramount Publications, Tamil Nadu.</li> <li>2. Benson, H.J. (1998). Microbiological Applications- Laboratory Manual in General Microbiology. 7<sup>th</sup> International Edition, McGraw-Hill, Boston.</li> <li>3. Jayaraman, J. (2011). Laboratory Manual in Biochemistry. 2<sup>nd</sup> Edition. New Age International (P) Ltd. Publishers, New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Reddy, S.R. and Reddy, S.M. (2005). Microbial Physiology. Scientific Publishers, India.</li> <li>2. Willey, J.M., Sherwood, L.M. and Woolverton, C.J. (2013). Prescott's Microbiology. 9<sup>th</sup> Edition. McGraw-Hill, Boston.</li> <li>3. Plummer, D.T. (1987). An Introduction to Practical Biochemistry. 3<sup>rd</sup> Edition. Tata McGraw Hill, New Delhi.</li> <li>4. Switzer, R.L. and Garrity, L.F. (1999). Experimental Biochemistry. 3<sup>rd</sup> Edition. WH Freeman and Co., New York.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://science.umd.edu/classroom/bsci424/BSCI223WebSiteFiles/LectureList.htm">http://science.umd.edu/classroom/bsci424/BSCI223WebSiteFiles/LectureList.htm</a></li> <li>2. <a href="https://microbiologysociety.org/why-microbiology-matters.html">https://microbiologysociety.org/why-microbiology-matters.html</a></li> <li>3. <a href="https://open.umn.edu/opentextbooks/textbooks/404">https://open.umn.edu/opentextbooks/textbooks/404</a></li> <li>4. <a href="https://microbiologyinfo.com/top-and-best-microbiology-books/">https://microbiologyinfo.com/top-and-best-microbiology-books/</a></li> </ol>

### COURSE OUTCOMES:

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

<b>CO1</b>	Utilize the basics ideas on instrumentation	<b>K1</b>
<b>CO2</b>	Apply and handle the various instruments for the routine laboratory work.	<b>K2</b>
<b>CO3</b>	To demonstrate the separation of macromolecules	<b>K2</b>
<b>CO4</b>	To characterize the nature of compounds using laboratory equipments	<b>K2</b>
<b>CO5</b>	To apply the acquired skills in various laboratories and research	<b>K2</b>

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

**Assessment Scheme****Components of CIA**

Component	Weight / Mark
Continuous Internal Assessment Test, Attendance and Class Participation	25
End Semester Examination	75

<b>Title of the Course</b>		<b>NUTRITION &amp; HEALTH HYGIENE</b>					
<b>TANSICHE Course type</b>		<b>SEC – 2</b>					
<b>Course Category</b>		<b>Skill Enhancement Course -SEC-2</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>	<b>23U2RSED2</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	
		2		-		-	
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		<b>Fundamental knowledge on nutrition, health and diseases</b>					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Learn about nutrition and their importance</li> <li>• Make student understand the nutritional facts for a better life.</li> <li>• Learn information to optimize our diet</li> <li>• Impart knowledge on different health care programs taken up by India</li> <li>• Learn knowledge on different health indicators and types of hygiene methods</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT I:</b> Nutrition – definition, importance, Good nutrition, and mal nutrition; Balanced Diet: Basics of Meal Planning. Carbohydrates, Lipids, Proteins and Vitamins –functions, dietary sources, effects of deficiency. Macro and micro minerals –functions, effects of deficiency; food sources of Calcium, Potassium, and Sodium; food sources of Iron, Iodine, and Zinc. Importance of water–functions, sources, requirements and effects of deficiency.</p> <p><b>UNIT II:</b> Nutrition for Life Cycle: Balanced diet - Normal, Pregnant, lactating women, Infancy, young children Adolescents, Adults, and the Elderly; Diet Chart; Nutritive value of Indian foods.</p> <p><b>UNIT III:</b> Improper diets: Definition, Identification, Signs and Symptoms - malnutrition, under-nutrition, over-nutrition, Protein Energy Malnutrition, obesity; Nutritional Disease and Disorder - hypertension, diabetes, anemia, osteomalacia, cardiovascular disease.</p> <p><b>UNIT IV:</b> Health - Determinants of health, Key Health Indicators, Environment health &amp; Public health; Health-Education: Principles and Strategies. Health Policy &amp; Health Organizations: Health Indicators and National Health Policy of Govt. of India; Functioning of various nutrition and health organizations in India.</p> <p><b>UNIT V:</b> Hygiene – Definition; Personal, Community, Medical and Culinary hygiene; WASH (Water, Sanitation and Hygiene) programme. Rural Community Health: Village health sanitation &amp; Nutritional committee. Community &amp; Personal Hygiene: Environmental Sanitation and Sanitation in Public places.</p>					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Case study report
<b>Skills acquired from this course</b>	Health and hygiene
<b>Justification for nature of course</b>	To understand proper nutrition and maintenance of good health
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Bamji, M.S., K. Krishnaswamy &amp; G.N.V. Brahmam (2009) Textbook of Human Nutrition (3rd edition) Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi</li> <li>2. Swaminathan (1995) Food &amp; Nutrition (Vol I, Second Edition) The Bangalore Printing &amp; Publishing Co Ltd., Bangalore</li> <li>3. SK. Halder (2022). Occupational Health and Hygiene in Industry. CBS Publishers.</li> <li>4. Acharya, Sankar Kr, Rama Das, Minati Sen (2021). Health Hygiene and Nutrition Perception and Practices. Satish Serial Publishing House</li> <li>5. Dass (2021). Public Health and Hygiene, Notion Press</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Vijaya Khader (2000) Food, nutrition &amp; health, Kalyan Publishers, New Delhi</li> <li>2. Srilakshmi, B., (2010) Food Science, (5<sup>th</sup> Edition) New Age International Ltd., New Delhi</li> <li>3. Arvind Kumar Goel (2005). A College Textbook of Health &amp; Hygiene, ABD Publishers</li> <li>4. Sharma D. (2015). Textbook on Food Science and Human Nutrition. Daya Publishing House.</li> <li>5. Revilla M. K. F., Titchenal A. and Draper J. (2020). Human Nutrition. University of Hawaii, Mānoa.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. National Rural Health Scheme: <a href="https://nhm.gov.in/index1.php?lang=1&amp;level=1&amp;sublinkid=969&amp;lid=49">https://nhm.gov.in/index1.php?lang=1&amp;level=1&amp;sublinkid=969&amp;lid=49</a></li> <li>2. National Urban Health Scheme: <a href="https://nhm.gov.in/index1.php?lang=1&amp;level=1&amp;sublinkid=970&amp;lid=137">https://nhm.gov.in/index1.php?lang=1&amp;level=1&amp;sublinkid=970&amp;lid=137</a></li> <li>3. Village health sanitation &amp; Nutritional committee <a href="https://nhm.gov.in/index1.php?lang=1&amp;level=1&amp;sublinkid=149&amp;lid=225">https://nhm.gov.in/index1.php?lang=1&amp;level=1&amp;sublinkid=149&amp;lid=225</a></li> <li>4. Health Impact Assessment - <a href="https://www.who.int/hia/about/faq/en/">https://www.who.int/hia/about/faq/en/</a></li> <li>5. Healthy Living <a href="https://www.nhp.gov.in/healthylivingViewall">https://www.nhp.gov.in/healthylivingViewall</a></li> </ol>

**COURSE OUTCOMES:**

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

<b>COURSE OUTCOMES</b>		<b>K-level</b>
<b>CO1</b>	Learn the importance of nutrition for a healthy life	Up to K-2
<b>CO2</b>	Study the nutrition for life cycle	Up to K-3
<b>CO3</b>	Know the health care programmes of India	Up to K-3
<b>CO4</b>	Learn the importance of community and personal health & hygiene measures	Up to K-3
<b>CO5</b>	Create awareness on community health and hygiene	Up to K-3

**MAPPING WITH PROGRAMME OUTCOMES**

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO2</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO3</b>	3	1	1	2	3	2	2	2	2	1	2
<b>CLO4</b>	3	1	1	2	3	2	2	2	2	1	1
<b>CLO5</b>	3	1	1	2	3	2	2	2	2	1	2

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

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 1	Up to K 2	1	K2	2 (K2&K2)	1(K2)
	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	10	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	30	40	<b>70</b>	58.33	<b>58%</b>
K4	-	-	-	-	-	-	-
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>SERICULTURE</b>					
<b>TANSICHE Course type</b>		<b>SEC – 3</b>					
<b>Course Category</b>		<b>Skill Enhancement Course -SEC-3</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>	<b>23U2RSED3</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>		<b>Total</b>	
		2	-	-		2	
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		<b>Fundamental knowledge on silkworm rearing methods</b>					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Acquire knowledge on the concepts of origin, growth and study of Sericulture as science and scientific approach of mulberry plant.</li> <li>• Describe the morphology and physiology of silkworm.</li> <li>• Discuss effective management of silkworm diseases.</li> <li>• Demonstrate field skills in mulberry cultivation and silkworm rearing with an emphasis on technological aspects.</li> <li>• Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises.</li> </ul>					
<b>Course Outline</b>		<b>UNIT I:</b> General introduction to Sericulture, its distribution in India. Botanical distribution and taxonomical characters of mulberry varieties and species. Biology of Mulberry plant and Mulberry crop cultivation and protection.					
		<b>UNIT II:</b> Silkworm- biology-morphology of silkworm. Life cycle of silkworm-egg, larva, pupa, and moth.					
		<b>UNIT III:</b> Silkworm pathology: Introduction to Parasitism, Commensalism, Symbiosis and Parasite relationship - Mulberry Silkworm Diseases: Introduction, types, Pebrine, Grasserie, Muscardine, Flacherie, Symptoms and Pathogens, Mode of Infection, Prevention and Control -Non – mulberry silkworm diseases: Pebrine, Bacterial and viral diseases. Brief Account of Pests and Predators of Silkworms, Nature of damage and control measures.					
		<b>UNIT IV:</b> Rearing of silkworm. Cocoon assessment and processing technologies. Value added products of mulberry and silkworms.					
		<b>UNIT V:</b> Entrepreneurship and rural development in sericulture: Planning for EDP, Project formulation, Marketing, Insectary facilities and equipments: Location, building specification, air conditioning and environmental control, furnishings and equipment, sanitation and equipment, subsidiary facilities.					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Field visit report
<b>Skills acquired from this course</b>	Rearing of silkworm
<b>Justification for nature of course</b>	To understand the technical skills of silkworm rearing
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ganga, G. and Sulochana Chetty (2010). Introduction to Sericulture,, J., Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.</li> <li>2. Dr. R. K. Rajan&amp;Dr. M. T. Himantharaj(2005). Silkworm Rearing Technology, Central Silk Board, Bangalore.</li> <li>3. Dandin S B, Jayant Jayaswal and Giridhar K (2010). Handbook of Sericulture technologies,Central Silk Board, Bangalore.</li> <li>4. M. C. Devaiah, K. C. Narayanaswamy and V. G. Maribashetty(2010). Advances in Mulberry Sericulture,,CVG Publications, Bangalore</li> <li>5. T.V.SatheandJadhav.A.D.(2021). <i>Sericulture and Pest Management</i>, Daya Publishing House.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. S. Morohoshi (2001). Development Physiology of Silkworms 2<sup>nd</sup> Edition, Oxford &amp; IBH Publishing Co. Pvt. Ltd. New Delhi</li> <li>2. Hamamura, Y (2001). Silkworm rearing on Artificial Diet. Oxford &amp; IBH publishing Co., Pvt. Ltd. NewDelhi.</li> <li>3. M.Johnson, M.Kesary (2019). Sericulture, 5<sup>th</sup>. Edition. Saras Publications.</li> <li>4. Manisha Bhattacharyya (2019). Economics of Sericulture, Rajesh Publications.</li> <li>5. Muzafar Ahmad Bhat, Suraksha Chanotra, Zafar Iqbal Buhroo, Abdul Aziz and Mohd. Azam (2020). A Textbook on Entrepreneurship Development Programme in Sericulture, IP Innovative Publication.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://egyankosh.ac.in">https://egyankosh.ac.in</a> &gt; bitstream</li> <li>2. <a href="https://archive.org">https://archive.org</a> &gt; details &gt; SericultureHandbook</li> <li>3. <a href="https://www.academic.oup.com">https://www.academic.oup.com</a></li> <li>4. <a href="https://www.sericulture.karnataka.gov.in">https://www.sericulture.karnataka.gov.in</a></li> <li>5. <a href="https://www.silks.csb.gov.in">https://www.silks.csb.gov.in</a></li> </ol>

**COURSE OUTCOMES:**

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

<b>COURSE OUTCOMES</b>		<b>K-level</b>
<b>CO1</b>	Discuss the overall aspects of Sericulture and the biology and varieties of mulberry plant. Creates awareness among students about the economic importance and suitability of Sericulture in Indian conditions.	Up to K-2
<b>CO2</b>	Familiarize with the lifecycle of silk worm.	Up to K-3
<b>CO3</b>	Explain common diseases of silkworm encountered during rearing, sources of infection, disease symptoms, pre-disposing factors and their management practices.	Up to K-3
<b>CO4</b>	Attain thorough knowledge about the cultivation of mulberry, maintenance of the farm, seed technology, silkworm rearing, post cocoon techniques like stifling, reeling, and utilization of by-products.	Up to K-3
<b>CO5</b>	Plan the facilities required for establishment of insectary. Competent to transfer the knowledge and technical skills to the Seri-farmers. Analyze the importance of sericulture in entrepreneurship development and emerge as potential entrepreneur.	Up to K-3

## MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	2	1	1	3	2	2	2	2	1	3
<b>CLO2</b>	2	1	2	3	3	1	1	2	2	1	2
<b>CLO3</b>	3	1	1	1	3	2	2	1	2	1	1
<b>CLO4</b>	2	2	2	1	2	2	2	2	1	2	2
<b>CLO5</b>	1	1	2	1	3	1	2	2	2	1	3

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

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUEPRINT FOR TEST COMPONENT OF CIA

#### BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 1	Up to K 2	1	K2	2 (K2&K2)	1(K2)
	CLO 2	Up to K 3	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
2.	CLO 4	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	10	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	30	40	<b>70</b>	58.33	<b>58%</b>
K4	-	-	-	-	-	-	-
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

**Department of Microbiology**  
**The Madura College Madurai**  
**M.Sc., Microbiology**

Semester	Subject code	Course	Course Title	Credit	No. of Hours
<b>I</b>	23P1RCCT1	Core I	General Microbiology and Microbial Diversity	5	6
	23P1RCCT2	Core II	Microbial Physiology	5	6
	23P1RCCP1	Core III	Practical-I – General Microbiology, Microbial Diversity and Microbial Physiology	4	6
	23P1RECT1	Elective I	Forensic Science/ Nanobiotechnology/ Microalgal Technology (Among the three choices anyone can be chosen by the student)	3	5
	23P1RECT2	Elective II	Bioinstrumentation/ Herbal Technology and Cosmetic Microbiology / Essentials of Laboratory Management and Biosafety (Among the three choices anyone can be chosen by the student)	3	5
	23P1RSED1	Skill Enhancement Course I	Microbial Cultivation and Growth	2	2
			<b>Total</b>	<b>22</b>	<b>30</b>

Semester	Subject code	Course	Course Title	Credit	No. of Hours
<b>II</b>	23P2RCCT3	Core IV	Medical Bacteriology and Mycology	5	6
	23P2RCCT4	Core V	Medical Virology and Parasitology	5	6
	23P2RCCP2	Core VI	Practical-II - Medical Microbiology	4	6
	23P2RECT3	Elective III	Epidemiology/ Clinical Diagnostic Microbiology/ Bioremediation (Among the three choices anyone can be chosen by the student)	3	5
	23P2RECT4	Elective IV	Bioinformatics/ Biosafety, Bioethics and IPR / Clinical Research and Clinical Trials (Among the three choices anyone can be chosen by the student)	3	5
	23P2RSEN1	Skill Enhancement Course II (NME)	Vermitechnology	2	2
			Internship* / Industrial Activity	-	-
		Total	<b>22</b>	<b>30</b>	

\* Internship during summer vacation. The credits shall be awarded in Semester – III

### Statement of Marks

### Credit Distribution for PG Course

S.No	Course Details	Credit
<b>1</b>	Core Course [12 Courses X 4 Credits]	48
<b>2</b>	Elective Course [ 6 Courses X 3 Credits]	18
<b>3</b>	Skill Enhancement Course [3 Courses X 2 Credits]	6
<b>4A</b>	Professional Competency Course & Industry Module	4
<b>4B</b>	Project Work VIVA VOCE	4
<b>5</b>	Ability Enhancement Compulsory Course [ 4 Courses X 2]	8
<b>6</b>	Internship	2
<b>7</b>	Extension Activity	1
		<b>91</b>

<b>Programme:</b>	<b>M.Sc. MICROBIOLOGY</b>
<b>Programme code:</b>	<b>22PGMB</b>
<b>Duration:</b>	<b>2 Years [PG]</b>
<b>Programme Outcomes:</b>	<p><b>PO1: Disciplinary Knowledge:</b> Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.</p> <p><b>PO2: Critical Thinking:</b> 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.</p> <p><b>PO3: Problem Solving:</b> 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.</p> <p><b>PO4: Analytical Reasoning:</b> 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.</p> <p><b>PO5: Scientific Reasoning:</b> 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.</p> <p><b>PO6: Self-directed &amp; Lifelong Learning:</b> 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.</p>
<b>Programme Specific Outcomes</b>	<p><b>PSO-1: Placement</b> Prepare the students in varied disciplines like agriculture, industry - medical, pharma, dairy, hotel, food and food processing, immunological, cosmetics, vermitechnology and water treatment for effective and respectful placement.</p> <p><b>PSO-2: Entrepreneurship</b> To create effective entrepreneur by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.</p> <p><b>PSO-3: Research and Development</b> Design and implement HR systems that comply with good laboratory practices, following ethical values, leading the organization towards growth and development. .</p> <p><b>PSO-4: Contribution to Society</b> To contribute to the development of society and produce microbiological products, by collaborating with stake holders, related to the betterment of environment and mankind at the national and global level.</p> <p><b>PSO 5 Communication skills</b> To acquire and demonstrate proficiency in good laboratory practices in a Microbiological laboratory and Develop strong oral and written communication skills through the effective presentation of experimental results as well as through seminars.</p>

### Assessment Scheme

<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, Short summary or overview
<b>Application (K3)</b>	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain
<b>Analyze (K4)</b>	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations.

<b>Title of the Course</b>		<b>GENERAL MICROBIOLOGY AND MICROBIAL DIVERSITY</b>					
<b>TANSICHE Course type</b>		<b>Core Course I</b>					
<b>Course Category</b>		<b>Core I</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	<b>23P1RCCT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		6	--		--		6
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Knowledge on microorganisms and their types.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Acquire knowledge on the principles of different types of microscopes and their applications.</li> <li>• Explain various pure culture techniques and discuss sterilization methods.</li> <li>• Exemplify, isolate and cultivate microalgae from diverse environmental sources.</li> <li>• Compare and contrast the structure of bacteria and fungi. Illustrate nutritional requirements and growth in bacteria.</li> <li>• Discuss the importance and conservation of microbial diversity.</li> </ul>					
<b>Course Outline</b>		<b>UNIT I:</b> History and Scope of Microbiology. Microscopy – Principles and applications. Types of Microscopes - Bright field, Dark-field, Phase-contrast, Fluorescence microscope, Transmission electron microscope (TEM) and Scanning electron microscope (SEM). Sample preparation for SEM & TEM. Atomic force, Confocal microscope. Micrometry – Stage, Ocular and its applications.					
		<b>UNIT II:</b> Microbial techniques - Safety guidelines in Microbiology Laboratories. Sterilization, Disinfection and its validation. Staining methods – Simple, Differential and Special staining. Automated Microbial identification systems - Pure cultures techniques – Cultivation of Anaerobic organisms. Maintenance and preservation of pure cultures. Culture collection centres - National and International.					
		<b>UNIT III:</b> Algae - Distribution, morphology, classification, reproduction and economic importance. Isolation of algae from soil and water. Media and methods used for culturing algae, Strain selection and large-scale cultivation. Life cycle - <i>Chlamydomonas</i> , <i>Volvox Spirogyra</i> (Green algae), <i>Nostoc</i> (Cyanobacteria) <i>Ectocarpus</i> , <i>Sargassum</i> (Brown algae), <i>Polysiphonia</i> , <i>Batrachospermum</i> (Red algae).					

