B.Sc. MICROBIOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

Curriculum and Syllabus

Regular (2025 – 2026)

Enable | Enlighten | Enrich
KARPAGAM
ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

DEPARTMENT OF MICROBIOLOGY

FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University,Established Under Section 3 of UGC Act, 1956)
(Accredited with A+ Grade by NAAC in the second cycle)
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FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT

UNDER – GRADUATE PROGRAMMES

(REGULAR PROGRAMME)

REGULATIONS

(2025)

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FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT
UNDERGRADUATE PROGRAMMES
REGULAR MODE
CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS – 2025 - 2026

The following regulations shall apply to candidates admitted to Undergraduate (UG) programmes in the Faculty of Arts, Science, Commerce and Management, Karpagam Academy of Higher Education (KAHE) from the academic year 2025-2026 onwards.

1 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

1.1 UG Programmes Offered

A candidate may undergo any one of the undergraduate programmes approved by KAHE as given below.

S. No.	PROGRAMME	DISCIPLINE
1.	B.Com.	Commerce
2.	B.Com.	Computer Applications
3.	B.Com.	Professional Accounting
4.	B.Com.	Business Process Services
5.	B.Com.	Financial Analytics
6.	B.Com.	International Accounting and Finance
7.	B.Com.	Information Technology
8.	B.Com.	FinTech
9.	BBA	Business Administration
10.	BCA	Computer Applications
11.	B.Sc.	Biotechnology
12.	B.Sc.	Microbiology
13.	B.Sc.	Computer Science
14.	B.Sc.	Information Technology
15.	B.Sc.	Computer Technology
16.	B.Sc.	Computer Science (Cognitive Systems)

17.	B.Sc.	Computer Science (Artificial Intelligence and Data Science)
18.	B.Sc.	Computer Science (Cyber Security)

1.2 Admission Requirements (Eligibility)

A student for admission to the first year of the UG degree Programme shall be required to have passed the Higher Secondary Examination (10 + 2) [Academic or Vocational] prescribed by the Government of Tamil Nadu Board or any similar examination of any other Board accepted by KAHE as equivalent thereto. (Annexure I)

1.3 Mode of Study

All Programmes are offered under Full-Time Regular mode.

2. DURATION OF THE PROGRAMMES

2.1 The minimum and maximum period for the completion of the UG Programmes are given below:

Programme(s) (Honors)	Min. No. of Semesters	Max. No. of Semesters
B.Sc., B.Com., BCA and BBA	8	15

2.2 Each semester normally consists of 90 working days or 450 instructional hours of study. Examination shall be conducted at the end of every semester for the respective courses.

2.3 Multiple Entry and Exit

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as: UG certificate after completing 1 year (2 semesters) of study in the chosen fields of study, UG diploma after 2 years (4 semesters) of study, bachelor's degree after a 3-year (6 semesters) programme of study, 4-year bachelor's degree (honours) after eight semesters programme of study. If the student completes a rigorous research project in their major area(s) of study in the 4th year of a bachelor's degree (honours with research). The 4-year bachelor's degree programme is considered a preferred option since it would provide the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per the choices of the student. Similarly, the student from other institutions can join Karpagam Academy of Higher Education in the 3rd, 5th or 7th semester with an appropriate UG Certificate or UG Diploma or Bachelor's Degree respectively.

3. CHOICE BASED CREDIT SYSTEM

Credit means the weightage given to each course by the experts of the Board of Studies concerned. All programmes are offered under Choice Based Credit System with a minimum of 120 and up to a maximum of 125 credits for three years. Additional credits of 40 can also be earned on successful completion of fourth year. A range of 160 to 165 credits are offered as per the UGC Guidelines for the four-year UG Programme.

4. STRUCTURE OF THE PROGRAMME

Major Courses, Minor Courses, Multi-Disciplinary Courses (MDC), Skill Enhancement Courses (SEC), Ability Enhancement Courses (AEC), Value Added Courses (VAC) (Common to all UG Programmes), Summer Internship, Minor Project (for 3 Year programme), Research Project/Dissertation (for 4 Year programme) are part of curricular structure.

4.1 Major Courses

Major Courses consist of theory and practical components of department domains. The student has to earn a minimum of 60/80 Credits in Major Courses for 3/4 years programme respectively.

4.2 Minor Courses

Students have courses from Major disciplinary / interdisciplinary minors and skill-based courses. Students have to earn a minimum of 24/32 Credits in Minor Courses for 3/4 years programme respectively.

4.3 Multi Disciplinary Courses (MDC)

All UG students are required to undergo 3 introductory-level courses relating to any of the broad disciplines. These courses are intended to broaden the intellectual experience and form part of liberal arts and science education. The students have to study three Multi-Disciplinary Courses and they have to earn a minimum of 09 Credits.