	<p><b>UNIT IV:</b> Bacterial Structure, properties and biosynthesis of cellular components – Cell wall. Actinomycetes and Fungi - Distribution, morphology, classification, reproduction and economic importance. Sporulation. Growth and nutrition - Nutritional requirements, Growth curve, Kinetics of growth, Batch culture, Synchronous growth, Measurement of growth and factors affecting growth.</p>
	<p><b>UNIT V:</b> Biodiversity - Introduction to microbial biodiversity – Thermophiles - Classification, Thermophilic Archaeobacteria and its applications. Methanogens - Classification, Habitats, applications. Alkaliphiles and Acidophiles - Classification, discovery basin, its cell wall and membrane. Barophiles - Classification and its applications. Halophiles - Classification, discovery basin, cell walls and membranes – purple membrane, compatible solutes. Microbial stress response -Osmoadaptation / halotolerance - Applications of halophiles.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Model Making and Mini-project</p>
<p><b>Skills acquired from this course</b></p>	<p>This course introduces the core concepts and basic principles in microbiology, examining microorganisms and how they interact with humans and the environment. Information regarding classification of microorganisms, characteristics of different cell types and processes critical for cell survival is presented.</p>
<p><b>Justification for nature of course</b></p>	<p>The course content provides the foundation of general microbiology necessary for students who are interested in applying to health profession programs.</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Kanunga R. (2017). Ananthanarayanan and Panicker's Text book of Microbiology. (10<sup>th</sup> Edition). Universities Press (India ) Pvt. Ltd.</li> <li>2. Chan E.C.S., Pelczar M. J. Jr. and Krieg N. R. (2010). Microbiology. (5<sup>th</sup> Edition). Mc.Graw Hill. Inc, New York.</li> <li>3. Prescott L. M., Harley J. P. and Klein D. A. (2004). Microbiology. (6<sup>th</sup> Edition). McGraw - Hill company, New York.</li> <li>4. White D. Drummond J. and Fuqua C. (2011). The Physiology and Biochemistry of Prokaryotes, Oxford University Press, Oxford, New York.</li> <li>5. Dubey R.C. and Maheshwari D. K. (2009). Textbook of Microbiology. S. Chand, Limited.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Tortora G. J., Funke B. R. and Case C. L. (2015). Microbiology: An Introduction (12<sup>th</sup> Edition). Pearson, London, United Kingdom</li> <li>2. Webster J. and Weber R.W.S. (2007). Introduction to Fungi. (3<sup>rd</sup> Edition). Cambridge University Press, Cambridge.</li> <li>3. Schaechter M. and Leaderberg J. (2004). The Desk encyclopedia of Microbiology. Elseiver Academic Press, California.</li> <li>4. Ingraham, J.L. and Ingraham, C.A. (2000) Introduction to Microbiology. (2<sup>nd</sup> Edition). Books / Cole Thomson Learning, UK.</li> <li>5. Madigan M. T., Bender K.S., Buckley D. H. Sattley W. M. and Stahl (2018) Brock Biology of Microorganisms. (15<sup>th</sup> Edition). Pearson.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://sciencenetlinks.com/tools/microbeworld">http://sciencenetlinks.com/tools/microbeworld</a></li> <li>2. <a href="https://www.microbes.info/">https://www.microbes.info/</a></li> <li>3. <a href="https://www.asmscience.org/VisualLibrary">https://www.asmscience.org/VisualLibrary</a></li> <li>4. <a href="https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=404">https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=404</a></li> <li>5. <a href="https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf">https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf</a></li> </ol>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Examine various microbes employing the microscopic techniques learnt. Measure and compare the size of microbes.	Up to K-3
<b>CLO2</b>	Create aseptic conditions by following good laboratory practices.	Up to K-4
<b>CLO3</b>	Identify and cultivate the algae understanding their habitat. Analyze the morphology, classify and propagate depending on its economic importance.	Up to K-3
<b>CLO4</b>	Differentiate and appreciate the anatomy of various microbes. Plan the growth of microbes for different environmental conditions.	Up to K-4
<b>CLO5</b>	Categorize and cultivate a variety of extremophiles following standard protocols for industrial applications.	Up to K-2

## MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	2	1	1	2	1	1	2	1	1	1	3
<b>CLO2</b>	1	1	1	3	1	1	2	1	1	1	1
<b>CLO3</b>	1	1	1	1	2	1	3	3	2	1	1
<b>CLO4</b>	2		3	3	1	1	3	2	1	1	1
<b>CLO5</b>	2	2	1	1	3	1	3	3	3	2	1

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

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUEPRINT FOR TEST COMPONENT OF CIA

#### BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 1	Up to K 3	1	K2	2 (K2&K2)	1(K3)
	CLO 2	Up to K 4	1	K2	2 (K2&K2)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
	CLO 4	Up to K 4	1	K2	2 (K3&K3)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

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

**Distribution of Unit-wise questions with K Levels**

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

Title of the Course		MICROBIAL PHYSIOLOGY					
TANSICHE Course type		Core Course II					
Course Category		Core II					
Nature of Course		Skill Development					
Category	Core	Year	I	Credits	5	Course Code	23P1RCCT 2
		Semester	I				
Instructional Hours per week		Lecture		Tutorial		Practical	Total
		6		--		--	6
Marks		CIA			Semester		Total
		25			75		100
Pre-requisite(s)		Basic knowledge on microbial growth and metabolism					
Objectives of the Course		<ul style="list-style-type: none"> <li>• Illustrate Bacterial nutrition and their utilization.</li> <li>• Discuss cultivation methods and factors related to microbial growth.</li> <li>• Demonstrate concepts of microbial metabolism.</li> <li>• Impart the fundamentals and importance of biosynthetic pathways.</li> <li>• Discuss the methods involved in Photosynthesis.</li> </ul>					
Course Outline		<b>UNIT I:</b> Nutrition – Nutritional requirements and types in bacteria – Phototrophs, Chemotrophs, Autotrophs and Heterotrophs. Nutrient transport mechanisms- Passive diffusion, Facilitated diffusion, Active transport, Group translocation and Specific transport system.					
		<b>UNIT II:</b> Microbial growth – Growth curve and Measurement of Growth – Cell Number and Cell Mass and metabolic activity. Batch, Continuous, Synchronous and Asynchronous cultures, Factors affecting growth.					
		<b>UNIT III:</b> Enzymes – properties, functions and regulation. Basic concepts of metabolism, Oxidation – reduction reactions, Energy generation by anaerobic metabolism – Glycolysis, Pentose Phosphate pathway, ED pathway, Fermentation. Energy generation by Aerobic metabolism - TCA cycle, Glycoxylate pathway and Electron Transport chain, Mechanism of ATP synthesis – Chemiosmosis, Pasteur effect. Metabolism of lipids- $\beta$ oxidation.					
		<b>UNIT IV:</b> Anaerobic Respiration. Nitrogen, Sulphur, Iron and Hydrogen Oxidation. Methanogenesis. Biosynthesis – Gluconeogenesis, Peptidoglycan synthesis, Amino acids, Purines, Pyrimidines, Fattyacids, Triglycerides, Phospholipids and Sterols.					
		<b>UNIT V:</b> Photosynthesis – process, antenna of light-harvesting pigments, Photochemical reaction centers, Photosynthetic Electron Transport Chain- Cyclic and Non-cyclic. Oxygenic and Anoxygenic Photosynthesis. Calvin-Benson cycle. Bioluminescence - Process and application.					
Extended Professional Component (is a part of internal component only,		Model Making and Mini-project					

<b>Not to be included in the External Examination)</b>	
<b>Skills acquired from this course</b>	It introduces students to the functions and metabolic capabilities of microbial cells.
<b>Justification for nature of course</b>	Understanding of microbial metabolism and photosynthesis
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Stanier R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (2010). General Microbiology. 5th Edn. Macmilan education Ltd. London.</li> <li>2. Prescott. L.M., Harley. J.P., Klein. D.A. (1993). Microbiology. 2nd edn. Wm. C. Brown publishers, Dubugue.</li> <li>3. Moat, A.G. and Foster, J.W. (2003). Microbial Physiology.4th Edn. John Wiley and Sons, New York.</li> <li>4. Doelle, H.W. (1975) Bacterial Metabolism, 2nd Edn. Academic Press, London.</li> <li>5. Caldwell, D.R (2000) Microbial physiology and metabolism, 2nd Edn. Star publishing, Belmont, California.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Salle. A.J. (1992). Fundamental Principles of Bacteriology. 7th edn. McGraw Hill Inc.New York.</li> <li>2. Madigan, M.T., Martinko, J.M., &amp; ParkerJ. (2000). Brock Biology of Microorganisms. 9th Edn. Prentice Hall International, Inc, London.</li> <li>3. Ingraham, J.L., &amp; Ingraham, C.A. (2000). Introduction to Microbiology. 2nd Edn. Brook /Cole. Singapore.</li> <li>4. Gottschalk, G. (1986). Bacterial Metabolism.2nd Edn. Springer-Verlag, New York.</li> <li>5. Rose, A.H. (1976). An Introduction to Microbial Physiology. 3rd Edn. Plenum, New York.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/">https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/</a></li> <li>2. <a href="https://www.lamission.edu/lifesciences/lecturenote/mic20/Chap06Growth.pdf">https://www.lamission.edu/lifesciences/lecturenote/mic20/Chap06Growth.pdf</a></li> <li>3. <a href="https://www.tandfonline.com/doi/abs/10.3109/07388558409082583?journalCode=ibty20">https://www.tandfonline.com/doi/abs/10.3109/07388558409082583?journalCode=ibty20</a></li> <li>4. <a href="https://www.sciencedirect.com/topics/neuroscience/microbial-respiration">https://www.sciencedirect.com/topics/neuroscience/microbial-respiration</a>.</li> <li>5. <a href="https://www.britannica.com/science/photosynthesis">https://www.britannica.com/science/photosynthesis</a>.</li> </ol>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Apply knowledge about nutritional requirement, modes of nutrient transport in microorganisms to various disciplines of Microbiology.	Up to K-3
<b>CLO2</b>	Analyse microbial growth, factors influencing growth and its measurement techniques for applications in various industries.	Up to K-4
<b>CLO3</b>	Compare various metabolic pathways and discuss the properties and functions of enzymes.	Up to K-3
<b>CLO4</b>	Apply anaerobic respiration and biosynthetic pathways to enhance/control microbial growth.	Up to K-4
<b>CLO5</b>	Assimilate methods involved in microbial photosynthesis and bioluminescence.	Up to K-2

## MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	1	1	2	1	2	3	2	3	1	1
<b>CLO2</b>	3	1	1	3	2	3	1	1	3	1	1
<b>CLO3</b>	2	2	1	3	1	3	3	3	3	2	1
<b>CLO4</b>	1	1	2	3	2	3	2	1	3	2	1
<b>CLO5</b>	2	1	1	3	2	3	2	2	3	3	1

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

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 1	Up to K 3	1	K2	2 (K2&K2)	1(K2)
	CLO 2	Up to K 4	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
	CLO 3	Up to K 3	1	K2	2 (K3&K3)	1(K2)
	CLO 4	Up to K 4	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

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

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>PRACTICAL I - GENERAL MICROBIOLOGY, MICROBIAL DIVERSITY AND MICROBIAL PHYSIOLOGY</b>					
<b>TANSICHE Course type</b>		<b>CORE COURSE III</b>					
<b>Course Category</b>		<b>CORE III</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	<b>23P1RCCP1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
						6	6
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>							
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Gain knowledge on the fundamentals, handling and applications of microscopy.</li> <li>• Provide fundamental skills in sterilization methods. Identify microbes by different staining methods.</li> <li>• Prepare media for bacterial growth. Analyze microbial enzymes.</li> <li>• Perform plating techniques and methods involved in microbial preservation.</li> <li>• Measure bacterial growth, identify optimal growth parameters, cultivate bacteria, and perform antibiotic sensitivity.</li> </ul>					
<b>Course Outline</b>		<b>Unit I:</b> Microscopic Techniques: Light microscopy: Hay infusion broth. Wet mount to show different types of microbes, hanging drop. Micrometry. Dark field microscopy – Motility of Spirochetes. Washing and cleaning of glass wares: Sterilization methods: moist heat, dry heat, and filtration. Quality control check for each method.					
		<b>Unit II:</b> Staining techniques - Simple staining, Gram's staining, Acid fast staining, Meta chromatic granule staining, Spore, Capsule, Flagella.					
		<b>Unit III:</b> Media Preparation: Preparation of liquid, solid and semisolid media. Agar deeps, slants, plates. Preparation of basal, enriched, selective and enrichment media. Preparation of Biochemical test media, media to demonstrate enzymatic activities.					
		<b>Unit IV:</b> Purification and maintenance of microbes. Streak plate, pour plate, and slide culture technique. Aseptic transfer. Direct counts – Total cell count, Turbidometry. Viable count - pour plate, spread plate					

	<b>Unit V:</b> Bacterial growth curve. Effect of physical and chemical factors on growth. Anaerobic culture methods.
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Workshop, internship, lab visit and industrial visit
<b>Skills acquired from this course</b>	Learn to pursue experimental procedures. Extend skills to create answerable questions/hypotheses, forecast expected results. Find out how to make careful observations, collect and analyze data, and depict appropriate conclusions. Utilize hands on training in basic microbiology and immunology
<b>Justification for nature of course</b>	Microbiology is one of the most significant fields in biology. The progress of microbiology has been seen in the fields of Agriculture, Environmental management, Medicine, Clinical research and Pharmacy
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Dubey R.C. and Maheshwari D. K. (2010). Practical Microbiology. S. Chand.</li> <li>2. Cappuccino, J. and Sherman, N. (2002). Microbiology: A Laboratory Manual, (6<sup>th</sup> Edition). Pearson Education, Publication, New Delhi.</li> <li>3. Cullimore D. R. (2010). Practical Atlas for Bacterial Identification. (2<sup>nd</sup> Edition). -Taylor &amp; Francis.</li> <li>4. Moat, A.G. Foster, J.W. and Spector, M. P (2002) Microbial Physiology, 4th Edn. Wiley - Liss, New York.</li> <li>5. Dawes, I. W. and Sutherland, I. W (1992) Microbial physiology, 2nd Edn. Black-well Scientific Publications, London.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Collee J. G., Fraser A.G. Marmion B. P. and Simmons A. (1996). Mackie &amp; McCartney Practical Medical Microbiology. (14<sup>th</sup> Edition). Elsevier, New Delhi.</li> <li>2. Stanier R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (2010). General Microbiology. 5th Edn. Macmillan education Ltd. London.</li> <li>3. Prescott. L.M., Harley. J.P., Klein. D.A. (1993). Microbiology. 2nd edn. Wm. C. Brown publishers, Dubuque.</li> <li>4. Gottschalk, G. (1986). Bacterial Metabolism. 2nd Edn. Springer-Verlag, New York.</li> <li>5. Rose, A.H. (1976). An Introduction to Microbial Physiology. 3rd Edn. Plenum, New York.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://textbookofbacteriology.net/">http://textbookofbacteriology.net/</a></li> <li>2. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC149666/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC149666/</a></li> <li>3. <a href="http://sciencenetlinks.com/tools/microbeworld">http://sciencenetlinks.com/tools/microbeworld</a></li> <li>4. <a href="https://www.microbes.info/">https://www.microbes.info/</a></li> <li>5. <a href="https://www.asmscience.org/VisualLibrary">https://www.asmscience.org/VisualLibrary</a></li> </ol>

## COURSE OUTCOMES:

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

<b>CO1</b>	Apply microscopic techniques and staining methods in the identification and differentiation of microbes.
<b>CO2</b>	Apply the knowledge on the sterilization of glass wares and media by different methods and measurement of cell growth.
<b>CO3</b>	Perform and evaluate immunological reactions to aid diagnosis.
<b>CO4</b>	Assess the level of lymphocytes in a blood sample and purify immunoglobulin employing appropriate techniques.
<b>CO5</b>	Perform DNA extraction and gene transfer mechanisms, analyze and identify by gel electrophoresis

## 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
<b>CLO1</b>	2	3	1	1	3	3	1	2	1	2	3
<b>CLO2</b>	2	1	1	3	1	3	3	1	1	1	3
<b>CLO3</b>	1	1	3	1	2	2	2	1	1	2	1
<b>CLO4</b>	1	1	1	3	1	3	3	1	2	1	2
<b>CLO5</b>	1	1	3	1	2	3	2	1	2	1	3

## Blueprint for Test component of CIA

Component	Mark
<b>Major question</b>	<b>10</b>
<b>Minor question</b>	<b>5</b>
<b>Spotters</b>	<b>5</b>
<b>Record</b>	<b>5</b>
<b>Total</b>	<b>25</b>

## Blueprint for Semester Examination

Component	Mark
<b>Major question</b>	<b>25</b>
<b>Minor question</b>	<b>15</b>
<b>Spotters</b>	<b>20</b>
<b>Viva-voce</b>	<b>10</b>
<b>Record</b>	<b>5</b>
<b>Total</b>	<b>75</b>

Title of the Course		<b>FORENSIC SCIENCE</b>					
TANSCH Course type		<b>Elective Course I</b>					
Course Category		<b>Elective Course I (Choice 1)</b>					
Nature of Course		Employability, Entrepreneurship and Skill Development					
Category	Elective	Year	I	Credits	3	Course Code	<b>23P1RECT1</b>
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		5					5
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Students must have the knowledge of Human physiology, sampling specimen.					
Objectives of the Course		<ul style="list-style-type: none"> <li>• Understand the Scope, need and learn the tools and techniques in forensic science.</li> <li>• Comprehend organizational setup of a forensic science laboratory.</li> <li>• Identify and Examine body fluids for identification.</li> <li>• Extract DNA from blood samples for investigation.</li> <li>• Recognize medico legal post mortem procedures and their importance.</li> </ul>					
Course Outline		<b>Unit I:</b> Forensic Science - Definition, history and development of forensic science. Scope and need of forensic science in present scenario. Branches of forensic science. Tools and techniques of forensic science. Duties of a forensic scientist.					
		<b>Unit II:</b> Forensic science laboratories - Organizational setup of a forensic science laboratory. Central and State level laboratories in India. Mobile forensic science laboratory and its functions. Forensic microbiology - Types and identification of microbial organisms of forensic significance.					
		<b>Unit III:</b> Forensic serology - Definition, identification and examination of body fluids - Blood, semen, saliva, sweat and urine. Forensic examination and identification of hair and fibre.					
		<b>Unit IV:</b> DNA profiling - Introduction, history of DNA typing. Extraction of DNA from blood samples - Organic and Inorganic extraction methods. DNA fingerprinting - RFLP, PCR, STR. DNA testing in disputed paternity.					
		<b>Unit V:</b> Forensic toxicology - Introduction and concept of forensic toxicology. Medico legal post mortem and their examination. Poisons - Types of poisons and their mode of action.					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Case study, project
Skills acquired from this course	Employability Skill, Entrepreneurial Skill, Research Related Skill, Instrumentation Skill, problem solving skill
Justification for nature of course	
Text Book(s)	<ol style="list-style-type: none"> <li>1. Nanda B. B. and Tewari R. K. (2001) Forensic Science in India: A Vision for the Twenty First Century. Select Publishers, New Delhi. ISBN- 10:8190113526 / ISBN- 13:9788190113526.</li> <li>2. James S. H. and Nordby, J. J. (2015) Forensic Science: An Introduction to Scientific and Investigative Techniques. (5<sup>th</sup> Edition). CRC Press. ISBN-10:9781439853832 / ISBN-13:978-1439853832.</li> <li>3. Li R. (2015) Forensic Biology. (2<sup>nd</sup> Edition). CRC Press, New York. ISBN-13:978-1-4398-8972-5.</li> <li>4. Sharma B.R (2020) Forensic science in criminal investigation and trials. (6<sup>th</sup> Edition)Universal Press.</li> <li>5. Richard Saferstein (2017). Criminalistics- An introduction to Forensic Science. (12<sup>th</sup> Edition).Pearson Press.</li> </ol>
Reference Book(s)	<ol style="list-style-type: none"> <li>1. Nordby J. J. (2000). Dead Reckoning. The Art of Forensic Detection- CRC Press, NewYork. ISBN:0-8493-8122-3.</li> <li>2. Saferstein R. and Hall A. B. (2020). Forensic Science Hand book, Vol. I, (3<sup>rd</sup> Edition).CRC Press, New York. ISBN-10:1498720196.</li> <li>3. Lincoln, P.J. and Thomson, J. (1998). (2<sup>nd</sup> Edition). Forensic DNA Profiling Protocols. Vol. 98. Humana Press. ISBN: 978-0-89603-443-3.</li> <li>4. Val McDermid (2014). Forensics. (2<sup>nd</sup> Edition). ISBN 9780802125156.</li> <li>5. Vincent J. DiMaio., Dominick DiMaio. (2001). Forensic Pathology (2<sup>nd</sup> Edition). CRCPress.</li> </ol>
Websites and e-Learning resources	<ol style="list-style-type: none"> <li>1. <a href="http://clsjournal.ascls.org/content/25/2/114">http://clsjournal.ascls.org/content/25/2/114</a></li> <li>2. <a href="https://www.ncbi.nlm.nih.gov/books/NBK234877/">https://www.ncbi.nlm.nih.gov/books/NBK234877/</a></li> <li>3. <a href="https://www.elsevier.com/books/microbial-forensics/budowle/978-0-12-382006-8">https://www.elsevier.com/books/microbial-forensics/budowle/978-0-12-382006-8</a></li> <li>4. <a href="https://www.researchgate.net/publication/289542469_Methods_in_microbial_forensics">https://www.researchgate.net/publication/289542469_Methods_in_microbial_forensics</a></li> <li>5. <a href="https://cisac.fsi.stanford.edu/events/microbial_forensics">https://cisac.fsi.stanford.edu/events/microbial_forensics</a></li> </ol>

**COURSE OUTCOMES:**

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

CO1	Identify the scope and need of forensic science in the presentscenario.	K3-level
CO2	Plan for the organizational setup and functioning of forensic science laboratories.	K3-level
CO3	Analyze the biological samples found at the crime scene.	K4-level
CO4	Perform extraction and identification of DNA obtained from body fluids.	K4-level
CO5	Discuss the concept of forensic toxicology.	K4-level

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

Assessment Scheme  
Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 3	1	K2	2 (K2&K2)	1(K3)
2	CLO 2	Up to K 3	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K3	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K3	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>NANOBIOTECHNOLOGY</b>					
<b>TANSICHE Course type</b>		<b>Elective Course I</b>					
<b>Course Category</b>		<b>Elective Course I (Choice 2)</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P1RECT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		5					5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Knowledge on Nanoparticles and Nanomedicine					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>Analyze nanomaterials based on the understanding of nanobiotechnology.</li> <li>Discuss the methods of fabrication of nanomaterials.</li> <li>Gain Knowledge on characterization of nanomaterials.</li> <li>Discover nanomaterials for targeted drug delivery.</li> <li>Explain nanomaterials in nanomedicine and environmental pollution</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I:</b> Introduction to nanobiotechnology, Nano size-changing phenomena at nano scale, Classification of nanomaterials based on their dimensions (0D, 1D, 2D and 3D materials) and based on realization of their applications (The First, second, third and fourth generation materials), Class of nanomaterials and their applications. Need for nanomaterials and the risks associated with the materials.</p>					
		<p><b>Unit II:</b> Fabrication of Nanomaterials-Top-down and Bottom-up approaches, Solid phase synthesis-milling, Liquid phase synthesis-Sol-gel synthesis, colloidal synthesis, micro emulsion method, hydrothermal synthesis and solvo thermal synthesis, Vapour/Gas phase synthesis-Inert gas condensation, flame pyrolysis, Laser ablation and plasma synthesis techniques. Microbial synthesis of nanoparticles.</p>					
		<p><b>Unit III:</b> Characterization of nanoparticles – Based on particle size/morphology- Dynamic light scattering (DLS), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM), Based on surface charge-zeta potential, Based on structure –X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Energy dispersive X-ray analysis (EDX), Based on optical properties- UV – Spectrophotometer, Based on magnetic properties-Vibrating sample magnetometer (VSM).</p>					

	<p><b>Unit IV:</b> Nanomaterial based Drug delivery and therapeutics-surface modified nano particles, MEMS/NEMS based devices, peptide/DNA coupled nanoparticles, lipid and inorganic nano particles for drug delivery, Metal/metaloxide nanoparticles as antibacterial, antifungal and antiviral agents. Toxicity of nanoparticles and Toxicity Evaluation.</p> <p><b>Unit V:</b> Nanomaterials in diagnosis-Imaging, nanosensors in detection of pathogens. Treatment of surface water, ground water and waste water contaminated by toxic metal ions, organic and inorganic solutes and microorganisms.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Case Studies
<b>Skills acquired from this course</b>	<p>Acquire knowledge on nanomatetials.</p> <p>Learn to fabricate the nanomaterials.</p> <p>Realize the characteristic features of nanomaterials.</p> <p>Discover nanomaterials for targeted drug delivery and bioremediation of recalcitrant pollutants.</p> <p>Improved manufacturing methods, water purification systems.</p>
<b>Justification for nature of course</b>	Nanobiotechnology obtains benefit of the unique properties of nanoscale materials, which include small size, high surface area, and high reactivity, to create new tools for microbiological research, electronics, biomaterials, energy production and medical applications.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Brydson R. M., Hammond, C. (2005). Generic Methodologies for Nanotechnology: Characterization. In Nanoscale Science and Technology. John Wiley &amp; Sons, Ltd.</li> <li>2. Leggett G. J., Jones R. A. L. (2005). Bionanotechnology. In Nanoscale Science and Technology. John Wiley &amp; Sons, Ltd.</li> <li>3. Mohan Kumar G. (2016). Nanotechnology: Nanomaterials and nanodevices. Narosa Publishing House.</li> <li>4. Goodsell D. S. (2004). Bionanotechnology. John Wiley &amp; Sons, Inc.</li> <li>5. Pradeep T. (2007). Nano: The Essentials-Understanding nanoscience and nanotechnology. Tata McGraw-Hill.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Nouailhat A. (2008). An Introduction to Nanoscience and Nanotechnology, Wiley.</li> <li>2. Sharon M. and Maheshwar (2012). Bio-Nanotechnology: Concepts and Applications. New Delhi. Ane books Pvt Ltd.</li> <li>3. Niemeyer C.M. and Mirkin C. A. (2005). Nanobiotechnology. Wiley Interscience.</li> <li>4. Rehm, B. (2006). Microbial Bionanotechnology: Biological Self-Assembly Systems and Biopolymer-Based Nanostructures. Horizon Scientific Press</li> <li>5. Reisner, D.E. (2009).</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.gale.com/nanotechnology">https://www.gale.com/nanotechnology</a></li> <li>2. <a href="https://www.understandingnano.com/resources.html">https://www.understandingnano.com/resources.html</a></li> <li>3. <a href="http://dbtnanobiotech.com/index2.php">http://dbtnanobiotech.com/index2.php</a></li> <li>4. <a href="http://www.isrl.org/11-winter/internet1.html">http://www.isrl.org/11-winter/internet1.html</a></li> <li>5. <a href="https://www.cdc.gov/niosh/topics/nanotech/default.html">https://www.cdc.gov/niosh/topics/nanotech/default.html</a></li> </ol>

### Course Outcomes

<b>CLOs</b>	<b>On completion of this course, students will;</b>	<b>K-level</b>
<b>CLO1</b>	Employ knowledge in the field of nanobiotechnology for development	Up to K-2
<b>CLO2</b>	Identify various applications of nanomaterials in the field of medicine and environment.	Up to K-3
<b>CLO3</b>	Examine the prospects and significance of nanobiotechnology.	Up to K-4
<b>CLO4</b>	Identify recent advances in this area and create a career or pursue research in the field.	Up to K-4
<b>CLO5</b>	Design non-toxic nanoparticles for targeted drug delivery.	Up to K-4

### 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).

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	3	1	2	2	2	3	2	2	2	2	2
<b>CLO2</b>	3	2	2	2	2	3	2	2	2	2	2
<b>CLO3</b>	3	3	2	3	2	3	3	2	2	3	2
<b>CLO4</b>	3	3	3	2	2	3	2	2	2	2	2
<b>CLO5</b>	3	3	3	3	2	3	3	2	2	3	2

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>MICROALGAL TECHNOLOGY</b>					
<b>TANSICHE Course type</b>		<b>Elective Course I</b>					
<b>Course Category</b>		<b>Elective Course I (Choice -3)</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P1RECT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		5		--		--	5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>							
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Characterize the different groups of algae.</li> <li>• Describe the cultivation and harvesting of algae.</li> <li>• Identify the commercial applications of various algal products.</li> <li>• Apply microalgae for environmental applications.</li> <li>• Employ microalgae as alternate fuels.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I</b> - Introduction to Algae - General characteristics. Classification of algae according to Fritsch. Salient features of different groups of algae. Distribution - Freshwater, brackish water and marine algae. Identification methods. An overview of applied Phycology. Economically important microalgae.</p>					
		<p><b>Unit II</b> - Cultivation of freshwater and marine microalgae - Growth media. Isolation and enumeration of microalgae. Laboratory cultivation and maintenance. Outdoor cultivation - Photobioreactors - construction, types and operation; raceway ponds - Heterotrophic and mixotrophic cultivation - Harvesting of microalgae biomass.</p>					
		<p><b>Unit III</b> - Microalgae in food and nutraceutical applications - Algal single cell proteins. Cultivation of <i>Spirulina</i> and <i>Dunaliella</i>. Microalgae as aquatic, poultry and cattle feed. Microalgal biofertilizers. Value-added products from microalgae. Pigments - Production of microalgal carotenoids and their uses. Phycobiliproteins - production and commercial applications. Polyunsaturated fatty acids as active nutraceuticals. Microalgal secondary metabolites - Pharmaceutical and cosmetic applications.</p>					
		<p><b>Unit IV</b> - Microalgae in environmental applications. Phycoremediation - Domestic and industrial waste water treatment. High-rate algal ponds and surface-immobilized systems - Treatment of gaseous wastes by microalgae. Sequestration of carbon dioxide. Scavenging of heavy metals by microalgae. Negative effects of algae. Algal blooms, algicides for algal control.</p>					

	<b>Unit V</b> - Microalgae as feed stock for production of biofuels - Carbon-neutral fuels. Lipid-rich algal strains - <i>Botryococcus braunii</i> . Drop-in fuels from algae - hydrocarbons and biodiesel, bioethanol, biomethane, biohydrogen and syngas from microalgae biomass. Biocrude synthesis from microalgae. Integrated biorefinery concept. Life cycle analysis of algae biofuels.
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	PPT presentation
<b>Skills acquired from this course</b>	Students will acquire knowledge on cultivation techniques for algae and its harvesting
<b>Justification for nature of course</b>	Students will have to explore the types of algae and their significance
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Lee R.E. (2008). Phycology. Cambridge University Press.</li> <li>2. Sharma O.P. (2011). Algae. Tata McGraw-Hill Education.</li> <li>3. Shekh A., Schenk P., Sarada R. (2021). Microalgal Biotechnology. Recent Advances, Market Potential and Sustainability. Royal Society of Chemistry.</li> <li>4. Lele. S.S., Jyothi Kishen Kumar (2008). Algal bio process technology. New Age International P(Ltd)</li> <li>5. Das., Mihirkumar. Algal Biotechnology. Daya Publishing House, New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Andersen R.A. (2005). Algal culturing techniques. Academic Press, Elsevier.</li> <li>2. Bux F. (2013). Biotechnological Applications of Microalgae: Biodiesel and Value-added Products. CRC Press.</li> <li>3. Singh B., Bauddh K., Bux, F. (2015). Algae and Environmental Sustainability. Springer.</li> <li>4. Das D. (2015). An algal biorefinery: An integrated approach. Springer.</li> <li>5. Bux F. and Chisti Y. (2016). Algae Biotechnology: Products and Processes. Springer.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.classcentral.com/course/algae-10442">https://www.classcentral.com/course/algae-10442</a></li> <li>2. <a href="https://onlinecourses.nptel.ac.in/noc19_bt16/preview">https://onlinecourses.nptel.ac.in/noc19_bt16/preview</a></li> <li>3. <a href="https://freevideolectures.com/course/4678/nptel-industrial-biotechnology/46">https://freevideolectures.com/course/4678/nptel-industrial-biotechnology/46</a></li> <li>4. <a href="https://nptel.ac.in/courses/103103207">https://nptel.ac.in/courses/103103207</a></li> <li>5. <a href="https://www.sciencedirect.com/topics/earth-and-planetary-sciences/microalgae">https://www.sciencedirect.com/topics/earth-and-planetary-sciences/microalgae</a></li> </ol>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Acquire knowledge in the field of microalgal technology and their characteristics.	K2
<b>CLO2</b>	Identify the methods of algal cultivation and harvesting.	K3
<b>CLO3</b>	Recognize and recommend the use of microalgae as food, feed and fodder.	K4
<b>CLO4</b>	Promote microalgae in phycoremediation.	K4
<b>CLO5</b>	Compare and critically evaluate recent applied research in these microalgal applications.	K4

## MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	2	1	1	1	1	2	1	1	1	2
<b>CLO2</b>	3	1	1	1	2	2	2	3	2	1	1
<b>CLO3</b>	1	2	1	1	1	1	2	1	1	1	1
<b>CLO4</b>	1	1	2	1	1	1	2	2	1		1
<b>CLO5</b>	1	1	1	1	1	1	2	1	2	2	1

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

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>BIOINSTRUMENTATION</b>					
<b>TANSICHE Course type</b>		<b>Elective Course II</b>					
<b>Course Category</b>		<b>Elective Course II (Choice -1)</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P1RECT2</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		5	--		--		5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>							
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Explain the principles and working mechanisms of laboratory instruments.</li> <li>• Discuss chromatography techniques and molecular biology techniques.</li> <li>• Illustrate molecular techniques in biological applications.</li> <li>• Acquire knowledge on spectroscopic techniques</li> <li>• Demonstrate the use of radio isotopes in various techniques.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I</b> - Basic laboratory Instruments. Aerobic and anaerobic incubator – Biosafety Cabinets - Fume Hood, pH meter, Lyophilizer, Flow cytometry. Centrifugation techniques: Basic principles of centrifugation - Standard sedimentation coefficient - measurement of sedimentation co-efficient; Principles, methodology and applications of differential, rate zonal and density gradient centrifugation – Applications in determination of molecular weight.</p>					
		<p><b>Unit II</b> - General principles of chromatography - Chromatographic Performance parameters; Types- Thin layer chromatography, Paper Chromatography, Liquid chromatography (LPLC &amp;HPLC), Adsorption, ion exchange, Gel filtration, affinity, Gas liquid (GLC). Flash Chromatography and Ultra Performance convergence chromatography. Two dimensional chromatography. Stimulated moving bed chromatography (SEC).</p>					
		<p><b>Unit III</b> - Electrophoresis: General principles - moving boundary electrophoresis - electrophoretic mobility – supportive materials – electro endosmosis – types (horizontal, vertical and two dimensional electrophoresis) - Principle and applications - paper electrophoresis, Serum electrophoresis, starch gel electrophoresis, Disc gel, Agarose gel, SDS – PAGE, Immuno electrophoresis. Blotting techniques -Southern, northern and western blotting.</p>					

	<p><b>Unit IV</b> - Spectroscopic techniques: Principle, simple theory of absorption of light by molecules, electromagnetic spectrum, instrumentation and application of UV- visible, Raman, FTIR spectrophotometer, spectrofluorimetry, Atomic Absorption Spectrophotometer, Flame spectrophotometer, NMR, ESR, Emission Flame Photometry and GC-MS. Detection of molecules in living cells - FISH and GISH. Biophysical methods: Analysis of biomolecules by Spectroscopy UV/visible.</p>
	<p><b>Unit V</b> - Radioisotopic techniques: Principle and applications of tracer techniques in biology. Radioactive isotopes - radioactive decay; Detection and measurement of radioactivity using ionization chamber, proportional chamber, Geiger- Muller and Scintillation counters, auto radiography and its applications. Commonly used isotopes in biology, labeling procedures and safety aspects.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>PPT presentation</p>
<p><b>Skills acquired from this course</b></p>	<p>Students will acquire knowledge on handling of bio-instruments</p>
<p><b>Justification for nature of course</b></p>	<p>Students will have to understand principles and working mechanisms of laboratory instruments</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Sharma B. K. (2014). Instrumental Method of Chemical Analysis. Krishna PrakashanMedia (P) Ltd.</li> <li>2. Chatwal G. R and Anand S. K. (2014.) Instrumental Methods of Chemical Analysis.Himalaya Publishing House.</li> <li>3. Mitchell G. H. (2017). Gel Electrophoresis: Types, Applications and Research. Nova Science Publishers Inc.</li> <li>4. Holme D. Peck H. (1998). Analytical Biochemistry. (3<sup>rd</sup> Edition). Prentice Hall.</li> <li>5. Jayaraman J. (2011). Laboratory Manual in Biochemistry. (2<sup>nd</sup> Edition). Wiley EastrnLtd., New Delhi.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Pavia D. L. (2012) Spectroscopy (4<sup>th</sup> Edition). Cengage.</li> <li>2. Skoog A. and West M. (2014). Principles of Instrumental Analysis. (14<sup>th</sup> Edition). W.B. Saunders Co., Philadelphia.</li> <li>3. Miller J. M. (2007). Chromatography: Concepts and Contrasts (2<sup>nd</sup> Edition) Wiley-Blackwell.</li> <li>4. Gurumani N. (2006). Research Methodology for Biological Sciences. (1<sup>st</sup> Edition) MJP Publishers.</li> <li>5. Ponmurugan P. and Gangathara P. B. (2012). Biotechniques. (1<sup>st</sup> Edition). MJ Publishers.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://norcaloa.com/BMIA">https://norcaloa.com/BMIA</a></li> <li>2. <a href="http://www.biologydiscussion.com/biochemistry/centrifugation/centrifuge-introduction-types-uses-and-other-details-with-diagram/12489">http://www.biologydiscussion.com/biochemistry/centrifugation/centrifuge-introduction-types-uses-and-other-details-with-diagram/12489</a></li> <li>3. <a href="https://www.watelectrical.com/biosensors-types-its-working-and-applications">https://www.watelectrical.com/biosensors-types-its-working-and-applications</a>.</li> <li>4. <a href="http://www.wikiscales.com/articles/electronic-analytical-balance/">http://www.wikiscales.com/articles/electronic-analytical-balance/</a></li> <li>5. <a href="https://study.com/academy/lesson/what-is-chromatography-definition-types-uses">https://study.com/academy/lesson/what-is-chromatography-definition-types-uses</a>.</li> </ol>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Make use of the laboratory instruments- laminar air flow, pH meter, centrifugation methods, biosafety cabinets following SOP.	K2
<b>CLO2</b>	Apply chromatography techniques in the separation of biomolecules.	K3
<b>CLO3</b>	Perform molecular techniques like mutagenesis and their detection.	K4
<b>CLO4</b>	Estimate molecules in biological samples by adopting UV spectroscopic techniques.	K4
<b>CLO5</b>	Cultivate organisms anaerobically.	K4

## MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	1	1	1	3		2	3	2		1	2
<b>CLO2</b>	1	2	1	3		2	1	1	1	1	2
<b>CLO3</b>		1	2	3		3		1		1	
<b>CLO4</b>		1	1	3		2	1		3		1
<b>CLO5</b>	1		1	3		2		1		1	2

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

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>HERBAL TECHNOLOGY AND COSMETIC MICROBIOLOGY</b>					
<b>TANSICHE Course type</b>		<b>Elective Course II</b>					
<b>Course Category</b>		<b>Elective Course II (Choice 2)</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Elective Course II</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P1RECT2</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		5	--		--		5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basic knowledge on microbiology					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Impart knowledge of Indian Medicinal Plants and their applications in microbiology.</li> <li>• Promote the technical skills involved in preparation of different types of plant extracts.</li> <li>• Explain methods to analyze the antimicrobial activity of medicinal plants.</li> <li>• Acquire knowledge on cosmetic microbiology and role of microorganisms in cosmetics.</li> <li>• Gain insight into pharmacopeial microbial assays and biosafety.</li> </ul>					
<b>Course Outline</b>		<b>UNIT 1</b> Herbs, Herbal medicine - Indian medicinal plants: Scope and Applications of Indian medicinal plants in treating bacterial, fungal and viral diseases. Basic principles involved in Ayurvedha, Sidha, Unani and Homeopathy.					
		<b>UNIT II</b> Collection and authentication of selected Indian medicinal plants: <i>Emblica officinalis</i> , <i>Withania somnifera</i> , <i>Phyllanthus amarus</i> , <i>Tinospora cordifolia</i> , <i>Andrographis paniculata</i> , <i>Piper longum</i> , <i>Ocimum sanctum</i> , <i>Azadirachta indica</i> , <i>Terminalia chebula</i> , <i>Allium sativum</i> . Preparation of extracts- Hot and cold methods. Preparation of stock solutions.					
		<b>UNIT III</b> Antimicrobial activity of selected Indian medicinal Plants: - In vitro determination of antibacterial and fungal activity of selected whole medicinal plants/ parts – well-diffusion methods. MIC - Macro and micro dilution techniques. Antiviral activity- cell lines- cytotoxicity, cytopathic and non-cytopathic effect.					

	<p><b>UNIT IV</b> History of Cosmetic Microbiology – Need for cosmetic microbiology, Scope of cosmetic microbiology, - Role of microbes in cosmetic preparation. Preservation of cosmetics. Antimicrobial properties of natural cosmetic products – Garlic, neem, turmeric, aloe vera and tulsi. Sanitary practices in cosmetic manufacturing - HACCP protocols in cosmetic microbiology.</p> <p><b>UNIT V</b> Cosmetic microbiology test methods - Antimicrobial preservative efficacy, microbial content testing and biological toxicological testing. Validation methods - bioburden and Pharmacopeial microbial assays. Preservatives of cosmetics - Global regulatory and toxicological aspect of cosmetic preservatives.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p><b>Case study</b></p>
<p><b>Skills acquired from this course</b></p>	<p>Identifying the medicinal plants with antimicrobial properties Preparation of cosmetic using microorganisms Evaluating antimicrobial efficacy of natural cosmetic products</p>
<p><b>Justification for nature of course</b></p>	<p>Natural products are usually safe and non-polluting. Finding novel active natural compounds is the main target of developing new cosmetics. The natural products from microbes have received great attention in the cosmetics industry.</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Ayurvedic Formulary of India. (2011). Part 1, 2 &amp; 3. Pharmacopoeia Commission for Indian Medicine and Homeopathy. ISBN-10:8190648977.</li> <li>2. Panda H. (2004). Handbook on herbal medicines. Asia Pacific Business Press Inc. ISBN:8178330911.</li> <li>3. Mehra P. S. (2019). A Textbook of Pharmaceutical Microbiology. Dreamtech Press. ISBN 13:9789389307344.</li> <li>4. Geis P. A. (2020). Cosmetic microbiology: A Practical Approach. (3rd Edition). CRC Press. ISBN:9780429113697.</li> <li>5. Brannan D. K. (1997). Cosmetic microbiology: A Practical Handbook. CRC Press. ISBN-10:0849337135.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Indian Herbal Pharmacopoeia (2002). Vol. I &amp;II Indian Drug Manufacturers Association, Mumbai.</li> <li>2. British Herbal Pharmacopoeia.(1990).Vol.I. British Herbal Medicine Association.ISBN: 0903032090.</li> <li>3. Verpoorte R. and Mukherjee, P. K. (2010). GMP for Botanicals: Regulatory and Quality issues on Phytomedicines. In GMP for botanicals: regulatory and quality issues on phytomedicines. (2nd edition). Saujanya Books, Delhi.ISBN-10:81-900788-5-2/8190078852. ISBN-13:978-81-900788-5-6/9788190078856.</li> <li>2. Turner R. (2013). Screening methods in Pharmacology. Elsevier. ISBN:9781483264233.</li> <li>3. 5. Cupp M. J. (2010). Toxicology and Clinical Pharmacology of Herbal Products (pp. 85-93). M. J. Cupp. Humana Press.Totowa, NJ, USA. ISBN-10:1617371904.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.academia.edu/50236711/Modern_Extraction_Methods_for_Preparation_of_Bioactive_Plant_Extracts">https://www.academia.edu/50236711/Modern_Extraction_Methods_for_Preparation_of_Bioactive_Plant_Extracts</a></li> <li>2. <a href="https://www.nhp.gov.in/introduction-and-importance-of-medicinal-plants-and-herbs_mtl">https://www.nhp.gov.in/introduction-and-importance-of-medicinal-plants-and-herbs_mtl</a></li> <li>3. <a href="https://pubmed.ncbi.nlm.nih.gov/17004305/">https://pubmed.ncbi.nlm.nih.gov/17004305/</a></li> <li>4. <a href="https://www.fda.gov/cosmetics/potential-contaminants-cosmetics/microbiological-safety-and-cosmetics">https://www.fda.gov/cosmetics/potential-contaminants-cosmetics/microbiological-safety-and-cosmetics</a></li> <li>5. <a href="https://pubmed.ncbi.nlm.nih.gov/15156038/">https://pubmed.ncbi.nlm.nih.gov/15156038/</a></li> </ol>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Identify the applications of Indian medicinal plants in treating diseases.	Up to K-2
<b>CLO2</b>	Identify and authenticate herbal plants.	Up to K-3
<b>CLO3</b>	Evaluate the antimicrobial activity of medicinal plants.	Up to K-4
<b>CLO4</b>	Describe the role of microorganisms and their metabolites in the preparation of cosmetics.	Up to K-4
<b>CLO5</b>	Validate procedures and biosafety measures in the mass production of cosmetics.	Up to K-4

### 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
<b>CLO1</b>	3	2	1	1	1	3	3	1	2	2	2
<b>CLO2</b>	3	2	2	2	2	3	3	2	3	3	3
<b>CLO3</b>	3	3	3	3	3	3	3	3	3	3	3
<b>CLO4</b>	3	3	3	3	3	3	3	3	3	3	3
<b>CLO5</b>	3	3	3	3	3	3	3	3	3	3	3

### Assessment Scheme Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUEPRINT FOR TEST COMPONENT OF CIA BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>ESSENTIALS OF LABORATORY MANAGEMENT AND BIOSAFETY</b>					
<b>TANSICHE Course type</b>		<b>Elective Course II (Choice 3)</b>					
<b>Course Category</b>		<b>Elective II (Choice 3)</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Elective Course II</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P1RECT2</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		5	--		--		5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>			<b>Total</b>
		25		75			100
<b>Pre-requisite(s)</b>		Basic knowledge on microbiology					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To utilize containment principles to ensure biosafety.</li> <li>To enrich the student role and responsibilities of laboratory hazards and their control.</li> <li>To know the importance of first aid technique for various common lab accidents.</li> <li>To acquire knowledge of biosafety level, risk assessment and maintain proper hygiene in the laboratory.</li> <li>To discuss the biosafety regulations and guidelines and implementation of safety programs.</li> </ul>					
<b>Course Outline</b>		<b>UNIT 1</b> Introduction to the laboratory and laboratory hazards - General laboratory facilities – Occupational safety- Lab accidents - Fires, chemical burns, slips and falls, Animal bites. Cuts from broken glass. Toxic fume inhalation. General laboratory rules, Good laboratory practice (GLP). Laboratory plan.					
		<b>UNIT II</b> Common hazards in laboratory: Chemical hazards- Safe handling of chemicals and gases, hazard labels and symbols. Material safety datasheet (MSDS), Chemical handling - Fume hood, Storage of chemicals. Chemical Waste Disposal Guideline. Physical hazards - Physical agent data sheets (PADS), Electric hazards- Electrical shock, Electrical explosions, Electrical burns. Safe work practices. Potential ignition sources in the lab. Stages of Fire. Fire Extinguishers. Fire Response.					