4.4 Skill Enhancement Courses (SEC)

These courses are aimed at imparting practical skills, hands-on training, soft skills, etc., to enhance the employability of students. Three Skill Enhancement Courses are offered within the first four semesters. Students have to earn a minimum of 09 Credits in Skill Enhancement Courses.

4.5 Ability Enhancement Course (AEC)

There are four Ability Enhancement Courses offered during the first four semesters. Three credits are awarded for each course and students have to earn a minimum of 12 Credits in Ability Enhancement Courses. Tamil or any one of the Indian / Foreign Languages *viz,* Hindi, Malayalam, Sanskrit, French is offered as an Ability Enhancement Course (AEC) for Arts, Science, Commerce and Management Programmes.

4.6 Value Added Courses (VAC)

The students shall study Value Added Courses in the first four semesters of their programme. 6 to 8 credits need to be earned under VAC. The assessment of the VAC is based on Internal Evaluation.

4.7 Internship

The students exiting the programme after first or second year must have completed an internship/apprenticeship of 02 or 04 credits respectively during the first year and second year summer term.

4.8 Minor Project Work

The project work shall start at the beginning of the sixth semester in the Department/Industry/Research Institute (National/International) and the project report has to be submitted at the end of the sixth semester. The project may be an individual or group task**.** The Head of the Department concerned shall assign a project supervisor who in turn shall monitor the project work of the student(s). A project work shall be carried out by the students and they have to earn 06 to 08 credits.

If the candidate undertakes the Project work outside the Department, the faculty concerned within the Department shall be the Supervisor and the teacher/scientist of the host institute will be the Co-supervisor. The candidate shall bring the attendance certificate from the place where the project work was carried out.

A Project Assessing Committee (PAC) shall be constituted with HoD and two senior faculty members of the Department. The PAC shall announce the dates for the reviews and demonstration. Three reviews shall be conducted as part of internal assessment. The student shall make a presentation on the progress and demonstration of their project before the PAC in the presence of their supervisor on the scheduled dates.

4.9 Research Project /Dissertation

The candidates shall undertake the Research Project work in the eighth Semester in the Department/Industry/Research Institute (National / International). The report shall be submitted at the end of the eighth semester. Students have to earn a minimum of 12 Credits in Research Project/Dissertation Work.

If the candidate undertakes the Research Project work outside the Department, the faculty concerned within the Department shall be the Supervisor and the teacher/scientist of the host Institute will be the Co-supervisor. The candidate shall bring the attendance certificate from the place where the project work was carried out.

HoD shall assign a Project Supervisor who shall monitor the student's project work(s). A Project Assessing Committee (PAC) shall be constituted with HoD and two senior faculty members of the Department. The PAC shall announce the dates for the reviews and demonstration. Three reviews shall be conducted as part of internal assessment. The student shall make a presentation on the progress and demonstration of their project before the PAC in the presence of their Supervisor on the scheduled dates.

Approval of the project

The candidate has to submit, in consultation with his/her supervisor, the title, objective and the action plan of his/her project to the PAC on the first review. Only after obtaining the approval of PAC, the student can initiate the project work.

5. ADVANCED LEARNERS AND ON-DEMAND EXAMINATION

Students who secure 7.5 CGPA, maintain an attendance of 80% in every semester and clear all the courses in their first appearance itself are referred to as advanced learners. When a student fails to maintain any of these conditions at any given time, the student will no longer retain advanced learner status.

These students can request for an on-demand examination for the courses from second semester onwards. These students on prior registration can appear for examinations well in advance and complete the entire courses well before the prescribed period of study and can progress for a full time Research Project/Internship/Minor Project during the remaining prescribed period of study. The Internal and External examinations shall be conducted for these courses as like the other courses. One or more faculty mentors will be allocated based on the number of students/courses enrolled for the on-demand

examination. When the number of students enrolled for a particular course is less than 30, only self-learning mode is applicable and will be monitored by the mentor. Otherwise, a faculty will handle the course after regular working hours. The examination will be conducted along with the current semester courses.

Also, these advanced learners can register for online courses from NPTEL/SWAYAM/SWAYAM Plus portals on prior and proper approval from the department. The credits earned from those courses will be transferred to the mark statement of the students as in Clause 6.

6. TRANSFER OF CREDITS EARNED THROUGH ONLINE PLATFORM / INTERNATIONAL STUDIES

Students are encouraged to enroll in courses offered by NPTEL/Swayam/ Swayam Plus platforms and international institutions of higher learning, either virtually or in person. The equivalent credits for these courses will be determined by a committee named Subject & Grade Equivalence Committee consisting of the Dean of the Faculty (Chairman), Dean (R&D and Industrial Relations), Head of the Department (HoD), and a faculty member nominated by the Vice Chancellor. The committee's decision will be submitted for ratification/approval by the Board of Studies (BoS) and the Academic Council. If the student fails in NPTEL/Swayam/ Swayam Plus course, he/she can appear for the examination conducted by the University for the equivalent course in the curriculum.