	<p><b>UNIT III</b></p> <p>Prevention and First aid for laboratory accidents. Personal protective equipment (PPE), Proper attire (Eye/Face Protection, laboratory coats, gloves, respirators. Disposal/Removal of PPE. Emergency equipment safety - Showers/ Eye Washes. Laboratory security and emergency response. First aid for - Injuries caused by broken glass, Acid/Alkali splashes on the skin, swallowing acid/alkali, burns caused by heat, electric shock.</p>
	<p><b>UNIT IV</b></p> <p>Biosafety - Historical background. Blood borne pathogens (BBP) and laboratory - acquired infections. Introduction to biological safety cabinets. Primary containment for biohazards. Biosafety levels of specific microorganisms. Recommended biosafety. Levels for infectious agents and infected animals. Risk groups with examples - Risk assessment. Safety levels. Case studies - Safe working, hand hygiene. Laboratory instruments, packing, sending, transport, import and export of biological agents. Hygiene, disinfection, decontamination, sterilization.</p>
	<p><b>UNIT V</b></p> <p>Biosafety regulations and guidelines. Centers for disease control and prevention and the National institutes of health. Occupational safety and health administration. Recombinant DNA advisory committee(RDAC), Institutional biosafety committee(IBSC), Review committee on genetic manipulation(RCGM), Genetic engineering approval committee (GEAC). Implementation of biosafety guidelines.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p><b>Case study</b></p>
<p><b>Skills acquired from this course</b></p>	<p>Applying standard procedures for safe handling of hazardous substances</p> <p>Implementing biosafety regulations and guidelines in laboratory</p> <p>Exploring theoretical and practical aspects in occupational safety and health administration</p>
<p><b>Justification for nature of course</b></p>	<p>Working safely in the laboratory and producing quality results are the key principles of any laboratory oriented/ research programs. Good laboratory practices are necessary to protect personnel working in the laboratory, laboratory instruments, health of the community and environment.</p>

<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Sateesh M. K. (2013). Bioethics and Biosafety, IK International Pvt Ltd. ISBN : 8190675702.</li> <li>2. Muthuraj M. and Usharani B. (2019). Biosafety in Microbiological Laboratories. (1st Edition). Notion Press. ISBN 10: 1645878856</li> <li>3. Biosafety in Microbiological and Biomedical Laboratories - U.S. Health Department and Human Services. (2016). (5th Edition). Lulu.com.</li> <li>4. Kanai. L. Mukherjee. (Medical Laboratory Technology(4th Edition). CBS Publishers.</li> <li>5. Ramakrishnan (2012). Manual of Medical Laboratory Techniques. JP brothers.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. World Health Organization, Biosafety programme management. (2010). (4th Edition). WHO Publications.</li> <li>2. Rashid N. (2013). Manual of Laboratory Safety (Chemical, Radioactive, and Biosafety with Biocides) (1st Edition).</li> <li>3. Dayuan X. (2015). Biosafety and Regulation for Genetically Modified Organisms, Alpha Science International Ltd, ISBN-10 : 1842657917</li> <li>4. Ochei J. Kolhatkar(2000). A. (Medical Laboratory Science – Theory and Practice. ISBN; 13:978-0074632239.</li> <li>5. Lynne S. Garcia. Clinical Laboratory Management (2nd Edition). ASM Press</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.cdc.gov/labs/pdf/CDCBiosafetyMicrobiologicalBiomedicalLaboratories-2009-P.pdf">https://www.cdc.gov/labs/pdf/CDCBiosafetyMicrobiologicalBiomedicalLaboratories-2009-P.pdf</a></li> <li>2. <a href="https://ucanapplym.s3.amazonaws.com/RGU/notifications/E_learning/Online_study/PG-SEM-IV-Biosafety%20regulation.pdf">https://ucanapplym.s3.amazonaws.com/RGU/notifications/E_learning/Online_study/PG-SEM-IV-Biosafety%20regulation.pdf</a></li> <li>3. <a href="https://consteril.com/biosafety-levels-difference/">https://consteril.com/biosafety-levels-difference/</a></li> <li>4. <a href="https://www.cdc.gov/labs/pdf/CDCBiosafetyMicrobiologicalBiomedicalLaboratories-2009-P.pdf">https://www.cdc.gov/labs/pdf/CDCBiosafetyMicrobiologicalBiomedicalLaboratories-2009-P.pdf</a></li> <li>5. <a href="https://www.who.int/publications/i/item/9789240011311">https://www.who.int/publications/i/item/9789240011311</a></li> </ol>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Employ skills on laboratory safety and avoid laboratory accidents	Up to K-2
<b>CLO2</b>	Prevent laboratory hazards by practicing safety strategies.	Up to K-3
<b>CLO3</b>	Practice various first aid procedures during common laboratory accidents.	Up to K-4
<b>CLO4</b>	Ensure biosafety strategies in laboratory.	Up to K-4
<b>CLO5</b>	Recognize the importance of biosafety guidelines.	Up to K-4

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

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUEPRINT FOR TEST COMPONENT OF CIA BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>MICROBIAL CULTIVATION AND GROWTH</b>						
<b>TANSICHE Course type</b>		<b>SEC I</b>						
<b>Course Category</b>		<b>Skill Enhancement Course I</b>						
<b>Nature of Course</b>		<b>Employability / Entrepreneurship /Skill Development</b>						
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	23P1RSED1	
		<b>Semester</b>	I					
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>		
		2		-		-		
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>	
		25			75		100	
<b>Pre-requisite(s)</b>		<b>Basic knowledge on microbial cultivation</b>						
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To gain knowledge on microbial nutrition and classification.</li> <li>To get a fundamental knowledge on microbial culture media.</li> <li>To explain the methods of cultivation of bacteria and Actinomycetes.</li> <li>To study the methods of cultivation of fungal and algal cultivation.</li> <li>To know the methods of viral cultivation</li> </ul>						
<b>Course Outline</b>		<b>UNIT I:</b> Microbial nutrition- Introduction – definition – importance of microbial nutrients. Classification of microbial nutrients: essential nutrients – micronutrients and macronutrients – non-essential nutrients.						
		<b>UNIT II:</b> Microbial culture media - types of media - components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media.						
		<b>UNIT III:</b> Bacterial cultivation - cultivation of aerobic and anaerobic bacteria. Actinomycetes cultivation – isolation, propagation and pure culture maintenance of actinomycetes. Media used for actinomycetes cultivation.						
		Unit IV: Fungal cultivation - Isolation of yeast, cultivation of other fungi cultivation on sabourauds agar. Static and shaker cultures, fungal wet mounts and study of morphological characteristics: <i>Aspergillus</i> , <i>Penicillium</i> . Algal cultivation- techniques for cultivation of algae in laboratory, seed culture & its maintenance. Designing of photobioreactor and raceway Ponds for algal cultivation.						
		<b>Unit V:</b> Viral cultivation - Isolation and cultivation of plant and animal viruses - experimental plants and tissue culture, experimental animals, embryonated eggs, organ cultures, primary and secondary cell cultures, suspension and monolayer cell cultures, cell strains, cell lines.						

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Practical methods
<b>Skills acquired from this course</b>	Microbial cultivation methods
<b>Justification for nature of course</b>	Microbial cultivation and nutrition
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Dubey. R.C and Maheshwari. D.K (2000) “Text book of Microbiology” S. Chand Publishing,</li> <li>2. Ananthanarayanan, R. and C.K. Jayaram Paniker, (1990)“Textbook of Microbiology”,4th Edition, Orient Longman</li> <li>3. Trivedi, P. C(2010) “Text book of Microbiology” Pointer publishers</li> <li>4. Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11<sup>th</sup> Edition., A La Carte Pearson.</li> <li>5. Boyd, R.F. (1998). General Microbiology,2<sup>nd</sup> Edition., Times Mirror, Mosby CollegePublishing, St Louis.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Sunita H. Patil, Pachorkar. Y and Suchita N. Patil(2019). “Microbial Cultivation and Growth” Success Publication</li> <li>2. <u>Rajashree Bhalchandra Patwardhan, Pragati Sunil Abhyankar</u> (2020)“Microbial Cultivation and Growth” Nirali Prakashan publishers</li> <li>3. Pelczar, M.J.(1993) “Microbiology”, 5th Edition, Tata McGraw-Hill</li> <li>4. Prescott. Harley, Klein (2008)“Microbiology “: McGraw-Hill Higher Education</li> <li>5. Dubey. R.C and Maheshwari. D.K. (2002)“Practical Microbiology” S. Chand Publishing.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://microbiologyinfo.com/category/basic-microbiology/">https://microbiologyinfo.com/category/basic-microbiology/</a></li> <li>2. <a href="https://microbiologyinfo.com/category/basic-microbiology/">https://microbiologyinfo.com/category/basic-microbiology/</a></li> <li>3. <a href="https://www.britannica.com/science/microbiology">https://www.britannica.com/science/microbiology</a></li> </ol>

### COURSE OUTCOMES:

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

<b>CO1</b>	Explain the basic concept of microbial nutrition and its classification	<b>K-level</b>
<b>CO2</b>	Acquire knowledge about the microbial culture media	Up to K-2
<b>CO3</b>	Understand the isolation and cultivation of bacteria and actinomycetes	Up to K-2
<b>CO4</b>	Explain the isolation and cultivation of algae and fungi	Up to K-2
<b>CO5</b>	Study about the isolation and cultivation of virus	Up to K-2

## MAPPING WITH PROGRAMME OUTCOMES

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

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

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUEPRINT FOR TEST COMPONENT OF CIA

#### BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
.	CLO 2	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
	CLO 3	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
	CLO 4	Up to K 2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

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

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>MEDICAL BACTERIOLOGY AND MYCOLOGY</b>					
<b>TANSICHE Course type</b>		<b>CORE COURSE IV</b>					
<b>Course Category</b>		<b>Core IV</b>					
<b>Nature of Course</b>		<b>Employability / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23P2RCCT3</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		6	--		--	6	
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic knowledge about bacteria and fungi.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Acquire Knowledge on collection, transportation and processing of various kinds of clinical specimens.</li> <li>• Explain morphology, characteristics and pathogenesis of bacteria.</li> <li>• Discuss various factors leading to pathogenesis of bacteria.</li> <li>• Acquire knowledge on antifungal agents and their importance.</li> <li>• Describe various diagnostic methods available for fungal disease diagnosis.</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT I</b> Classification of medically important bacteria, Normal flora of human body, Collection, transport, storage and processing of clinical specimens, Microbiological examination of clinical specimens, antimicrobial susceptibility testing. Handling and maintenance of laboratory animals – Rabbits, guinea pigs and mice.</p> <p><b>UNIT II</b> Morphology, classification, characteristics, pathogenesis, laboratory diagnosis and treatment of diseases caused by species of <i>Staphylococci</i>, <i>Streptococci</i>, <i>Pneumococci</i>, <i>Neisseriae</i>, <i>Bacillus</i>, <i>Corynebacteria</i>, <i>Mycobacteria</i> and <i>Clostridium</i>.</p> <p><b>UNIT III</b> Morphology, classification, characteristics, pathogenesis, laboratory diagnosis and treatment of diseases caused by Enterobacteriaceae members, <i>Yersinia</i>, <i>Pseudomonas</i>, <i>Vibrio</i>, <i>Mycoplasma</i>, <i>Helicobacter</i>, <i>Rickettsiae</i>, <i>Chlamydiae</i>, <i>Bordetella</i>, <i>Francisella</i>, <i>Spirochaetes</i>- <i>Leptospira</i>, <i>Treponema</i> and <i>Borrelia</i>. Nosocomial, zoonotic and opportunistic infections - prevention and control.</p> <p><b>UNIT IV</b> Morphology, taxonomy and classification of fungi. Detection and recovery of fungi from clinical specimens. Dermatophytes and agents of superficial mycoses. <i>Trichophyton</i>, <i>Epidermophyton</i> &amp; <i>Microsporium</i>. Yeasts of medical importance – <i>Candida</i>, <i>Cryptococcus</i>. Mycotoxins. Antifungal agents, testing methods and quality control.</p> <p><b>UNIT V</b> Dimorphic fungi causing Systemic mycoses, <i>Histoplasma</i>, <i>Coccidioides</i>, <i>Sporothrix</i>, <i>Blastomyces</i>. Fungi causing Eumycotic Mycetoma, Opportunistic fungi- Fungi causing secondary infections in immunocompromised patients. Immunodiagnostic methods in mycology- Recent advancements in diagnosis. Antifungal agents.</p>					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Case study, project model
<b>Skills acquired from this course</b>	Employ various methods to detect microbes in clinical samples and apply knowledge on diagnosis.
<b>Justification for nature of course</b>	Students will be able to determine various ways to treat diseases caused but also finds measures that can be used to prevent or at least minimize infection rates.
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Kanunga R. (2017). Ananthanarayanan and Panicker's Text book of Microbiology.(2017).Orient Longman, Hyderabad.</li> <li>2. Greenwood, D., Slack, R. B. and Peutherer, J. F. (2012) Medical Microbiology, (18<sup>th</sup>Edition). Churchill Livingstone, London.</li> <li>3. Finegold, S. M. (2000) Diagnostic Microbiology, (10th Edition). C.V. Mosby Company, St. Louis.</li> <li>4. Alexopoulos C. J., Mims C. W. and Blackwell M. (2007). Introductory Mycology, (4th Edition). Wiley Publishers.</li> <li>5. Chander J. (2018). Textbook of Medical Mycology. (4th Edition). Jaypee brothers Medical Publishers.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Salle A. J. (2007). Fundamental Principles of Bacteriology. (4<sup>th</sup> Edition). TataMcGraw-Hill Publications.</li> <li>2. Collee J.C. Duguid J.P. Foraser, A.C, Marimon B.P, (1996). Mackie &amp; McCartney Practical Medical Microbiology. 14<sup>th</sup>edn, Churchill Livingston.</li> <li>3. Cheesbrough M. (2006). District Laboratory Practice in Tropical countries.- Part 22ndedn.Cambridge University Press.</li> <li>4. Topley and Wilson's. (1998). <u>Principles of Bacteriology</u>.9<sup>th</sup> edn. Edward Arnold, London..</li> <li>5. Murray P.R., Rosenthal K.S. and Michael A. (2013). <u>Medical Microbiology</u>. Pfaller.7<sup>th</sup> edn. Elsevier, Mosby Saunders.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://textbookofbacteriology.net/nd">http://textbookofbacteriology.net/nd</a></li> <li>2. <a href="https://microbiologysociety.org/members-outreach-resources/links.html">https://microbiologysociety.org/members-outreach-resources/links.html</a></li> <li>3. <a href="https://www.pathelective.com/micro-resources">https://www.pathelective.com/micro-resources</a></li> <li>4. <a href="http://mycology.cornell.edu/fteach.html">http://mycology.cornell.edu/fteach.html</a></li> <li>5. <a href="https://www.adelaide.edu.au/mycology/">https://www.adelaide.edu.au/mycology/</a></li> </ol>

## COURSE OUTCOMES

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

<b>Course Outcomes</b>	<b>CLOs</b> On completion of this course, students will;	<b>K-level</b>
<b>CLO1</b>	Collect, transport and process of various kinds of clinical specimens.	Up to K-2
<b>CLO2</b>	Analyze various bacteria based on morphology and pathogenesis.	Up to K-3
<b>CLO3</b>	Discuss various treatment methods for bacterial disease.	Up to K-4
<b>CLO4</b>	Employ various methods detect fungi in clinical samples and apply knowledge on antifungal agents.	Up to K-4
<b>CLO5</b>	Apply various immunodiagnostic method to detect fungal infections.	Up to K-4

### 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).

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	3	2	2	2	2	2	3	1	2	3	2
<b>CLO2</b>	3	2	2	2	2	2	3	1	2	3	2
<b>CLO3</b>	3	2	2	2	3	2	3	1	2	3	2
<b>CLO4</b>	3	3	3	3	3	2	3	1	2	3	2
<b>CLO5</b>	3	3	3	3	2	2	3	1	2	3	2

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>MEDICAL VIROLOGY AND PARASITOLOGY</b>					
<b>TANSICHE Course type</b>		<b>CORE COURSE V</b>					
<b>Course Category</b>		<b>Core V</b>					
<b>Nature of Course</b>		<b>Employability / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>5</b>	<b>Course Code</b>	<b>23P2RCCT4</b>
		<b>Semester</b>	<b>II</b>				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		6		--		--	6
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic knowledge about virus and parasites.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Describe the replication strategy and cultivation methods of viruses.</li> <li>• Acquire knowledge about oncogenic virus and human viral infections.</li> <li>• Develop diagnostic skills, in the identification of virus infections.</li> <li>• Impart knowledge about parasitic infections.</li> <li>• Develop diagnostic skills, in the identification of parasitic infections.</li> </ul>					
<b>Course Outline</b>		<b>UNIT 1</b> General properties of viruses - Structure and Classification - viroids, prions, satellite RNAs and virusoids. Cultivation of viruses - embryonated eggs, experimental animals and cell cultures. Purification and Assay of viruses – Physical and Chemical methods (Electron Microscopy, Protein and Nucleic acids studies) Infectivity Assays (Plaque and end-point).					
		<b>UNIT II</b> Virus Entry, Host Defenses Against Viral Infections, Epidemiology, pathogenic mechanisms, Pathogenesis, laboratory diagnosis, treatment for the following viruses: DNA Viruses- Pox, Herpes, Adeno, Papova and Hepadna, RNA Viruses- Picorna, Orthomyxo, Paramyxo, Rhabdo, Rota, HIV and other Hepatitis viruses, Arbo – Dengue virus, Ebola virus, Emerging and reemerging viral infections.					
		<b>UNIT III</b> Bacterial viruses - $\Phi$ X 174, M13, MU, T4, lambda, Pi; Structural organization, life cycle and phage production. Lysogenic cycle-typing and application in bacterial genetics. Diagnosis of viral infections –conventional serological and molecular methods. Antiviral agents andviral vaccines.					

	<p><b>UNIT IV</b> Introduction to Medical Parasitology – Classification, host- parasite relationships. Epidemiology, life cycle, pathogenic mechanisms, laboratory diagnosis, treatment for the following: Protozoa causing human infections – <i>Entamoeba</i>, Aerobic and Anaerobic amoebae, <i>Giardia</i>, <i>Trichomonas</i>, <i>Balantidium</i>. <i>Toxoplasma</i>, <i>Cryptosporidium</i>, <i>Leishmania</i>, and <i>Trypanasoma</i>.</p>
	<p><b>UNIT V</b> Classification, life cycle, pathogenicity, laboratory diagnosis and treatment for parasites – Helminthes - Cestodes – <i>Taenia solium</i>, <i>T. Saginata</i>, <i>T. Echinococcus</i>. Trematodes – <i>Fasciola hepatica</i>, <i>Fasciolopsis buski</i>, <i>Paragonimus</i>, <i>Schistosomes</i>. Nematodes - <i>Ascaris</i>, <i>Ankylostoma</i>, <i>Trichuris</i>, <i>Trichinella</i>, <i>Enterobius</i>, <i>Strongyloides</i> and <i>Wuchereria</i>. Other parasites causing infections in immune compromised hosts and AIDS. Cultivation of parasites. Diagnosis of parasitic infections – Serological and molecular diagnosis. Anti- protozoan drugs.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Case study, project model</p>
<p><b>Skills acquired from this course</b></p>	<p>Identify viral and parasitic infections and able to do serological and molecular diagnosis.</p>
<p><b>Justification for nature of course</b></p>	<p>Contrast differences in virus architecture and classification.</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Kanunga R. (2017). Ananthanarayanan and Panicker’s Text book of Microbiology. (10<sup>th</sup> Edition). Universities Press (India) Pvt. Ltd.</li> <li>2. Dubey, R.C. and Maheshwari D.K. (2010). A Text Book of Microbiology. S.Chand &amp; Co.</li> <li>3. Rajan S. (2007). Medical Microbiology. MJP publisher.</li> <li>4. Paniker J. (2006). Text Book of Parasitology. Jay Pee Brothers, New Delhi.</li> <li>5. Arora, D. R. and Arora B. B. (2020). Medical Parasitology. (5<sup>th</sup> Edition). CBSPublishers &amp; Distributors Pvt. Ltd. New Delhi.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Carter J.(2001). Virology: Principles and Applications (1<sup>st</sup> Edition). WileyPublications.</li> <li>2. Willey J., Sandman K. and Wood D. Prescott's Microbiology. (11<sup>th</sup> Edition).McGraw Hill Book.</li> <li>3. Jawetz E., Melnick J. L. and Adelberg E. A. (2000). Review of Medical Microbiology. (19th Edition). Lange Medical Publications, U.S.A.</li> <li>4. Finegold S.M. (2000). Diagnostic Microbiology. (10<sup>th</sup> Edition). C.V. Mosby Company, St. Louis.</li> <li>5. Levanthal R. and Cheadle R. S. (2012). Medical Parasitology. (6<sup>th</sup> Edition). S.A. Davies Co. Philadelphia.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://en.wikipedia.org/wiki/Virology">https://en.wikipedia.org/wiki/Virology</a></li> <li>2. <a href="https://academic.oup.com/femsre/article/30/3/321/546048">https://academic.oup.com/femsre/article/30/3/321/546048</a></li> <li>3. <a href="https://www.sciencedirect.com/science/article/pii/S0042682215000859">https://www.sciencedirect.com/science/article/pii/S0042682215000859</a></li> <li>4. <a href="https://nptel.ac.in/courses/102/103/102103039/">https://nptel.ac.in/courses/102/103/102103039/</a></li> <li>5. <a href="https://www.healthline.com/health/viral-diseases#contagiousness">https://www.healthline.com/health/viral-diseases#contagiousness</a></li> </ol>

## COURSE OUTCOMES

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

<b>Course Outcomes</b>	<b>CLOs</b> On completion of this course, students will;	<b>K-level</b>
<b>CLO1</b>	Cultivate viruses by different methods and aid indiagnosis. Perform purification and viral assay.	Up to K-2
<b>CLO2</b>	Investigate the symptoms of viral infections and presumptively identify the viral disease.	Up to K-3
<b>CLO3</b>	Diagnose various viral diseases by different methods. (serological, conventional and molecular)	Up to K-4
<b>CLO4</b>	Educate public about the spread, control and prevention of parasitic diseases.	Up to K-4
<b>CLO5</b>	Identify the protozoans and helminthes present in stool and blood specimens. Perform serological and molecular diagnosis of parasitic infections.	Up to K-4

**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	2	3	2	2	2	2	2
CLO2	3	2	2	2	2	3	2	2	2	2	2
CLO3	3	3	2	3	2	3	3	2	2	3	2
CLO4	3	3	3	2	2	3	2	2	2	2	2
CLO5	3	3	3	3	2	3	3	2	2	3	2

**Assessment Scheme****Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA  
BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>PRACTICAL II - MEDICAL MICROBIOLOGY</b>					
<b>TANSICHE Course type</b>		<b>CORE COURSE VI</b>					
<b>Course Category</b>		<b>CORE VI</b>					
<b>Nature of Course</b>		<b>Employability / Entrepreneurship / Skill Development</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	<b>23P2RCCP2</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	
						6	
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>							
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Develop skills in the diagnosis of bacterial infections and antimicrobial sensitivity.</li> <li>• Impart knowledge on fungal infections and its diagnosis.</li> <li>• Cultivation, identification and assay of viruses for diagnostics and vaccine production</li> <li>• Diagnose parasitic infections.</li> <li>• Identification of medically important vectors.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I:</b>            Staining of clinical specimens - Wet mount, Differential and Special staining methods.            Isolation and identification of bacterial pathogens from clinical specimens - cultivation in basal, differential, enriched, selective and special media – Biochemical identification tests.            Enumeration of bacteria in urine to detect significant bacteriuria.            Antimicrobial sensitivity testing - Kirby Bauer method and Stokes method.            Minimum inhibitory concentration (MIC) test.            Minimum bactericidal concentration (MBC) test.</p>					
		<p><b>Unit II:</b>            Identification and Classification of common fungi.            Examination of different fungi by Lactophenol cotton blue staining.            Examination of different fungi by KOH staining.            Cultivation of fungi and their identification - <i>Mucor</i>, <i>Rhizopus</i>, <i>Aspergillus</i>, <i>Penicillium</i>.            Microscopic observation of different asexual fungal spores.            Microscopic observation of fungal fruiting bodies.            Identification of Dermatophytes.</p>					

	<p><b>Unit III:</b> Isolation and characterization of bacteriophage from natural sources by phage titration. Cultivation of viruses –Egg Inoculation methods. Diagnosis of Viral Infections –ELISA –HIA. Spotters of viral inclusions and CPE-stained smears.</p> <p><b>Unit IV:</b> Examination of parasites in clinical specimens - Ova/cysts in faeces. Concentration: methods – Floatation methods-simple Saturated salt solution method – Zinc sulphate methods - Sedimentation methods- Formal ether method. Blood smear examination for malarial parasites. Thin smear by Leishman's stain – Thick smear by J.B. stain.</p> <p><b>Unit V:</b> Identification of common arthropods of medical importance - spotters of <i>Anopheles</i>, <i>Glossina</i>, <i>Phlebotomus</i>, <i>Aedes</i>, Ticks and mites.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Workshop, Clinical Lab visit, internship.</p>
<p><b>Skills acquired from this course</b></p>	<p>Learn to pursue experimental procedures. Extend skills to create answerable questions/hypotheses, forecast expected results. Find out how to make careful observations, collect and analyze data, and depict appropriate conclusions. Utilize hands on training in Medical microbiology</p>
<p><b>Justification for nature of course</b></p>	<p>Microbiology is one of the most significant fields in biology. The progress of microbiology has been seen in the fields of Agriculture, Environmental management, Medicine, Clinical research , Pharmacy and industries</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Cullimore D. R. (2010). Practical Atlas for Bacterial Identification, 2<sup>nd</sup> Edition. Publisher-Taylor and Francis.</li> <li>2. Abbott A.C. (2010). The Principles of Bacteriology. Nabu Press.</li> <li>3. Parija S. C. (2012). Textbook of Practical Microbiology. Ahuja Publishing House.</li> <li>4. Cappuccino, J. and Sherman, N. (2002) Microbiology: A Laboratory Manual, (6<sup>th</sup>Edition). Pearson Education, Publication, New Delhi.</li> <li>5. Morag C. and Timbury M.C. (1994).__Medical Virology. 4<sup>th</sup> edn. Blackwell Scientific Publishers.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Collee J. G., Fraser A.G. Marmion B. P. and Simmons A. (1996). Mackie &amp; McCartney Practical Medical Microbiology. (14<sup>th</sup> Edition). Elsevier, New Delhi.</li> <li>2. Chart H. (2018). Practical Laboratory Bacteriology. CRC Press.</li> <li>3. Moore V. A. (2017). Laboratory Directions for Beginners in Bacteriology. Triste Publishing Ltd.</li> <li>4. Cheesbrough M. (2006). District Laboratory Practice in Tropical countries.- Part 22<sup>nd</sup> Edition. Cambridge University Press.</li> <li>5. Murray P.R., Rosenthal K.S. and Michael A. (2013). Medical Microbiology. Pfaller. 7<sup>th</sup> Edition. Elsevier, Mosby Saunders</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://textbookofbacteriology.net/">http://textbookofbacteriology.net/</a></li> <li>2. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7173454/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7173454/</a></li> <li>3. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3768729">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3768729</a></li> <li>4. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC149666/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC149666/</a></li> <li>5. <a href="https://www.intechopen.com/books/current-issues-in-molecular-virology-viral-genetics-and-biotechnological-applications/vaccines-and-antiviral-agents">https://www.intechopen.com/books/current-issues-in-molecular-virology-viral-genetics-and-biotechnological-applications/vaccines-and-antiviral-agents</a></li> </ol>

### **COURSE OUTCOMES:**

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

<b>CO1</b>	Collection of different clinical samples, transport, culture and examination.
<b>CO2</b>	Identify medically important fungus from the clinical samples.
<b>CO3</b>	Perform and Interpret serological tests for viral diseases.
<b>CO4</b>	Exam and identify ova and cyst in samples.
<b>CO5</b>	Collection and identification of arthropod vectors.

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

**Blueprint for Test component of CIA**

Component	Mark
Major question	10
Minor question	5
Spotters	5
Record	5
<b>Total</b>	<b>25</b>

**Blueprint for Semester Examination**

Component	Mark
Major question	25
Minor question	15
Spotters	20
Viva-voce	10
Record	5
<b>Total</b>	<b>75</b>

<b>Title of the Course</b>		<b>EPIDEMIOLOGY</b>					
<b>TANSICHE Course type</b>		<b>Elective Course III</b>					
<b>Course Category</b>		<b>Elective III (Choice 1)</b>					
<b>Nature of Course</b>		<b>Employability / Skill Development</b>					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P2RECT3</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>
		5	--		--		5
<b>Marks</b>		<b>CIA</b>		<b>Semester</b>		<b>Total</b>	
		25		75		100	
<b>Pre-requisite(s)</b>		Basic knowledge about epidemiology.					
<b>Objectives of the Course</b>		<p>Describe the role of epidemiology in public health.</p> <p>Explain about epidemiology tools and disease surveillance methods.</p> <p>Analyze various communicable and non-communicable diseases in India.</p> <p>Discuss on mechanism of antimicrobial resistance.</p> <p>Outline on National health programmes that have been designed to address the issues.</p>					
<b>Course Outline</b>		<p><b>UNIT 1</b></p> <p>Fundamentals of epidemiology - Definitions of epidemiology – Epidemiology of infectious diseases in Public Health. Natural history of disease - Historical aspects of epidemiology. Common risk factors - Epidemiologic Triad - Agent factors, host factors and environmental factors. Transmission basics - Chain of infection, portal of entry. Modes of transmission - Direct and indirect. Stages of infectious diseases. Agents and vectors of communicable diseases of public health importance and dynamics of disease transmission. Epidemiology of Zoonosis - Factors, routes of transmission of bacterial, viral, parasitic and fungal zoonotic agents. Control of zoonosis.</p>					
		<p><b>UNIT II</b></p> <p>Tools of Epidemiology - Measures of Disease - Prevalence, incidence. Index case. Risk rates. Descriptive Epidemiology - Cohort studies, measuring infectivity, survey methodology including census procedures. Surveillance strategies - Disease surveillance, geographical indication system, outbreak investigation in public health and contact investigation.</p>					

	<p><b>UNIT III</b></p> <p>Epidemiological aspects of diseases of national importance - Background to communicable and non-communicable diseases. Vector borne diseases in India. Diarrhoeal diseases. Zoonoses. Viral haemorrhagic fevers. Mycobacterial infections. Sexually transmitted diseases. Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS). Emerging disease threats - Severe Acute Respiratory Syndrome (SARS), Covid-19, Ebola, MDR-TB, Malaria, Mucor mycosis, Avian flu. Dengue, Swine Flu, Chikungunya. Epidemiology, prevention, and control of non-communicable diseases - Asthma, Coronary heart disease, Malignancy, diabetes mellitus, respiratory diseases, eye diseases, Dental disorders. Emerging and Re-emerging Diseases.</p> <p><b>UNIT IV</b></p> <p>Mechanisms of Antimicrobial resistance - Multidrug Efflux pumps, Extended Spectrum <math>\beta</math>-lactamases (ESBL). Hospital acquired infections - Factors, infection sites, mechanisms, Role of Multidrug resistant pathogens. Role of Pseudomonas, Acinetobacter, Clostridium difficile, HBV, HCV, Rotavirus, Cryptosporidium and Aspergillus in Nosocomial infections. Prevention and management of nosocomial infections.</p> <p><b>UNIT V</b></p> <p>National Programmes related to Communicable and Non- Communicable diseases - National Malaria Eradication Programme, Revised National Tuberculosis Control Programme, Vector Borne Disease Control Programme, National AIDS Control Programme, National Cancer Control Programme and National Diabetes Control Programme. Biochemical and immunological tools in epidemiology - Biotyping, Serotyping, Phage typing, FAME (Fatty acid methyl ester analysis), Curie Point PyMS (Pyrolysis Mass spectrometry), Protein profiling, Molecular typing methods.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Case study, project model</p>
<p><b>Skills acquired from this course</b></p>	<p>Students able to handle biochemical and immunological tools in epidemiology.</p>
<p><b>Justification for nature of course</b></p>	<p>Analyze various communicable and non-communicable diseases.</p>

<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Dicker R., Coronado F., Koo. D. and Parrish. R. G. (2012). Principles of Epidemiology in Public Health Practice., (3<sup>rd</sup> Edition). CDC.</li> <li>2. Gerstman B. (2013). Epidemiology Kept Simple: An Introduction to Classic and Modern Epidemiology. (3rd Edition). Wiley Blackwell.</li> <li>3. Greenwood, D., Slack, R. B. and Peutherer, J. F. (2012) Medical Microbiology, (18th Edition). Churchill Livingstone, London.</li> <li>4. Jawetz E., Melnick J. L. and Adelberg E. A. (2000). Review of Medical Microbiology. (19th Edition). Lange Medical Publications, U.S.A.</li> <li>5. Dimmok N. J. and Primrose S. B. (1994). Introduction to Modern Virology.5th edn. Blackwell Scientific Publishers.</li> </ol>
<p><b>Reference Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Bhopal R. S. (2016). Concepts of Epidemiology - An Integrated Introduction to the Ideas, Theories, Principles and Methods of Epidemiology. (3rd Edition). Oxford University Press, New York.</li> <li>2. Celentano D. D. and Szklo M. (2018). Gordis Epidemiology. (6th Edition). Elseiver, USA.</li> <li>3. Cheesbrough, M. (2004). District Laboratory Practice in Tropical Countries - Part 2, (2nd Edition). Cambridge University Press.</li> <li>4. Ryan K. J. and Ray C. G. (2004). Sherris Medical Microbiology. (4th Edition), McGraw Hill, New York.</li> <li>5. Topley W.W. C., Wilson, G. S., Parker M. T. and Collier L. H. (1998). Principles of Bacteriology. (9th Edition). Edward Arnold, London.</li> </ol>
<p><b>Websites and e-Learning resources</b></p>	<ol style="list-style-type: none"> <li>1. <a href="https://www.scielo.br/j/rbca/a/mjDFGTtfWtBm786ZmR9TG9d/?lang=en">https://www.scielo.br/j/rbca/a/mjDFGTtfWtBm786ZmR9TG9d/?lang=en</a></li> <li>2. <a href="https://hal.archives-ouvertes.fr/hal-00902711/document">https://hal.archives-ouvertes.fr/hal-00902711/document</a></li> <li>3. <a href="https://www.who.int/csr/resources/publications/whocdscsreph200212.pdf">https://www.who.int/csr/resources/publications/whocdscsreph200212.pdf</a></li> <li>4. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7187955/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7187955/</a></li> <li>5. <a href="https://www.who.int/diseasecontrol_emergencies/publications/idhe_2009_london_outbreaks.pdf">https://www.who.int/diseasecontrol_emergencies/publications/idhe_2009_london_outbreaks.pdf</a></li> </ol>

## COURSE OUTCOMES

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

Course Outcomes	CLOs On completion of this course, students will;	K-level
<b>CLO1</b>	Apply the knowledge acquired on concepts of epidemiology to clinical and public health environment.	Up to K-2
<b>CLO2</b>	Plan various strategies to trace the epidemiology.	Up to K-3
<b>CLO3</b>	Plan the control of communicable and non-communicable diseases.	Up to K-4
<b>CLO4</b>	Analyze the implications of drug resistance in the society and design the control of antimicrobial resistance and its management.	Up to K-4
<b>CLO5</b>	Employ National control programs related to Communicable and Non-Communicable diseases with the public.	Up to K-4

### 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
<b>CLO1</b>	2	2	2	2	2	3	2	1	2	2	2
<b>CLO2</b>	2	2	3	2	2	2	2	1	2	2	2
<b>CLO3</b>	1	2	2	3	3	2	2	2	3	3	2
<b>CLO4</b>	2	2	3	3	3	2	2	2	3	1	2
<b>CLO5</b>	2	2	3	3	2	3	2	3	3	3	2

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>CLINICAL AND DIAGNOSTIC MICROBIOLOGY</b>					
<b>TANSICHE Course type</b>		<b>Elective course III</b>					
<b>Course Category</b>		<b>Elective course III (Choice 2)</b>					
<b>Nature of Course</b>		<b>Employability</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P2RECT3</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		5		--		--	5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Knowledge on Clinical diagnostic.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>Describe appropriate safety protocol and laboratory techniques for handling specimens and biomedical waste management.</li> <li>Develop working knowledge of techniques used to identify infectious agents in the clinical microbiology lab.</li> <li>Elucidate various diagnostic procedures in microbiology.</li> <li>Acquire knowledge on different methods employed to check antibiotic sensitivity.</li> <li>Gain knowledge on hospital acquired infections and their control measures.</li> </ul>					
<b>Course Outline</b>		<b>UNIT 1</b> Microbiology Laboratory Safety Practices -General Safety Guidelines, Handling of Biological Hazards, Infectious health care waste disposal - Biomedical waste management, Emerging and Re-emerging infections.					
		<b>UNIT II</b> Diagnostic procedures - General concept of Clinical specimen collection, transport, storage and general processing in Microbiology laboratory - Specimen acceptance and rejection criteria.					
		<b>UNIT III</b> Diagnosis of microbial diseases - Clinical, differential, Microbiological, immunological and molecular diagnosis of microbial diseases. Modern and novel microbial diagnostic methods. Automation in Microbial diagnosis.					
		<b>UNIT IV</b> Antibiotic sensitivity tests - Disc diffusion - Stokes and Kirby Bauer methods, E test - Dilution - Agar dilution & broth dilution - MBC/MIC - Quality control for antibiotics and standard strains.					

	<p><b>UNIT V</b></p> <p>Nosocomial infections – common types, sources, reservoir and mode of transmission, pathogenesis and control measures. Hospital Infection Control Committee (HICC) – Functions.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Clinical case study.</p>
<p><b>Skills acquired from this course</b></p>	<p>Disease diagnosis, disease control, Laboratory safety.</p>
<p><b>Justification for nature of course</b></p>	<p>Clinical diagnosis and Laboratory safety.</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Collee J. G., Fraser A.G. Marmion B. P. and Simmons A. (1996). Mackie &amp; McCartney Practical Medical Microbiology. (14th Edition). Elsevier, New Delhi. ISBN-10:0443047219 / ISBN-13-978-0443047213.</li> <li>2. Tille P. M. (2021). Bailey and Scott's Diagnostic Microbiology. (15 th Edition). Elsevier. ISBN:9780323681056.</li> <li>3. Jawetz E., Melnick J. L. and Adelberg E. A. (2000). Review of Medical Microbiology. (19th Edition). Lange Medical Publications, U.S.A.</li> <li>4. Mukherjee K.L. (2000). Medical Laboratory Technology. Vol. 1-3. (2nd Edition). Tata McGraw-Hill Education. ISBN-10:0074632604.</li> <li>5. Sood R. (2009). Medical Laboratory Technology – Methods and Interpretations. (6th Edition). Jaypee Brothers Medical Publishers (P) Ltd. New Delhi. ISBN:9788184484496.</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Murray P. R., Baron E. J., Jorgenson J. H., Pfaller M. A. and Tenover F. C. (2003). <i>Manual of Clinical Microbiology</i>. (8th Edition). American Society for Microbiology, Washington, DC. ISBN:1-555810255-4.</li> <li>2. Bennett J. E., Dolin R. and Blaser M. J. (2019). <i>Principles and Practice of Infectious Diseases</i>. (9<sup>th</sup> Edition). Elsevier. EBook ISBN:9780323550277. Hardcover ISBN:9780323482554.</li> <li>3. Ridgway G. L., Stokes E. J. and Wren M. W. D. (1987). <i>Clinical Microbiology</i> 7th Edition. Hodder Arnold Publication. ISBN-10:0340554231 / ISBN13:9780340554234.</li> <li>4. Koneman E.W., Allen S. D., Schreckenbach P. C. and Winn W. C. (2020). <i>Koneman's Color Atlas and Textbook of Diagnostic Microbiology</i>. (7<sup>th</sup> Edition). Jones &amp; Bartlett Learning. ISBN:1284322378 9781284322378.</li> <li>5. Cheesbrough, M. (2004). <i>District Laboratory Practice in Tropical Countries - Part 2</i>, (2nd Edition). Cambridge University Press. ISBN-13:978-0-521-67631-1 / ISBN-10:0- 521-67631-2.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.ncbi.nlm.nih.gov/books/NBK20370/">https://www.ncbi.nlm.nih.gov/books/NBK20370/</a></li> <li>2. <a href="https://www.msdmanuals.com/en-in/home/infections/diagnosis-of-infectious3disease/diagnosis-of-infectious-disease">https://www.msdmanuals.com/en-in/home/infections/diagnosis-of-infectious3disease/diagnosis-of-infectious-disease</a>.</li> <li>3. <a href="https://journals.asm.org/doi/10.1128/JCM.02592-20">https://journals.asm.org/doi/10.1128/JCM.02592-20</a></li> <li>4. <a href="https://www.sciencedirect.com/science/article/pii/S2221169116309509">https://www.sciencedirect.com/science/article/pii/S2221169116309509</a></li> <li>5. <a href="http://www.textbookofbacteriology.net/normalflora_3.html">http://www.textbookofbacteriology.net/normalflora_3.html</a></li> </ol>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Apply Laboratory safety procedures and hospital waste disposal strategies.	Up to K-2
<b>CLO2</b>	Collect various clinical specimens, handle, preserve and process safely.	Up to K-3
<b>CLO3</b>	Identify the causative agents of diseases by conventional and molecular methods following standard protocols.	Up to K-4
<b>CLO4</b>	Assess the antimicrobial susceptibility pattern of pathogens.	Up to K-4
<b>CLO5</b>	Trace the sources of nosocomial infection and recommend control measures	Up to K-4

### 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
<b>CLO1</b>	3	2	1	1	2	2	3	3	2	3	2
<b>CLO2</b>	3	2	1	1	2	2	3	3	2	3	2
<b>CLO3</b>	3	2	1	1	2	2	3	3	2	3	2
<b>CLO4</b>	3	2	1	1	2	2	3	3	2	3	2
<b>CLO5</b>	3	2	1	1	2	2	3	3	2	3	2

### Assessment Scheme Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUE PRINT FOR TEST COMPONENT OF CIA BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>BIOREMEDIATION</b>					
<b>TANSICHE Course type</b>		<b>Elective course III</b>					
<b>Course Category</b>		<b>Elective course III (Choice 3)</b>					
<b>Nature of Course</b>		<b>Employability</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P2RECT3</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		5		--		--	5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Knowledge on bioremediation					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Describe the nature and importance of bioremediation and use in real world applications.</li> <li>• Describe the typical composition of waste water and application of efficient technologies for water treatment.</li> <li>• Explain the fundamentals of treatment technologies and the considerations for its design and implementation in treatment plants.</li> <li>• Explain the potential of microbes in ore extraction and acquaint students with methods of reducing health risks caused by xenobiotics.</li> <li>• Familiarize the role of plants and their associated microbes in remediation and management of environmental pollution.</li> </ul>					
<b>Course Outline</b>		<b>UNIT 1</b> Bioremediation - process and organisms involved. Bioaugmentation - Ex-situ and in-situ processes; Intrinsic and engineered bioremediation. Major pollutants and associated risks; organic pollutant degradation. Microbial aspects and metabolic aspects. Factors affecting the process. Recent developments and significance.					
		<b>UNIT II</b> Microbes involved in aerobic and anaerobic processes in nature. Water treatment - BOD, COD, dissolved gases, removal of heavy metals, total organic carbon removal. Secondary waste water treatments - use of membrane bioreactor. Aquaculture effluent treatment. Aerobic sludge and landfill leachate process. Aerobic digestion.					