7. EXTRA CURRICULAR ACTIVITIES

Every student is encouraged to participate in at least any one of the following activities:

- National Service Scheme (NSS)
- National Cadet Corps (NCC)
- Sports / Mass drill
- Youth Red Cross (YRC)
- Club activities
- Other Extra-curricular activities

The student's performance shall be examined by the staff in-charge of activities along with the faculty mentor and the Head of the respective department. Marks for Extra-curricular shall be sent to the Controller of Examination (CoE) before the commencement of the Sixth End Semester Examinations.

8. MEDIUM OF INSTRUCTION

The medium of instruction and examinations for the courses under Language I – Tamil / Hindi / Malayalam / French / Sanskrit shall be in the language concerned. For all other courses, the medium of instruction and examination is in English.

9. SCHEME OF EXAMINATION

Evaluation: Evaluation of the course comprises two parts such as the Continuous Internal Assessment (CIA) and the End Semester Examination (ESE) until or otherwise the course is explicitly mentioned as only internal/only external.

The theory and practical courses shall carry a maximum of 100 marks, out of which 40 percent of marks are awarded for Continuous Internal Assessment (CIA) and 60 percent of marks for End Semester Examinations (ESE). When it is only an internal assessment course, 100 percent of marks are awarded for Continuous Internal Assessment.

10. FACULTY MENTOR

To help students in planning their courses of study and for general advice on the academic programme, the HoD shall allot twenty students to a faculty who will function as a faculty mentor throughout their period of study. A Faculty mentor shall advise the students and monitor their behavior and academic performance. Problems if any shall be counseled by them periodically. The faculty mentor is also responsible to inform the parents of their mentee's progress. The faculty mentor shall display the cumulative attendance particulars of his / her mentees periodically (once in 15 working days) on the Notice Board to know their attendance status and satisfy clause 14 of this regulation.

11. ONLINE COURSE COORDINATOR

To help students for planning their online courses and for general orientation on online courses, the HoD shall nominate a coordinator for the online courses. The Online course coordinator shall identify the courses which students can select for their programme from the available online courses offered by different agencies periodically and inform the same to the students. Further, the coordinators shall orient the students regarding the online courses and monitor their participation.

12. CLASS COMMITTEE

Every class shall have a Class Committee consisting of the faculty members of various courses of the class concerned, student representatives (Minimum 2 boys and 2 girls of various capabilities and Maximum of 6 members) and the concerned HoD / senior faculty as Chairperson. The objective of the Class Committee Meeting is all about the teaching – learning process. The Class Committee shall be convened at least once in a month. The constitution and functions of the Class Committee shall include

1.The class committee shall be constituted during the first week of each semester.

2.The Class Committee of a particular class of any department is normally constituted by the HoD/Chairperson of the Class Committee. However, if the students of different departments are mixed in a class, the Class Committee shall be constituted by the respective Dean of the Faculty.

3.The HoD/Chairperson of the Class committee is authorized to convene the meeting of the class committee.

4. The respective Dean of the Faculty has the right to participate in any Class committee meeting.

5. The Chairperson is required to prepare the minutes of every meeting, and submit the same to the Dean concerned within two days after having convened the meeting. Serious issues, if any, shall be brought to the notice of the Registrar by the HoD/Chairperson immediately.

6.Analyzing and solving problems experienced by students in the classroom and in the laboratories.

7.Analyzing the performance of the students of the class after each test and finding the ways and means to improve the performance.

13. COURSE COMMITTEE FOR COMMON COURSES

Each common course offered to more than one programme or department shall have a “Course Committee” comprising all the teachers handling the common course with one of them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the respective Dean depending upon whether all the teachers handling the common course belong to a single department or to various other departments. The ‘Course Committee’ shall meet in order to arrive at a common scheme of evaluation for the tests to ensure a

uniform evaluation of the tests. If feasible, the course committee shall prepare a common question paper for the Internal Assessment Test(s). The Course Committee Meeting is conducted once in a semester. To indicate the common course, the Course Code should be suffixed with the letter "G".