	<p><b>UNIT III</b> Composting of solid wastes, anaerobic digestion - methane production and important factors involved, Pros and cons of anaerobic process, sulphur, iron and nitrate reduction, hydrocarbon degradation, degradation of nitroaromatic compounds. Bioremediation of dyes, bioremediation in paper and pulp industries. Aerobic and anaerobic digesters – design. Various types of digester for bioremediation of industrial effluents.</p> <p><b>UNIT IV</b> Microbial leaching of ores - process, microorganismsinvolved and metal recovery with special reference to copperand iron. Biotransformation of heavy metals and xenobiotics. Petroleum biodegradation - reductive and oxidative. Dechlorination. Biodegradable of plastics and super bug.</p> <p><b>UNIT V</b> Phytoremediation of heavy metals in soil - Basic principles of phytoremediation - Uptake and transport, Accumulation and sequestration. Phytoextraction. Phytodegradation. Phytovolatilization. Rhizodegradation. Phytostabilization – Organic and synthetic amendments in multi metal contaminated mine sites. Role of Arbuscular mycorrhizal fungi and plant growth promoting rhizobacteria in phytoremediation.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Field study report</p>
<p><b>Skills acquired from this course</b></p>	<p>Bioremediation methods</p>
<p><b>Justification for nature of course</b></p>	<p>Pollution control, environmental monitoring,</p>
<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Bhatia H.S. (2018). A Text book on Environmental Pollution and Control. (2<sup>nd</sup>Edition). Galgotia Publications.</li> <li>2. Chatterjee A. K. (2011). Introduction to Environmental Biotechnology. (3<sup>rd</sup> Edition). Printice-Hall, India.</li> <li>3. Pichtel, J. (2014). Waste Management Practices: Municipal, Hazardous, andIndustrial, 2<sup>nd</sup> edition, CRC Press.</li> <li>4. Liu, D.H.F and Liptak, B.G (2005). Hazardous Wastes and Solid Wastes, LewisPublishers.</li> <li>5. 5. Rajendran, P. &amp; Gunasekaran, P. (2006). Microbial Bioremediation. 1<sup>st</sup> edition. MJPPublishers</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Sangeetha J., Thangadurai D., David M. and Abdullah M.A. (2016). Environmental Biotechnology: Biodegradation, Bioremediation, and Bioconversion of Xenobiotics for Sustainable Development. (1<sup>st</sup> Edition). Apple Academic Press.</li> <li>2. Singh A. and Ward O. P. (2004). Biodegradation and Bioremediation. Soil Biology.Springer.</li> <li>3. Singh A., Kuhad R. C., and Ward O. P. (2009). Advances in Applied Bioremediation (1<sup>st</sup> Edition). Springer-Verlag Berlin Heidelberg, Germany.</li> <li>4. Atlas, R.M &amp; Bartha, R. (2000). Microbial Ecology. Addison Wesley Longman Inc.</li> <li>5. Rathoure, A.K. (Ed.). (2017). Bioremediation: Current Research and Applications. 1<sup>st</sup> edition. I.K. International Publishing House Pvt. Ltd.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. Bioremediation- Objective, Principle, Categories, Types, Methods, Applications (microbenotes.com)</li> <li>2. <a href="https://agris.fao.org/agris-search">https://agris.fao.org/agris-search</a></li> <li>3. <a href="https://www.sciencedirect.com/topics/earth-and-planetary-sciences/bioremediation">https://www.sciencedirect.com/topics/earth-and-planetary-sciences/bioremediation</a></li> <li>4. <a href="https://www.intechopen.com/chapters/70661">https://www.intechopen.com/chapters/70661</a></li> <li>5. <a href="https://microbiologysociety.org/blog/bioremediation-the-pollution-solution.html">https://microbiologysociety.org/blog/bioremediation-the-pollution-solution.html</a></li> </ol>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Differentiate Ex-situ bioremediation and In-situ bioremediation. Assess the roles of organisms in bioremediation.	Up to K-2
<b>CLO2</b>	Distinguish microbial processes necessary for the design and optimization of biological processing unit operations.	Up to K-3
<b>CLO3</b>	Identify, formulate and design engineered solutions to environmental problems.	Up to K-4
<b>CLO4</b>	Explore microbes in degradation of toxic wastes and playing role on biological mechanisms.	Up to K-4
<b>CLO5</b>	Establish the mechanisms of Arbuscular mycorrhizal fungi and Plant growth promoting <i>Rhizobacteria</i> in phytoremediation.	Up to K-4

### 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
<b>CLO1</b>	2	1	1	2	3	2	2	3	2	2	2
<b>CLO2</b>	2	1	1	2	3	2	2	3	2	2	2
<b>CLO3</b>	2	1	1	2	3	2	2	3	2	2	2
<b>CLO4</b>	2	1	1	2	3	2	2	3	2	2	2
<b>CLO5</b>	2	1	1	2	3	2	2	3	2	2	2

### Assessment Scheme Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUE PRINT FOR TEST COMPONENT OF CIA BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>BIOINFORMATICS</b>					
<b>TANSICHE Course type</b>		<b>Elective course IV</b>					
<b>Course Category</b>		<b>Elective course IV (Choice 1)</b>					
<b>Nature of Course</b>		<b>Employability</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P2RECT4</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		5		--		--	5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Basic Knowledge on biological sequence database					
<b>Objectives of the Course</b>		<ol style="list-style-type: none"> <li>1. Discuss about various biological data mining concepts, tools.</li> <li>2. Elucidate the principles and applications of sequence alignment methods and tools.</li> <li>3. Demonstrate different phylogenetic tree construction methods and its uses in phylogenetic analysis.</li> <li>4. Acquaint with various approaches in predicting 3D and 2D structure of proteins.</li> <li>5. Describe various tools and techniques used in molecular docking, immunoinformatics and subtractive genomics.</li> </ol>					
<b>Course Outline</b>		<b>UNIT 1</b> Biological Data Mining – Exploration of Data Mining Tools. Cluster Analysis Methods. Data Visualization. Biological Data Management. Biological Algorithms – Biological Primary and Derived Databases. Concept of Alignment, Pairwise Sequence Alignment (PSA), Multiple Sequence Alignment (MSA), BLAST, CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM).					
		<b>UNIT II</b> Phylogenetic Tree Construction - Concept of Dendrograms. Evolutionary Trees - Distance Based Tree Reconstruction - Ultrametric trees and Ultrametric distances – Reconstructing Trees from Additive Matrices - Evolutionary Trees and Hierarchical Clustering - Character Based Tree Reconstruction - Maximum Parsimony Method, Maximum likelihood method - Reliability of Trees – Substitution matrices – Evolutionary models.					

	<p><b>UNIT III</b>  Computational Protein Structure prediction – Secondary structure – Homology modelling- Fold recognition and ab initio 3D structure prediction – Structure comparison and alignment – Prediction of function from structure. Geometrical parameters – Potential energy surfaces – Hardware and Software requirements-Molecular graphics – Molecular file formats-Molecular visualization tools.</p> <p><b>UNIT IV</b>  Prediction of Properties of Ligand Compounds – 3D Autocorrelation - 3D Morse Code-Conformation Dependent and Independent Chirality Codes –Comparative Molecular Field Analysis – 4 D QSAR –HYBOT Descriptors – Structure Descriptors – Applications – Linear Free Energy Relationships – Quantity Structure - Property Relationships – Prediction of the Toxicity of Compounds.</p> <p><b>UNIT V</b>  Molecular Docking- Flexible - Rigid docking- Target- Ligand preparation- Solvent accessibility- Surface volume calculation, Active site prediction- Docking algorithms- Genetic, Lamarckian - Docking analyses- Molecular interactions, bonded and nonbonded - Molecular Docking Software and Working Methods. Genome to drug discovery – Subtractive Genomics – Principles of Immunoinformatics and Vaccine Development.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Biological database report.
<b>Skills acquired from this course</b>	Bioinformatics software, molecular modelling and molecular docking.
<b>Justification for nature of course</b>	Biological sequence analysis.

<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Lesk A. M. (2002). Introduction to Bioinformatics. (4<sup>th</sup> Edition). Oxford University Press.</li> <li>2. Lengauer T. (2008). Bioinformatics- from Genomes to Therapies (Vol-1).Wiley- VCH.</li> <li>3. Rastogi S.C., Mendiratta N. and Rastogi P. (2014). Bioinformatics - Methods and Applications (Genomics, Proteomics and Drug Discovery) (4<sup>th</sup> Edition). Prentice-Hall of India Pvt.Ltd.</li> <li>4. Attwood, T.K. and Parry-Smith, D.J. (1999). Introduction to Bioinformatics. AddisonWesley Longman Limited, England.</li> <li>5. Mount D.W., (2013).Bioinformatics sequence and genome analysis, 2<sup>nd</sup>edn.CBSPublishers, New Delhi.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Baxevanis A. D. and Ouellette F. (2004). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. (2<sup>nd</sup> Edition). John Wiley and Sons.</li> <li>2. Bosu O. and Kaur S. (2007). Bioinformatics - Database, Tools, and Algorithms. Oxford University Press.</li> <li>3. David W. M. (2001). Bioinformatics Sequence and Genome Analysis (2<sup>nd</sup> Edition). CBS Publishers and Distributors(Pvt.)Ltd.</li> <li>4. Xiong J, (2011). Essential bioinformatics, First south Indian Edition, CambridgeUniversity Press.</li> <li>5. Harshawardhan P.Bal, (2006). Bioinformatics Principles and Applications, TataMcGraw-Hill Publishing Company Limited.</li> </ol>
<b>Websites and Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.hsls.pitt.edu/obrc/">https://www.hsls.pitt.edu/obrc/</a></li> <li>2. <a href="https://www.hsls.pitt.edu/obrc/index.php?page=dna">https://www.hsls.pitt.edu/obrc/index.php?page=dna</a></li> <li>3. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1669712/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1669712/</a></li> <li>4. <a href="https://www.ebi.ac.uk/">https://www.ebi.ac.uk/</a></li> <li>5. <a href="https://www.kegg.jp/kegg/kegg2.html">https://www.kegg.jp/kegg/kegg2.html</a></li> </ol>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Access to databases that provides information on nucleic acids and proteins.	Up to K-2
<b>CLO2</b>	Invent algorithms for sequence alignment.	Up to K-3
<b>CLO3</b>	Construct phylogenetic tree.	Up to K-4
<b>CLO4</b>	Predict the structure of proteins.	Up to K-4
<b>CLO5</b>	Design drugs by predicting drug ligand interactions and molecular docking.	Up to K-4

**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
<b>CLO1</b>	1	1	2	1	1	2	3	1	3	2	2
<b>CLO2</b>	1	1	2	1	1	2	3	1	3	2	2
<b>CLO3</b>	1	1	2	1	1	2	3	1	3	2	2
<b>CLO4</b>	1	1	2	1	2	2	3	1	3	2	2
<b>CLO5</b>	1	1	2	1	2	2	3	1	3	2	2

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUE PRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

<b>Title of the Course</b>		<b>BIOSAFETY, BIOETHICS AND IPR</b>					
<b>TANSICHE Course type</b>		<b>Elective Course IV</b>					
<b>Course Category</b>		<b>Elective Course IV (Choice 2)</b>					
<b>Nature of Course</b>		<b>Skill Development</b>					
<b>Category</b>	Elective	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23P2RECT4</b>
		<b>Semester</b>	II				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		5					5
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Knowledge on biosafety and bioethics.					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Create a research environment. Encourage investigation, analysis and study the bioethical principles, values, concepts, and social and juridical implications in the areas of science, biotechnology and medicine.</li> <li>• Discuss about various aspects of biosafety regulations, IPR and bioethics concerns arising from the commercialization of biotechnological products.</li> <li>• Familiarize fundamental aspects of Intellectual property Rights in the development and management of innovative projects in industries.</li> <li>• Acquire knowledge about bioethics, biodiversity and Genetically modified foods and food crops</li> <li>• Provide students with an understanding of bioethics in research associated with medicine</li> </ul>					
<b>Course Outline</b>		<b>Unit I:</b> Intellectual Property Rights: Different forms of Intellectual Property Rights – their relevance, importance to industry, Academia. Role of IPR's in Biotechnology, Patent Terminology - Patents, trademarks, copyrights, industrial designs, geographical indications, trade secrets, non-disclosure agreements. Patent life and geographical boundaries. International organizations and IPR - Overview of WTO, TRIPS, WIPO, GATT, International conventions, Trade agreements, Implication of TRIPS for developing countries.					
		<b>Unit II:</b> Process involved in patenting. Patent Search - Procedural steps in patenting, process of filing, PCT application, pre-grant & post-grant opposition, PCT and patent harmonization including Sui-generis system, patent search methods, patent databases and libraries, online tools, Country-wise patent searches (USPTO, EPO, India etc.), patent mapping.					

	<p><b>Unit III:</b>  Patentability of biotechnology inventions - Patentability of biotechnology inventions in India, statutory provisions regarding biotechnological inventions under the current Patent Act 1970 (as Amended 2005). Biotechnological inventions as patentable subject matter, territorial nature of patents - from territorial to global patent regime, interpreting trips in the light of biotechnology inventions, feasibility of a uniform global patent system, merits and demerits of uniform patent law, relevance of the existing international patent, tentative harmonisation efforts, implications of setting up a uniform world patent system.</p> <p><b>Unit IV:</b>  Introduction to bioethics - need of bioethics, applications and issues related to bioethics, social and cultural issues. Bioethics and biodiversity - conserving natural biodiversity, convention on protecting biodiversity, protocols in exchanging biological material across borders. Bioethics &amp; GMO's - issues and concerns pertaining to genetically modified foods and food crops, organisms and their possible health implications and mixing up with the gene-pool.</p> <p><b>Unit V:</b>  Bioethics in medicine - Protocols of ethical concerns related to prenatal diagnosis, gene therapy, organ transplantation, xeno transplantation, ethics in patient care, informed consent. bioethics and cloning - permissions and procedures in animal cloning, human cloning, risks and hopes. Bioethics in research: stem cell research, human genome project, use of animals in research, human volunteers for clinical research, studies on ethnic races. he Nuremberg code.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p><b>Case Studies</b></p>
<p><b>Skills acquired from this course</b></p>	<p>Equipped with the principles involved in ethical, legal, and regulatory issues.</p>
<p><b>Justification for nature of course</b></p>	<p>It provides scientific analysis of the risks and safety and ethical issues.</p>

<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Usharani B., Anbazhagi S. and Vidya C. K. (2019). Biosafety in Microbiological Laboratories. (1<sup>st</sup> Edition). Notion Press. ISBN-101645878856</li> <li>2. Satheesh M. K. (2009). Bioethics and Biosafety. (1<sup>st</sup> Edition). J. K International Publishing House Pvt. Ltd: Delhi. ISBN:9788190675703</li> <li>3. Goel D. and Parashar S. (2013). IPR, Biosaftey and Bioethics. (1<sup>st</sup> Edition). Pearson education: Chennai. ISBN-13: 978-8131774700</li> <li>4. Raj Mohan joshi. Biosafety and Bioethics. Wiley Publications.</li> <li>5. Sibi. GIntellectual, Property Rights, Bioethics, Biosafety and Entrepreneurship in biotechnology. (2021). Wiley Publications.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Nithyananda K. V. (2019). Intellectual Property Rights: Protection and Management, India, IN: Cengage Learning India Private Limited.</li> <li>2. Neeraj, P. and Khusdeep, D. (2014). Intellectual Property Rights, India, IN: PHI learning Private Limited,</li> <li>3. Ahuja, V K. (2017). Law relating to Intellectual Property Rights, India, IN: Lexis Nexis.</li> <li>4. Tony Hope (2004). Medical Ethics: A very Short introduction,. Oxford Publication.</li> <li>5. Goel Parashar. IPR, Biosafety and Bioethics (2013). Pearson Publications.</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf">http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf</a>.</li> <li>2. <a href="https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf">https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf</a>.</li> <li>3. <a href="https://www.cdc.gov/training/quicklearns/biosafety/">https://www.cdc.gov/training/quicklearns/biosafety/</a></li> <li>4. <a href="https://bioethics.msu.edu/what-is-bioethics">https://bioethics.msu.edu/what-is-bioethics</a></li> <li>5. <a href="https://www.wto.org/english/tratop_e/trips_e/intell_e.htm">https://www.wto.org/english/tratop_e/trips_e/intell_e.htm</a></li> </ol>

<b>Course Outcomes</b>	<b>CLOs</b> On completion of this course, students will;	<b>K-level</b>
<b>CLO1</b>	Execute the role of IPR, Patent, Trademarks and its importance.	Up to K-2
<b>CLO2</b>	Develop patent procedure, patent filling and its mapping.	Up to K-3
<b>CLO3</b>	Become Patent attorneys and Patent officers.	Up to K-4
<b>CLO4</b>	Apply bioethics in GMO, food crops and its biodiversity.	Up to K-4
<b>CLO5</b>	Analyze the importance of bioethics in research associated with HGP, clinical research, stem cell therapy.	Up to K-4

### MAPPING WITH PROGRAMME OUTCOMES:

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

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

### Assessment Scheme Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUEPRINT FOR TEST COMPONENT OF CIA BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

Title of the Course		CLINICAL RESEARCH AND CLINICAL TRIALS					
TANSICHE Course type		Elective Course IV					
Course Category		Elective Course IV (Choice 3)					
Nature of Course		Skill Development					
Category	Elective	Year	I	Credits	3	Course Code	23P2RECT4
		Semester	II				
Instructional Hours per week		Lecture	Tutorial	Practical		Total	
		5				5	
Marks		CIA		Semester		Total	
		25		75		100	
Pre-requisite(s)		Knowledge on Medical Microbiology					
Objectives of the Course		<ol style="list-style-type: none"> <li>1. Provide an overview of history and methods involved in conducting clinical research.</li> <li>2. Design the principles involved in ethical, legal, and regulatory issues in clinical research on human subjects.</li> <li>3. Describe principles and issues involved in monitoring patient-oriented research.</li> <li>4. Formulate a well- defined quality assurance and quality control plans.</li> <li>5. Acquire business development skills in the area of clinical research.</li> </ol>					
Course Outline		<p><b>Unit I:</b> Introduction to Clinical Research: Clinical Research: An Overview, Different types of Clinical Research. Clinical Pharmacology: Pharmacokinetics, Pharmacodynamics, Pharmacoepidemiology, Bioavailability, Bioequivalence, Terminologies and definition in Clinical Research. Drug Development Process: Drug Discovery Pipeline, Drug Discovery Process. Preclinical trail, Human Pharmacology (Phase-I), Therapeutic Exploratory trail (Phase-II), Therapeutic Confirmatory Trail (Phase-III) and Post marketing surveillance (Phase-IV).</p>					
		<p><b>Unit II:</b> Ethical Considerations and Guideline in Clinical Research: Historical guidelines in Clinical Research-Nuremberg code, Declaration of Helsinki, Belmont report. International Conference on Harmonization (ICH)-Brief history of ICH, Structure of ICH &amp; ICH Harmonization Process, Guidelines for Good Clinical Practice. Regulation in Clinical Research Drug and cosmetic act, FDA, Schedule-Y- Ethics Committee and their responsibilities. Clinical Research Regulatory Submission &amp; approval Process- IND, NDA and ANDA submission Procedure. DCGI submission procedure. Other Regulatory authorities- EMEA, MHRA, PhRMA.</p>					

	<p><b>Unit III:</b> Clinical Trial Management: Key Stakeholders in Clinical Research, Ethics Committees and Institutional Review Board, Responsibilities of Sponsor. Responsibilities of Investigator, Protocol in Clinical Research Clinical Trial Design, Project Planning Project Managements - Informed Consent, Investigator’s Brochure (IB), Selection of an Investigator and Site, Patient screening, Inclusion and exclusion criteria, Randomization, Blinding. Essential Documents in clinical research -IB, ICF, PIS, TMF, ISF, CDA &amp; CTA.</p> <p><b>Unit IV:</b> Quality Assurance, Quality Control &amp; Clinical Monitoring: Defining the terminology-Quality, Quality system, Quality Assurance &amp; Quality Control-QA audit plan. 21 CFR Part 11, Site Auditing, Sponsor Compliance and Auditing, SOP For Clinical Research-CRF Review &amp; Source Data Verification, Drug Safety Reporting Corrective and preventative action process.</p> <p><b>Unit V:</b> Business Development in the Clinical Research Industry: Introduction &amp; Stages of Business Development-Start-up Phase, Growth Phase, Maturity Phase, Decline Phase. Outsourcing in Clinical Research, Reasons for outsourcing to contract research organizations, The India Advantage, Scope and Future of CRO, List of Clinical Research Organizations in India, List of IT companies offering services in Clinical Research. Role of business development manager.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p><b>Case Studies</b></p>
<p><b>Skills acquired from this course</b></p>	<p>Acquire knowledge in history and methods involved in conducting clinical research.</p> <p>Equipped with the principles involved in ethical, legal, and regulatory issues in clinical research on human subjects.</p> <p>Learn the principles and issues involved in monitoring patient-oriented research.</p> <p>Able to formulate a well- defined quality assurance and quality control plans.</p> <p>Acquire business development skills in the area of clinical research.</p>
<p><b>Justification for nature of course</b></p>	<p>It provides scientific analysis of the impact, risks and benefits of medicines or a medicinal product. The trials are done before initiating the products in the market. The tests are performed at different stages and after-launch supervision is maintained to scrutinize the safety and monitor the side effects if any.</p>

<p><b>Text Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Gallin J. I., Ognibene F. P. and Johnson L. L. (2007). Principles and Practice of Clinical Research. (4th Edition). Elsevier, 2007.ISBN-10: 0128499052</li> <li>2. Friedman L. M., Furberg C. D. and Demets D. (1998). Fundamentals of Clinical Trials, Vol: XVIII. (3rd Edition). Springer Science &amp; Business Media.</li> <li>3. Hulley S. B., Cummings S. R., Browner W. S., Grady D. G. and Newman T. B. (2013). Designing Clinical Research. (4th Edition). Jaypee Medical. ISBN-13: 978-1608318049.</li> <li>4. Reed,G. (2004). Prescott and Dunn’s Industrial Microbiology, 4th edn, CBS publication and distributors.</li> <li>5. Himanshu B. Text book of Clinical Research, Pee Vee books.</li> </ol>
<p><b>Reference Book(s)</b></p>	<ol style="list-style-type: none"> <li>1. Friedman L.M., Fuberge C.D., DeMets D. and Reboussen, D.M. (2015). Fundamentals of Clinical Trials, Springer.</li> <li>2. Browner W. S., (2012). Publishing and Presenting Clinical Research. (3rd Edition). Lippincott Williams and Wilkins.</li> <li>3. Rondel R. K., Varley S. A. and Webb C. F. (2008). Clinical Data Management. (2nd Edition). Wiley.</li> <li>4. Peppler, H.J. and Pearl Man, D. (1979). Fermentation Technology, Vol 1 &amp; 2, 2nd Edition Academic Press, London</li> <li>5. E1-Mansi, E.M.T., 5. E1-Mansi, E.M.T., Bryce, C.F.A., Demain, A.L. and Allman,A.R. (2007). Fermentation Microbiology and Biotechnology. 2nd Edition, CRC press, Taylor and Francis Group.</li> </ol>
<p><b>Websites and e-Learning resources</b></p>	<ol style="list-style-type: none"> <li>1. <a href="https://www.hzu.edu.in/uploads/2020/10/Textbook-of-Clinical-Trials-Wiley-(2004).pdf">https://www.hzu.edu.in/uploads/2020/10/Textbook-of-Clinical-Trials-Wiley-(2004).pdf</a></li> <li>2. <a href="https://www.routledge.com/A-Practical-Guide-to-Managing-Clinical-Trials/Pfeiffer-Wells/p/book/9780367497828">https://www.routledge.com/A-Practical-Guide-to-Managing-Clinical-Trials/Pfeiffer-Wells/p/book/9780367497828</a></li> <li>3. <a href="https://www.auctoresonline.org/journals/clinical-research-and-clinical-trials">https://www.auctoresonline.org/journals/clinical-research-and-clinical-trials</a></li> <li>4. <a href="https://www.who.int/health-topics/clinical-trials#tab=tab_1">https://www.who.int/health-topics/clinical-trials#tab=tab_1</a></li> <li>5. <a href="https://www.cancerresearchuk.org/about-cancer/find-a-clinical-trial/what-clinical-trials-are/types-of-clinical-trials">https://www.cancerresearchuk.org/about-cancer/find-a-clinical-trial/what-clinical-trials-are/types-of-clinical-trials</a></li> </ol>

<b>Course Outcomes</b>	<b>CLOs</b> On completion of this course, students will;	<b>K-level</b>
<b>CLO1</b>	Apprehend the Drug Development process and different phases of clinical trials.	Up to K-2
<b>CLO2</b>	Recognize the ethics and regulatory perspectives on clinical research trials activities.	Up to K-3
<b>CLO3</b>	Accentuate about clinical trials management concepts and documentation process.	Up to K-4
<b>CLO4</b>	Accomplish quality assurance and quality control to ensure the protection of human subjects and the reliability of clinical trial results.	Up to K-4
<b>CLO5</b>	To nurture skills recitation to commercial start up and industriousness.	Up to K-4

### **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).

<b>CLO</b>	<b>POs</b>						<b>PSOs</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CLO1</b>	3	1	2	2	2	3	2	2	2	2	2
<b>CLO2</b>	3	2	2	2	2	3	2	2	2	2	2
<b>CLO3</b>	3	3	2	3	2	3	3	2	2	3	2
<b>CLO4</b>	3	3	3	2	2	3	2	2	2	2	2
<b>CLO5</b>	3	3	3	3	2	3	3	2	2	3	2

**Assessment Scheme**  
**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**  
**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K 3	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 4	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

<b>K Levels</b>	<b>Section A (No Choice)</b>	<b>Section B (No Choice)</b>	<b>Section C (Either/or)</b>	<b>Section D (Open Choice)</b>	<b>Total Marks</b>	<b>% of Marks without choice</b>	<b>Consolidated</b>
K1	5	4	0	-	<b>9</b>	7.5	<b>42%</b>
K2	5	6	20	10	<b>41</b>	34.17	
K3	-	-	20	10	<b>30</b>	25	<b>25%</b>
K4	-	-	10	30	<b>40</b>	33.33	<b>33%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

**Distribution of Unit-wise questions with K Levels**

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

Title of the Course		VERMITECHNOLOGY					
TANSICHE Course type		SEC II					
Course Category		Skill Enhancement Course II (NME)					
Nature of Course		Skill Development					
Category	Skill Enhancement Course	Year	I	Credits	2	Course Code	23P2RSEN1
		Semester	II				
Instructional Hours per week		Lecture	Tutorial		Practical		Total
		2					2
Marks		CIA		Semester			Total
		25		75			100
Pre-requisite(s)		Knowledge on Biofertilizers					
Objectives of the Course		<ul style="list-style-type: none"> <li>• Introduce the concepts of vermicomposting.</li> <li>• Explain the physiology, anatomy and biology of earthworms.</li> <li>• Acquire the knowledge of the vermicomposting process.</li> <li>• Explain the trouble shooting, harvesting and packaging of vermin composts.</li> <li>• Gain knowledge on applications of vermin composts and their value added products.</li> </ul>					
Course Outline		<p><b>Unit I:</b> Introduction to Vermiculture - Definition, classification, history, economic importance- In sustainable agriculture, organic farming, earthworm activities, soil fertility &amp; texture, soil aeration, water impercolation, decomposition &amp; moisture, bait &amp; food and their value in maintenance of soil structure. Its role in the bio transformation of the residues generated by human activity and production of organic fertilizers. Choosing the right worm. Useful species of earthworms. Local species of earthworms. Exotic species of earthworms. Factors affecting distribution of earthworms in soil.</p> <p><b>Unit II:</b> Earthworm Biology and Rearing - Key to identify the species of earthworms. Biology of <i>Eisenia fetida</i>. a) Taxonomy Anatomy, physiology and reproduction of Lumbricidae. b) Vital cycle of <i>Eisenia fetida</i>: alimentation, fecundity, annual reproducer potential and limiting factors (gases, diet, humidity, temperature, PH, light, and climatic factors). Biology of <i>Eudrilus eugeniae</i>. c) Taxonomy Anatomy, physiology and reproduction of Eudrilidae. d) Vital cycle of <i>Eudrilus eugeniae</i>: alimentation, fecundity, annual reproducer potential and limit factors (gases, diet, humidity, temperature, PH, light, and climatic factors).</p>					

	<p><b>Unit III:</b> Vermicomposting Process - Feeds for Vermitech systems- Animal manures- Kitchen Waste and Urban waste- Paper pulp and card board solids- Compost and waste products- Industrial Wastes. Vermicomposting Basic process- Initial pre-composting phase- Mesophilic phase- Maturing and stabilization phase- Mechanism of Earthworm action. Methods of vermicomposting- a) windrows system; b) wedge system; c) container system-pits, tanks &amp; cement rings; commercial model; beds or bins-top fed type, stacked type, d) Continuous flow system.</p> <p><b>Unit IV:</b> Vermicomposting - Trouble Shooting-Temperature-Aeration- Acidity- Pests and Diseases- Ants, rodents, Birds, Centipedes, sour crop, Mite pests. Odour problems. Separation techniques- Light Separation-Sideways Separation-Vertical Separation-Gradual transfer. Harvesting Earthworms- manual method- migration method. Packing &amp; Nutritional analysis of vermicompost.</p> <p><b>Unit V:</b> Applications of Vermiculture - Vermiculture Bio-technology, use of vermi castings in organic farming/horticulture, as feed/bait for capture/culture fisheries; forest regeneration. Application quantity of vermicompost in Agricultural fields- crops, fruits, vegetables &amp; flowers. By-products and value-added products- Verm wash- vermicompost tea-vermi meal-enriched vermicompost-pelleted vermicompost.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p><b>Field visit</b></p>
<p><b>Skills acquired from this course</b></p>	<p>Learn the concepts of vermicomposting.</p> <p>Acquire knowledge about the physiology, anatomy and biology of earthworms.</p> <p>Familiar with the vermicomposting process.</p> <p>Gain experience in trouble shooting, harvesting and packaging of vermin composts.</p> <p>Progresses on applications of vermicomposts and their value added products.</p>
<p><b>Justification for nature of course</b></p>	<p>Vermitechnology includes the study and commercial application of technologies that utilise earthworms for degrading waste organic materials for sanitation and agricultural re-use. Organic wastes degraded and stabilised by earthworms include those suspended or dissolved in water and also solid organic material.</p>

<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. Ismail S. A. (2005). The Earthworm Book, Second Revised Edition. Other India Press, Goa, India.</li> <li>2. Rathoure A. K., Bharati P. K. and Ray J. (2020). Vermitechnology, Farm and Fertilizer. Vermitechnology, Farm and Fertilizer Discovery Publishing House Pvt Ltd.</li> <li>3. Christy M. V. 2008. Vermitechnology, (1st Edition), MJP Publishers.</li> <li>4. The complete technology book on Vermiculture and Vermicompost with manufacturing Process, machinery equipment details and Plant Layout. AB Press.</li> <li>5. Keshav Singh (2014). A Textbook of vermicompost: Vermiwash and Biopesticide.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Roy D. (2018). Handbook of Vermitechnology. Lambert Academic Publishing.</li> <li>2. Kumar A. (2005). Verms and Vermitechnology, A.P.H. Publishing Corporation, New Delhi.</li> <li>3. Lekshmy M. S., Santhi R. (2012). Vermitechnology, Sara Publications, New Delhi, India.</li> <li>4. Edwards CA, Arancon NQ ShermanRL. (2011) Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management 1st edn.CRC Press.</li> <li>5. Ismail, S.A. (1997). Vermiculture-The Biology of Earthworm.1st edn. Orient longman</li> </ol>
<b>Websites and e-Learning resources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://en.wikipedia.org/wiki/Vermicompost">https://en.wikipedia.org/wiki/Vermicompost</a></li> <li>2. <a href="http://stjosephs.edu.in/upload/papers/9567411a78c63d4ccfbbe85e6aa22840.pdf">http://stjosephs.edu.in/upload/papers/9567411a78c63d4ccfbbe85e6aa22840.pdf</a></li> <li>3. <a href="https://www.kngac.ac.in/elearning-portal/ec/admin/contents/4_18K4ZEL02_2021012803204629.pdf">https://www.kngac.ac.in/elearning-portal/ec/admin/contents/4_18K4ZEL02_2021012803204629.pdf</a></li> <li>4. <a href="https://composting.ces.ncsu.edu/vermicomposting-2/">https://composting.ces.ncsu.edu/vermicomposting-2/</a></li> <li>5. <a href="https://rodaleinstitute.org/science/articles/vermicomposting-for-beginners/">https://rodaleinstitute.org/science/articles/vermicomposting-for-beginners/</a></li> </ol>

<b>Course Outcomes</b>	<b>CLOs</b> On completion of this course, students will;	<b>K-level</b>
<b>CLO1</b>	Compare and contrast the uses of vermicompost to the soil.	Up to K-2
<b>CLO2</b>	Recommend different species of earthworms after acquiring knowledge on its biology.	Up to K-2
<b>CLO3</b>	Design the vermicomposting process.	Up to K-2
<b>CLO4</b>	Assess the Best Practices of Vermicomposting	Up to K-2
<b>CLO5</b>	Recommend the applications of vermicompost to different soils and for different crops.	Up to K-2

### 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	2	3	2	2	2	2	2
CLO2	3	2	2	2	2	3	2	2	2	2	2
CLO3	3	3	2	3	2	3	3	2	2	3	2
CLO4	3	3	3	2	2	3	2	2	2	2	2
CLO5	3	3	3	3	2	3	3	2	2	3	2

#### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 40 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Seminar/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUEPRINT FOR TEST COMPONENT OF CIA BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 1	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2.	CLO 2	Up to K 2	1	K1	2 (K2&K2)	1(K2)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A		Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K-Level		
1.	CLO 3	Up to K 2	1	K1	2 (K2&K2)	1(K2)
2.	CLO 4	Up to K 2	1	K1	2 (K2&K2)	1(K2)
No. of Questions to be asked			2		4	2
No. of Questions to be answered			2		2	1
Marks for each Question			2.5		5	10
Total Marks for each Section			5		10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

**Distribution of Section-wise Marks with K Levels**

K Levels	Section A(No choice)	Section B(No choice)	Section C (Either/ or)	Total marks	% of marks without choice	Consolidated
K1	10	-	50	60	46.15	46%
K2	-	70	-	70	53.84	54%



# DEPARTMENT OF BIOTECHNOLOGY

**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., Biotechnology)**  
**Allied Courses (B.Sc., Biotechnology)**

## Department of Biotechnology

### **Vision**

To produce disciplined and competent students of high calibre, to become socially committed and ethically strong to meet the challenges.

### **Mission**

- To foster excellence in the field of biotechnology.
- To adopt proper pedagogical methods to ensure quality education and academic excellence.
- To provide conducive environment for learning following ethical, moral, and spiritual values.

### **Programme Outcomes (defined by TANSCHÉ):**

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

**PO2: Critical Thinking:** Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

**PO3: Problem Solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real-life situations.

**PO4: Analytical Reasoning:** Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.

**PO5: Scientific Reasoning:** Ability to 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 (PSOs)

On the successful completion of B.Sc., Biotechnology the students will be able to

	PSOs	Graduate Attributes
<b>PSO-1</b>	Infer knowledge in core concepts, recent developments, and laboratory skills in various domains of biotechnology.	<ul style="list-style-type: none"><li>• Knowledge on core competency</li><li>• Modern Tool Usage</li></ul>
<b>PSO-2</b>	Identify the various biological processes in prokaryotic and eukaryotic organisms and make use of skills in biological and computational tools and techniques.	<ul style="list-style-type: none"><li>• Life-long learning</li><li>• Design</li><li>• Problem analysis</li></ul>
<b>PSO-3</b>	Correlate and apply physio-chemical, biological, computational, biological, and chemical principles and techniques in various areas of Biotechnology.	<ul style="list-style-type: none"><li>• Problem analysis</li><li>• Conduct investigations of complex problems</li><li>• Design &amp; Development of solutions for complex problems</li><li>• Modern Tool Usage</li></ul>
<b>PSO-4</b>	Exhibit in depth knowledge in various thrust areas of Biotechnology to meet the demands in industry and academia.	<ul style="list-style-type: none"><li>• Individual and teamwork</li><li>• Communication</li><li>• Life-long learning</li></ul>
<b>PSO-5</b>	Explain the importance of ethics and socioeconomic development through Biotechnology.	<ul style="list-style-type: none"><li>• Ethics</li><li>• Environment and sustainability</li></ul>

**Department of Biotechnology**  
**The Madura College**  
**Madurai**

Semester	Subject Code	Course	Title of the Course	H	C
I	23U1TLAN1/ 23U1HLAN1/ 23U1SLAN1	Language - I	Tamil / Hindi / Sanskrit	6	3
	23U1NENG1	Language - II	English	6	3
	23U1LCCT1	Core Course - 1 (CC1)	Cell and Molecular Developmental Biology	5	5
	23U1LCCP1	Core Course - 2 (CC2)	Major Practical-I	3	3
	23U1CGET1 (L)	Generic Elective - 1 (EC1)	Biological Chemistry	4	4
	23U1CGEP1	Generic Elective - 1 (EC1-P)	Allied Practical-I	2	1
	23U1LSED1	Skill Enhancement Course-I (SEC-1)	Food Chemistry	2	2
	23U1LFCT1	Foundation course (FC)	Basics of Biotechnology	2	2
				<b>30</b>	<b>23</b>
II	23U2TLAN2/ 23U2HLAN2/ 23U2SLAN2	Language - I	Tamil / Hindi / Sanskrit	6	3
	23U2NENG2	Language - II	English	6	3
	23U2LCCT2	Core Course - 1 (CC3)	Genetics	5	5
	23U2LCCP2	Core Course - 2 (CC4)	Major Practical-II	3	3
	23U2CGET2 (L)	Generic Elective - 1 (EC1)	Bioinstrumentation	4	4
	23U2CGEP2	Generic Elective - 1 (EC1-P)	Allied Practical-II	2	1
	23U2LSED2	Skill Enhancement Course-II (SEC-2)	Vermitechnology	2	2
	23U2LSED3	SEC - Major (SEC-3)	Mushroom Cultivation	2	2
				<b>30</b>	<b>23</b>

<b>Title of the Course</b>		<b>Cell, Molecular and Developmental Biology</b>					
<b>TANSICHE Course type</b>		CC1					
<b>Course Category</b>		Core					
<b>Nature of Course</b>		Skill Development					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	<b>23U1LCCT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		4	1		--	5	
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Knowledge about cellular structure and various cell organelles					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• To equip students with a basic knowledge of the structural and functional properties of cell organelles.</li> <li>• To be aware of various macromolecular complexity and their functions.</li> <li>• To provide an overview of the flow of information from genes to proteins.</li> <li>• To relate the properties of cancerous cells to mutational changes in gene function</li> </ul>					
<b>Course Outline</b>		<b>UNIT 1</b> Discovery and diversity of cells - Cell theory - Structure of prokaryotic (bacteria) and eukaryotic cells (plant and animal cells). Biomacromolecules and Biomimicromolecules (Primary functions in the cell).					
		<b>UNIT II</b> Structure and Functions of Cell Organelles: Cell wall - Cell membrane - Cytoplasm - Nucleus - chromosomes -Endoplasmic reticulum - Ribosomes - Golgi bodies - Plastids - Vacuoles - Lysosomes - Mitochondria - Microbodies - Flagella - Cilia - Centrosome and Centrioles - Cytoskeleton.					

	<p><b>UNIT III</b></p> <p>Structure and functions of DNA and RNA -Central Dogma of the cell. DNA -Replication in prokaryotes - Transcription in Prokaryotes and Eukaryotes - RNA Processing - Genetic code- Translation - Similarities and differences in prokaryotic and eukaryotic translation - Post Translational Modifications - Protein Sorting - Protein degradation.</p> <p><b>UNIT IV</b></p> <p>Cell cycle - Cell cycle check points - Cell division - Mitosis and Meiosis - Cellular differentiation - Cell junctions - Cell Adhesion - Extra Cellular Matrix - Cell to cell communications - Signal transduction - G - Protein Coupled Receptors Signal transduction pathways.</p> <p><b>UNIT V</b></p> <p>Gametogenesis - Spermatogenesis and Oogenesis in mammals. Fertilization- Types of cleavage, blastula formation, embryonic fields, gastrulation, and formation of germ layers in animals- Organogenesis.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (Tutorial session)</p>
<p><b>Skills acquired from this course</b></p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Justification for nature of course</b></p>	<p>The course focuses on the basic aspects of cellular organization, gene expression, macromolecular complexity with its structure and function and to gain knowledge on the cell cycle and its regulation.</p>

<b>Textbook(s)</b>	<ol style="list-style-type: none"> <li>1. Devasena T. 2012. Cell Biology. Oxford University Press.</li> <li>2. Gupta R, Makhija S &amp; Toteja R. 2018. Cell Biology Practical Manual. Prestige Publishers.</li> <li>3. Gilbert SF. 2016. Developmental Biology. 11th Edition. Sinauer Associates Inc. Publishers.</li> <li>4. Alberts B. 2014. Molecular Biology of the Cell. 6th Edition. W. W. Norton &amp; Company.</li> <li>5. Watson JD. 2001. The Double Helix: A Personal Account of the Discovery of the Structure of DNA. Touchstone Publishers.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Karp J, Iwasa J &amp; Marshall W. 2015. Karp's Cell and Molecular Biology: Concepts and Experiments. 8<sup>th</sup> Edition. Wiley Publications.</li> <li>2. Cooper GM. 2015. The Cell: A Molecular Approach. 7<sup>th</sup> Edition. Sinauer Associates.</li> <li>3. Harwey L. 2016. Molecular Cell Biology. 6<sup>th</sup> Edition. W. H. Freeman Publications.</li> <li>4. Wolpert L &amp; Tickle C. 2015. Principles of Development, 5<sup>th</sup> edition, Oxford University Press.</li> </ol>
<b>Websites and e-Learning resources</b>	<p><a href="http://www.cellbiol.com/education.php">http://www.cellbiol.com/education.php</a></p> <p><a href="https://global.oup.com/uk/orc/biosciences/cellbiology/wang/student/weblinks/ch16/">https://global.oup.com/uk/orc/biosciences/cellbiology/wang/student/weblinks/ch16/</a></p> <p><a href="https://dnalc.cshl.edu/websites/">https://dnalc.cshl.edu/websites/</a></p> <p><a href="https://www.cellsignal.com/contents/science/cst-pathways/science-pathways">https://www.cellsignal.com/contents/science/cst-pathways/science-pathways</a></p> <p><a href="https://nptel.ac.in/courses/102/106/102106025/11">https://nptel.ac.in/courses/102/106/102106025/11.</a></p>

## COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Interpret the structure of prokaryotic and eukaryotic cells	Up to K-2
<b>CLO2</b>	Illustrate the importance various cell organelles	Up to K-3
<b>CLO3</b>	Analyse the expression of genes in prokaryotic and eukaryotic cells	Up to K-4
<b>CLO4</b>	Illustrate cell division and regulation of cell cycle	Up to K-3
<b>CLO5</b>	Explain various stages of Developmental process	Up to K-4

## MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	1	1	1	1	1	1	2	2	1	1
<b>CLO2</b>	3	1	1	1	1	1	1	1	2	1	1
<b>CLO3</b>	3	1	3	2	3	1	3	3	3	1	2
<b>CLO4</b>	3	3	3	2	3	1	3	3	3	2	3
<b>CLO5</b>	3	1	1	1	1	1	3	3	2	2	1

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

### Assessment Scheme

#### Components of CIA

Component	Weight / Mark
Test (Average of two tests) Conducted for 25 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

### BLUEPRINT FOR TEST COMPONENT OF CIA

#### BLUEPRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A	Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers		
1.	CLO 1	Up to K-2	1 (K2)	2 (K1&K1)	1 (K2)
2.	CLO 2	Up to K-3	1 (K2)	2 (K3&K3)	1 (K3)
No. of Questions to be asked			2	4	2
No. of Questions to be answered			2	2	1
Marks for each Question			2.5	5	10
Total Marks for each Section			5	10	10

**BLUEPRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A	Section B	Section C
			Short Answers	(Either / or Choice)	(Open Choice)
1.	CLO 3	Up to K-4	1 (K1)	2 (K3&K3)	1 (K4)
2.	CLO 4	Up to K-3	1 (K2)	2 (K2&K2)	1 (K3)
No. of Questions to be asked			2	4	2
No. of Questions to be answered			2	2	1
Marks for each Question			2.5	5	10
Total Marks for each Section			5	10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

### 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	<b>42%</b>
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	<b>42%</b>
K4	-	-	10	10	20	16.67	<b>16%</b>
Total Marks	10	10	50	50	120	100.00	<b>100%</b>

### Distribution of Unit-wise questions with K Levels

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

K1 –Remembering and recalling facts with specific answers.

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

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidence.

<b>Title of the Course</b>		<b>Major Practicals-I</b>					
TANSICHE Course type		CC2					
Course Category		Core Practical					
Nature of Course		Skill Development					
Category	Core	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	<b>23U1LCCP1</b>
		<b>Semester</b>	I				
Instructional Hours per week		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		--		--		3	3
Marks		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
Pre-requisite(s)							
Objectives of the Course		To learn, understand & develop skill and hands on training in basics of cell and Molecular developmental biology.					
Course Outline		1. Measurement of cells using micrometer					
		2. Blood smear preparation and Identification of Blood cells					
		3. Observation of Plant cells & permanent Slide preparation					
		4. Observation of sperm & Egg					
		5. Cell fractionation and Identification of cell organelles (Demo)					
		6. Buccal smear preparation and Identification of squamous epithelial cells.					
		7. Isolation of chloroplast & estimation of chlorophyll content					
		8. Mounting of chick embryo - 24 hrs, 48 hrs, 72 hrs, 96 hrs.					
		9. Isolation of Genomic DNA from bacterial Cells					
		10. Restriction Digestion of genomic DNA					
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 (Tutorial session)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Justification for nature of course	The major core practical focuses on the student's ability to have a practical knowledge on techniques in Cell, Molecular and Developmental biology
Text book (s)	Chaitanya KV. 2013. Cell and Molecular Biology: Lab manual, PHI publishers.
Reference Book(s)	Gupta, R., Seema, M. & Ravi, T. (2018). Cell Biology: Practical Manual. Prestige Publishers.
Websites and e-Learning resources	<a href="https://www.devbio.com/">https://www.devbio.com/</a> <a href="https://www.cshl.edu/">https://www.cshl.edu/</a> <a href="http://www.cellimagelibrary.org/home">http://www.cellimagelibrary.org/home</a>

### COURSE OUTCOMES

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

#	CLOs	K-level
<b>CLO1</b>	Use microscopy and micrometry in biotechnological applications.	K2
<b>CLO2</b>	Perform cell counting techniques and be able to prepare the Blood smear and Buccal smear.	K4
<b>CLO3</b>	Isolate and prepare the permanent slides.	K3
<b>CLO4</b>	Analyze the various developmental stages using chick embryo	K4
<b>CLO5</b>	Demonstrate the basic principles of Cell fractionation and Identification of cell organelles.	K3

**MAPPING WITH PROGRAMME OUTCOMES:**

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	3	3	3	3	1	1	3	1	1	2
<b>CLO2</b>	3	1	1	1	1	1	1	3	1	1	1
<b>CLO3</b>	3	2	1	1	1	1	1	3	1	1	1
<b>CLO4</b>	3	3	2	3	3	2	1	3	1	1	1
<b>CLO5</b>	3	3	3	3	3	3	1	3	3	3	3

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

**Assessment Scheme****Components of CIA****Practical**

	Components	Marks	Total Marks
<b>Internal [Formative]</b>	Continuous assessment	10	25
	Test	10	
	Observation	5	
<b>External [Summative]</b>		75	75
<b>Total Marks</b>			100

**Question Paper pattern for External examination - Practical (75 marks)**

Section		Marks
<b>I</b>	Major Question (1 X 25 Marks)	25
<b>II</b>	Minor Question (1 X 20 Marks)	20
<b>III</b>	Spotters (4 X 5 marks)	20
<b>IV</b>	Record Notebook	10
	<b>Total</b>	<b>75</b>

<b>Title of the Course</b>		<b>Food Chemistry</b>					
<b>TANSICHE Course type</b>		SEC-1					
<b>Course Category</b>		Skill Enhancement Course					
<b>Nature of Course</b>		Skill Development					
<b>Category</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	23U1LSED1	
	<b>Semester</b>	I					
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>	
		2				2	
<b>Marks</b>		<b>CIA</b>	<b>Semester</b>			<b>Total</b>	
		25	75			100	
<b>Pre-requisite(s)</b>							
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To equip students with a basic knowledge about the sources of food</li> <li>To provide an overview of food adulterants and its detection</li> <li>To be aware of various food poisons and food additives.</li> <li>To relate the diseases associated with food habits</li> </ul>					
<b>Course Outline</b>		<p><b>Unit-I</b> 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. Common adulterants Ghee adulterants and their detection. Detection of adulterated Foods by simple analytical techniques.</p> <p><b>Unit-II</b> Food Poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion)- Chemical poisons - First aid for Poison consumed victims.</p> <p><b>Unit-III</b> Food additives - artificial sweeteners- Saccharin - Cyclamate and aspartame. Food flavours - esters, aldehydes and heterocyclic compounds. Food colours - Emulsifying agents-preservatives - leavening agents. Baking powder - yeast - taste makers - MSG vinegar.</p>					

	<p><b>Unit–IV</b></p> <p>Beverages - soft drinks - soda - fruit juices - alcoholic beverages. Carbonation - addiction to alcohol - diseases of liver and social problems.</p>
	<p><b>Unit– V</b></p> <p>Fats, 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.</p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b></p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (Tutorial session)</p>
<p><b>Skills acquired from this course</b></p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Justification for nature of course</b></p>	<p>The Skill Enhancement Course focuses on the basic concepts on food adulterants and additives and the diseases associated with foods.</p>
<p><b>Textbook(s)</b></p>	<p>1. Swaminathan M., 1979. Food Science and Experimental foods, Ganesh and Company.</p>
<p><b>Reference Book(s)</b></p>	<p>1. Jayashree Ghosh, Fundamental concepts of applied chemistry, S. Chand &amp; Co. Publishers.</p> <p>2. Thangamma Jacob, Textbooks of applied chemistry for Home Science and Allied Sciences, Macmillan.</p>
<p><b>Websites and e-Learning resources</b></p>	<p><a href="https://vidyamidra.inflibnet.ac.in/content/index/5a5dcabd8007be7fccbc3193/SL">https://vidyamidra.inflibnet.ac.in/content/index/5a5dcabd8007be7fccbc3193/SL</a></p>

**COURSE OUTCOMES:**

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

#	CLOs	K-level
<b>CLO1</b>	Explain about the various food adulterants	K2
<b>CLO2</b>	Classify the food poisons and explain about the first aids for the poisoning	K3
<b>CLO3</b>	Illustrate the various food adulterants	K4
<b>CLO4</b>	Explain about beverages and diseases associated with alcoholic addictions	K3
<b>CLO5</b>	Relate the role of PUFA in preventing heart disease	K4

**MAPPING WITH PROGRAMME OUTCOMES:**

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	2	1	2	3	3	3	1	2	3	3
<b>CLO2</b>	3	2	1	2	3	3	3	1	2	3	3
<b>CLO3</b>	3	2	1	2	3	3	3	1	2	3	3
<b>CLO4</b>	3	2	1	2	3	3	3	1	2	3	3
<b>CLO5</b>	3	2	1	2	3	3	3	1	2	3	3

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

**Assessment Scheme**

**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 25 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**

**BLUEPRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A	Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers		
1.	CLO 1	Up to K-2	1 (K2)	2 (K1&K1)	1 (K2)
2.	CLO 2	Up to K-3	1 (K2)	2 (K3&K3)	1 (K3)
No. of Questions to be asked			2	4	2
No. of Questions to be answered			2	2	1
Marks for each Question			2.5	5	10
Total Marks for each Section			5	10	10

**BLUEPRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A	Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers		
1.	CLO 3	Up to K-4	1 (K1)	2 (K3&K3)	1 (K4)
2.	CLO 4	Up to K-3	1 (K2)	2 (K2&K2)	1 (K3)
No. of Questions to be asked			2	4	2
No. of Questions to be answered			2	2	1
Marks for each Question			2.5	5	10
Total Marks for each Section			5	10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

### Distribution of Unit-wise questions with K Levels

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

K1 –Remembering and recalling facts with specific answers.

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

K3 – Application oriented – Solving Problems

K4 – Examining, analysing, presentation and make interferences with evidence.

<b>Title of the Course</b>		<b>Basics of Biotechnology</b>					
<b>TANSCHÉ Course type</b>		Foundation Course					
<b>Course Category</b>		Skill Enhancement Course					
<b>Nature of Course</b>		Skill development					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	<b>23U1LFCT1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		2					2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		25			75		100
<b>Pre-requisite(s)</b>		Knowledge on concepts in biology					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To introduce basic concepts of Biotechnology to the students.</li> <li>To make students aware of tools and techniques of Biotechnology.</li> <li>To motivate the students to aspire for research/industrial career in the field of Biotechnology.</li> <li>To make students aware of bioethics and judicious usage of biotechnological application</li> </ul>					
<b>Course Outline</b>		<b>UNIT-I: History and Gene concept</b>					
		History of Biotechnology – traditional - ghee, butter, fermentation - curd, idli, wine and modern approaches - pasteurization, vaccination,					
		<b>UNIT-II: Tools of Biotechnology</b>					
		Restriction enzymes- nomenclature, types, cleavage site- cohesive and blunt end, DNA methylases, DNA ligases. Types of vectors: Cloning, Expression Vectors and Shuttle vectors. Plasmids - pBR 322, pUC, PCR					
		<b>UNIT-III: Microbial and animal biotechnology</b>					
		Experimental models – <i>E. coli</i> , <i>Saccharomyces cerevisiae</i> , zebrafish, and mice. Gene transfer methods – Physical-gene gun, Chemical-Ca <sup>2+</sup> & biological-transformation, conjugation, transduction. Engineered microbes - recombinant insulin. genetically engineered sheep - Dolly.					

	<p><b>UNIT-IV: Plant and Environmental biotechnology</b></p> <p>Plant tissue culture – totipotency , callus culture, <i>Agrobacterium tumefaciens</i> - crown gall, Ti-plasmid, T-DNA transfer. Genetically engineered plants-Bt cotton. Bioremediation - <i>In-situ</i> and <i>Ex situ</i>. Phytoremediation.</p>
	<p><b>UNIT-V: Medical Applications and Bioethics</b></p> <p>Gene therapy - adenosine deaminase - SCID. Diagnosis of diseases and disorders - Sickle cell anemia. Recombinant vaccines –hepatitis B. Patent: definition and form of patent, patent rights, patent filing. Ethics- usage of genetically engineered microbes, plants, animals</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (Tutorial session)
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	This foundation course focuses on students’ ability to understand the basic concepts in Biotechnology.
<b>Textbook(s)</b>	<ol style="list-style-type: none"> <li>1. Satyanarayana U. 2009. Biotechnology. Books and Allied Pvt. Ltd.</li> <li>2. Kumaresan. 2015. Biotechnology. Saras Publications.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Brown TA. 2012. Gene Cloning and DNA Analysis- An Introduction. Wiley Blackwell.</li> <li>2. Balasubramaniam D, CFA Bryce, K Dharmalingam, J Green, Kunthala Jayaraman. Concepts in Biotechnology, University Press Reference Book.</li> <li>3. Dubey RC. 2012. A textbook of Biotechnology, S. Chand Publications.</li> </ol>
<b>Websites and e-Learning resources</b>	<p>(<a href="https://www.bioteach.ubc.ca/">https://www.bioteach.ubc.ca/</a>)</p> <p>(<a href="https://www.open.edu/openlearn/science-maths-technology/biology">https://www.open.edu/openlearn/science-maths-technology/biology</a>)</p>

**COURSE OUTCOMES:**

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

#	CLOs	K-level
<b>CLO1</b>	Elaborate with the history of biotechnology and understand the gene concept	K2
<b>CLO2</b>	Develop knowledge on the principles and applications of essential biotechnological tools and methods	K3
<b>CLO3</b>	Dissect the methods and applications of microbial and animal Biotechnology	K4
<b>CLO4</b>	Identify the applications and values of plant and environmental biotechnology strategies	K3
<b>CLO5</b>	Describe the merits and demerits of biotechnological applications	K4

**MAPPING WITH PROGRAMME OUTCOMES:**

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	1	1	2	2	1	3	1	2	1	1
<b>CLO2</b>	3	1	1	2	2	1	3	3	2	2	2
<b>CLO3</b>	3	3	1	2	3	1	3	3	3	3	2
<b>CLO4</b>	3	2	2	2	3	3	3	3	3	3	2
<b>CLO5</b>	3	3	3	2	3	3	3	3	3	3	3

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

**Assessment Scheme**

**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 25 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**

**BLUEPRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A	Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers		
3.	CLO 1	Up to K-2	1 (K2)	2 (K1&K1)	1 (K2)
4.	CLO 2	Up to K-3	1 (K2)	2 (K3&K3)	1 (K3)
No. of Questions to be asked			2	4	2
No. of Questions to be answered			2	2	1
Marks for each Question			2.5	5	10
Total Marks for each Section			5	10	10

**BLUEPRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A	Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers		
3.	CLO 3	Up to K-4	1 (K1)	2 (K3&K3)	1 (K4)
4.	CLO 4	Up to K-3	1 (K2)	2 (K2&K2)	1 (K3)
No. of Questions to be asked			2	4	2
No. of Questions to be answered			2	2	1
Marks for each Question			2.5	5	10
Total Marks for each Section			5	10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

### Distribution of Unit-wise questions with K Levels

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

K1 –Remembering and recalling facts with specific answers.

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

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidence.

<b>Title of the Course</b>		<b>Biological Chemistry</b>					
<b>TANSICHE Course type</b>		EC1					
<b>Course Category</b>		Generic Elective					
<b>Nature of Course</b>		Skill Development					
<b>Category</b>	<b>Allied</b>	<b>Year</b>	I	<b>Credits</b>	4	<b>Course Code</b>	<b>23U1CGET1 (L)</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>		<b>Practical</b>		<b>Total</b>	
	4			--		4	
<b>Marks</b>	<b>CIA</b>			<b>Semester</b>		<b>Total</b>	
	25			75		100	
<b>Pre-requisite(s)</b>							
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>To introduce basic concepts of biological chemistry and its nature of interdisciplinary importance.</li> <li>To make students to understand the physical and chemical properties of macromolecules.</li> <li>To understand the bioenergetics of metabolic pathways</li> </ul>					
<b>Course Outline</b>		<p>Atomic theory, formation of molecules, electronic configuration of atoms- s &amp; 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.</p> <p>Acids &amp; 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.</p>					
		<p>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.</p>					

	<p>Classification of Lipids. Characteristics, Properties and Biological importance of lipids. Metabolism of Fatty acids, triglycerides, phospholipids, cholesterol. B-oxidation of fatty acids. Classification of nucleic acids. Purine and Pyrimidine bases. Classification of DNA &amp; RNA. Metabolism of Nucleic acids, Salvage pathway.</p> <p>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.</p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (Tutorial session)</p>
<b>Skills acquired from this course</b>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<b>Justification for nature of course</b>	<p>The Allied paper enables the students to gain knowledge on Bio-molecules and pathways</p>
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. P.L. Soni , A Text-book of Inorganic Chemistry, 11th Edition, S. Chand &amp; Sons publications</li> <li>2. Abhilasha Shourie, Shilpa S, Chapadgoankar &amp; Anamika Singh (2020) Textbook of Biochemistry 1st Edition</li> <li>3. J.L. Jain, 2016, Fundamentals of Biochemistry, S. Chand publication, 7th edition.</li> <li>4. A.C. Deb, 2016, Fundamentals of Biochemistry, New central book agencies, 7th edition.</li> <li>5. Satyanarayana .U, 2016, Biochemistry, MJ publishers 3rd edition (2006).</li> </ol>

<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Lehninger (2013) Principles of Biochemistry 4<sup>th</sup> edition WH Freeman and Company NY</li> <li>2. Murray et al., (2003) Harper's biochemistry 26<sup>th</sup> edition Appleton and Lange Publishers Florida USA</li> <li>3. Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, 1995, Principles of Biochemistry, W.C. Brown Publishers, 1995, 3<sup>rd</sup> edition.</li> <li>4. Lubert Stryer (2007) Biochemistry –Stanford University 5<sup>th</sup> Edition-W H Freemann and company San Francisco</li> <li>5. Bahl Arun, Bahl B. S. (2016), A Textbook of Organic Chemistry, 22<sup>nd</sup> Edition, S. Chand &amp; Sons publications</li> </ol>
<b>Websites and e-Learning resources</b>	<a href="http://dwb4.unl.edu/chem869p/chem869plinks/s">http://dwb4.unl.edu/chem869p/chem869plinks/s</a> <a href="http://www.longwood.edu/staff/buckalewdw/C3%20Biomolecules.pp">www.longwood.edu/staff/buckalewdw/C3%20Biomolecules.pp</a> <a href="https://www.britannica.com/science/biochemistry">https://www.britannica.com/science/biochemistry</a> <a href="https://www.sciencedirect.com/topics/agricultural-and-biological-sciences">https://www.sciencedirect.com/topics/agricultural-and-biological-sciences</a> <a href="https://biochemistry.org/education/careers/becoming-a-bioscientist">https://biochemistry.org/education/careers/becoming-a-bioscientist</a>

### COURSE OUTCOMES:

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

#	CLOs	K-level
<b>CLO1</b>	Explain about the various reaction mechanism.	<b>K2</b>
<b>CLO2</b>	Describe the concepts of acids and bases	K4
<b>CLO3</b>	Illustrate the carbohydrate structure and metabolism	K3
<b>CLO4</b>	Explain about lipids and nucleic acids	K4
<b>CLO5</b>	Relate the energetics with metabolic pathways.	K3

### MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	3	1	3	2	2	1	1	2	1	1
<b>CLO2</b>	3	2	1	3	2	2	3	3	3	1	2
<b>CLO3</b>	3	1	2	3	2	2	3	3	3	2	3
<b>CLO4</b>	3	2	3	3	2	1	3	3	2	2	1
<b>CLO5</b>	3	2	3	2	2	2	1	2	2	1	1

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

**Assessment Scheme**

**Components of CIA**

Component	Weight / Mark
Test (Average of two tests) Conducted for 25 marks and converted into 10 marks)	10
Assignment	5
Quiz	5
Attendance / Documentation/ Case study/ ICT based Assignment/ Mini Projects	5
<b>Total</b>	<b>25</b>

**BLUEPRINT FOR TEST COMPONENT OF CIA**

**BLUE PRINT FOR INTERNAL ASSESSMENT – I**

S. No.	CLOs	K-Level	Section A	Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers		
1.	CLO 1	Up to K-2	1 (K2)	2 (K1&K1)	1 (K3)
2.	CLO 2	Up to K-3	1 (K2)	2 (K3&K3)	1 (K4)
No. of Questions to be asked			2	4	2
No. of Questions to be answered			2	2	1
Marks for each Question			2.5	5	10
Total Marks for each Section			5	10	10

**BLUE PRINT FOR INTERNAL ASSESSMENT – II**

S. No.	CLOs	K-Level	Section A	Section B (Either / or Choice)	Section C (Open Choice)
			Short Answers		
1.	CLO 3	Up to K-4	1 (K1)	2 (K3&K3)	1 (K3)
2.	CLO 4	Up to K-3	1 (K2)	2 (K4&K4)	1 (K3)
No. of Questions to be asked			2	4	2
No. of Questions to be answered			2	2	1
Marks for each Question			2.5	5	10
Total Marks for each Section			5	10	10

**Blueprint for Semester Examination**

**Learning Outcome Based Education & Assessment (LOBE)**

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

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

### 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	-	<b>19</b>	15.83	<b>42%</b>
K2	5	6	10	10	<b>31</b>	25.83	
K3	-	-	20	30	<b>50</b>	41.67	<b>42%</b>
K4	-	-	10	10	<b>20</b>	16.67	<b>16%</b>
Total Marks	10	10	50	50	<b>120</b>	100.00	<b>100%</b>

### Distribution of Unit-wise questions with K Levels

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

K1 – Remembering and recalling facts with specific answers

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

K3 – Application oriented – Solving Problems

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

<b>Title of the Course</b>		<b>Allied Practicals-I</b>					
<b>TANSICHE Course type</b>		EC1-P					
<b>Course Category</b>		Generic Elective - Practical					
<b>Nature of Course</b>		Skill Development					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	1	<b>Course Code</b>	<b>23U1CGEP1</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Practical</b>	<b>Total</b>
		--		--		2	2
<b>Marks</b>		<b>CIA</b>			<b>Semester</b>		<b>Total</b>
		40			60		100
<b>Pre-requisite(s)</b>							
<b>Objectives of the Course</b>		To learn, understand & develop skill and hands on training in qualitative and quantitative analysis of biochemical compounds.					
<b>Course Outline</b>		<b>Systematic analysis of Organic compounds</b>					
		<ol style="list-style-type: none"> <li>1. Functional group tests (Carboxylic acid (Benzoic acid, phthalic acid), Phenol, Urea, Benzaldehyde, Aniline (Aniline not to be given for exam))</li> <li>2. Detection of elements (N, Halogens)</li> <li>3. Distinguish between aliphatic and aromatic compounds.</li> <li>4. Distinguish between Saturated and unsaturated compounds</li> </ol>					
		<b>Qualitative Analysis</b>					
		<ol style="list-style-type: none"> <li>1. Qualitative analysis of carbohydrates - Glucose, Fructose, Lactose, maltose, sucrose, starch &amp; glycogen.</li> <li>2. Qualitative analysis of amino acids - Tyrosine, Tryptophan, Arginine, Proline and Cysteine.</li> </ol>					
		<b>Volumetric Analysis</b>					
		<ol style="list-style-type: none"> <li>1. Estimation of Glycine- Formal Titration.</li> <li>2. Determination of Ascorbic acid – DCPIP method.</li> <li>3. Estimation of Ferrous sulphate using standard Mohr's salt</li> </ol>					
		<b>Colorimetric Analysis</b>					
		<ol style="list-style-type: none"> <li>1. Estimation of glucose</li> <li>2. Estimation of Cholesterol- Zak's method</li> <li>3. Estimation of proteins – Bradford's method</li> </ol>					

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)</b>	
<b>Skills acquired from this course</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
<b>Justification for nature of course</b>	
<b>Text Book(s)</b>	<ol style="list-style-type: none"> <li>1. J. Jayaraman, Laboratory Manual in Biochemistry, New Age International Pvt Ltd Publishers, 2011.</li> <li>2. S. K. Sawhney Randhir, Singh, Introductory Practical Biochemistry, Alpha Science International Ltd, 2nd edition, 2005.</li> <li>3. Irwin H.Segel, Biochemical calculations, Liss, Newyork,1991.</li> </ol>
<b>Reference Book(s)</b>	<ol style="list-style-type: none"> <li>1. Dr. O P Panday, D N Bajpai, Dr. S Giri, PRACTICAL CHEMISTRY, S Chand, Revised edition 2016.</li> <li>2. Hands Thacher Clarke, A hand book of Oraganic:Qualitative and quantitative Analysis, 2007.</li> <li>3. N.S. Gnanapragasam and G. Ramamurthy, Organic chemistry Lab manual, S.Viswanathan Co. Pvt. Ltd., 1998.</li> </ol>
<b>Websites and e-Learning resources</b>	<a href="http://www.nptel.ac.in">www.nptel.ac.in</a> <a href="http://www.swayam.gov.in">www.swayam.gov.in</a>

### COURSE OUTCOMES:

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

#	CLOs	K-Level
<b>CLO1</b>	Experiment with aromatic functional groups	K3
<b>CLO2</b>	Perform qualitative analysis of carbohydrates	K4
<b>CLO3</b>	Demonstrate the qualitative analysis amino acids	K3
<b>CLO4</b>	Analyse the biochemical compounds	K4
<b>CLO5</b>	Demonstrate the basic principles colorimetry	K2

## MAPPING WITH PROGRAMME OUTCOMES

CLO	POs						PSOs				
	1	2	3	4	5	6	1	2	3	4	5
<b>CLO1</b>	3	3	3	3	3	2	3	3	2	2	2
<b>CLO2</b>	3	2	2	2	2	2	3	3	2	2	2
<b>CLO3</b>	3	2	2	2	2	2	3	3	2	2	2
<b>CLO4</b>	3	3	2	3	3	2	3	3	2	2	2
<b>CLO5</b>	3	3	3	3	3	3	3	3	3	3	3

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

### Assessment Scheme

#### Components of CIA

##### Practicals

	Components	Marks	Total Marks
<b>Internal [Formative]</b>	Continuous assessment	20	40
	Observation	10	
	Test	10	
<b>External [Summative]</b>		60	60
<b>Total Marks</b>			100

#### Question Paper pattern for External examination - Practical (60 marks)

Section		Marks
<b>I</b>	Major Question (1 X 20 Marks)	20
<b>II</b>	Minor Question (1 X 15 Marks)	15
<b>III</b>	Spotters (4 X 5 marks)	20
<b>IV</b>	Record Notebook	5
	<b>Total</b>	<b>60</b>



# ASSESSMENT RUBRICS

## Revised Curriculum

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

Academic Year 2023-2024 onwards



**THE MADURA COLLEGE**  
**An Autonomous Institution affiliated to Madurai Kamaraj University**  
**Re-accredited (3<sup>rd</sup> cycle) with 'A' grade by NAAC**  
**Vidya Nagar, T.P.K. Road, Madurai – 625 011**

**ASSESSMENT RUBRICS**

**TEST**

#	Timeline
1	36 <sup>th</sup> day
2	72 <sup>nd</sup> 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 relevant 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 - open choice – one question to be answered out of 2 question asked)	1/2	10	5
<b>Total marks</b>			<b>25</b>

#### 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**

<b>Timeline</b>
Spread over the entire semester from days 20 to 80

**Assessment Strategy****Rubric:**

<b>Criteria</b>	<b>Performance Marks</b>		
	<b>3</b>	<b>2</b>	<b>1</b>
<b>Presentation</b>	-	Presentation was done with ICT tools and the tools were appropriate for the content.	Usage of ICT tools is inadequate.
<b>Content</b>	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****Poster/chart presentation**

<b>Timeline</b>
Spread over the entire semester from days 20 to 80

**Assessment Strategy****Rubric:**

<b>Criteria</b>	<b>Performance Marks</b>		
	<b>3</b>	<b>2</b>	<b>1</b>
<b>Preparation</b>	-	Content is illustrated with good usage of narrative techniques.	Content is not prepared with adequate usage of narrative techniques.
<b>Presentation</b>	-	The content is presented well with clarity.	The content is presented without clarity.
<b>Content</b>	-	-	The question asked by the evaluators are answered.

**Weight: 5 marks**

## ASSIGNMENT

#	Timeline
1	30 <sup>th</sup> day
2	70 <sup>th</sup> day

### Assessment Strategy

#### Rubric:

Criteria	Performance Marks		
	3	2	1
<b>Timely submission</b>	-	-	The assignment is submitted on time
<b>Content</b>	-	-	Content is relevant and complete in all respects
<b>Originality</b>	-	-	Content is written in own words with paraphrasing
<b>Library and Information resources usage</b>	-	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 <sup>th</sup> day
2	48 <sup>th</sup> day
3	78 <sup>th</sup> day

(Or)

#	Timeline
1	40 <sup>th</sup> day
2	80 <sup>th</sup> 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 <sup>rd</sup> day
2	63 <sup>rd</sup> day
3	83 <sup>rd</sup> 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.