14. ATTENDANCE REQUIREMENTS TO APPEAR FOR THE END SEMESTER EXAMINATION

a**.** Every student is expected to attend all classes and should secure 100% attendance. However, in order to allow for certain unavoidable circumstances, the student is expected to have at least 75% of attendance and the conduct of the student has been satisfactory during the Programme.

b. A candidate who has secured attendance between 65.00% and 74.99% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) shall be given exemption from prescribed minimum attendance requirements and shall be permitted to appear for the examination on the recommendation of the Head of the Department concerned and the Dean. The Head of the Department has to verify and certify the genuineness of the case before recommending it to the Dean concerned. However, the candidate has to execute an undertaking along with the parent and assure that this situation does not arise in the future. This permission is given only once during the entire period of study.

c. A candidate who has secured attendance between 55.00% and 64.99% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness with all the medical records, bills and discharge summary), will not be presented to that semester examination. However, that candidate will be permitted to go to the next semester wherein he / she has to compensate for the previous semester's lack of attendance. In such a case, the candidate will be permitted to write both semester examinations at the end of the next semester. This combination of lack of attendance can be done only between subsequent semesters. That is 1 & 2 or 2 & 3 or 3 & 4 or 4 & 5 or 5 & 6.

d. However, a Student who has secured less than 55% in any of the semesters due to any reasons, shall not be permitted to appear for the End Semester Examinations. But he/she will be permitted to appear for his/her arrear examinations. In order to redo the semester with lack of attendance, he/she has to attend the corresponding semester of the subsequent year(s) with the approval of the Dean of the Faculty, Dean - Students Affairs and the Registrar.

15. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

15.1 Attendance and Assessment: Every Faculty is required to maintain an **Attendance and Assessment Record (Log book)** which consists of attendance of students marked for each lecture/practical/ project work, the CIA, Assignment and Seminar marks and the record of class work completed (topic covered), separately for each course. This should be submitted to the HoD once in a week for checking the syllabus coverage, records of test marks and attendance. The HoD shall sign with the date after due verification. The same shall be submitted to the respective Dean once in a fortnight. After the completion of the semester, the HoD should keep this record in safe custody for five years as records of attendance and assessment and shall be submitted for inspection as and when required by the KAHE/any other approved body.

15.2 Continuous Internal Assessment (CIA): The performance of students in each course will be continuously assessed. Retest will be conducted and considered based on the requirements and recommendations by the Head of the Department on valid reasons. The distribution of marks for the Continuous Internal Assessment (CIA) are given below:

Theory Courses

S. No.	Category	Maximum Marks
1.	Assignment	5
2.	Attendance	5
3.	Seminar	5
4.	Test – I (2 ½ Units)	12.5
5.	Test – II (2 ½ Units)	12.5
Total		40

For Environmental Studies and Universal Human Values:

S. No.	Category	Maximum Marks
1.	Assignment	15
2.	Attendance	5
3.	Test – I (2 ½ Units)	40
4.	Test – II (2 ½ Units)	40
Total		100

For Yoga for Youth Empowerment:

S. No.	Category	Maximum Marks
1.	Activity	15
2.	Attendance	5
3.	Test – I (2 ½ Units)	40
4.	Test – II (2 ½ Units)	40
Total		100

For Community Engagement and Social Responsibility:

S. No.	Category	Maximum Marks
1.	Field Visit	15
2.	Attendance	5
3.	Test – I (1 ½ Units)	40
4.	Test – II (1 ½ Units)	40
	Total	100

Practical Courses

S.No.	Category	Maximum Marks
1.	Attendance	5
2.	Observation work	5
3.	Record work	5
4.	Internal Practical Assessment	20
5.	*Viva – voce* [Comprehensive]*	5
	Total	**40**

* *Viva- voce* is conducted during the model practical exam.

Every practical Exercise / Experiment shall be evaluated based on the conduct of Exercise/ Experiment and records need to be maintained.

15.3 Pattern of Test Question Paper

Theory Courses:

Maximum Marks : 60* **Duration: 2 ½ Hours**

Section	Marks
Part – A	Answer ALL the Questions (6 x 2 = 12 Marks)
Part - B	Answer ALL the Questions (3 x 6 = 18 Marks) (‘either – or’ type)
Part - C	Answer ALL the Questions (3 x 10 = 30 Marks) (‘either – or’ type)

* The 60 Marks will be converted to 12.5 Marks.

15.4 Attendance

Distribution of Marks for Attendance

S. No.	Attendance (%)	Maximum Marks
1	91 and above	5
2	81 - 90	4
3	75-80	3

16. ESE EXAMINATIONS

16.1 End Semester Examination (ESE): End Semester Examination will be conducted at the end of each semester for each course. The question paper is for a maximum of 100 marks.

16.2 Pattern of ESE Question Paper:

Theory Courses:

Maximum Marks: 100* **Duration: 3 Hours**

Section	Marks
Part – A	Answer ALL the Questions (10 x 2 = 20 Marks)
Part - B	Answer ALL the Questions (5 x 6 = 30 Marks) ('either – or' type)
Part - C	Answer ALL the Questions (5 x 10 = 50 Marks) ('either – or' type)

*****The 100 Marks will be converted to 60 Marks.

Practical Courses: There shall be combined evaluation by the Internal and External examiners. The pattern of distribution of marks shall be as given below.

S. No.	Category	Maximum Marks
1.	Experiments	40
2.	Record work	10
3.	*Viva – voce* [Comprehensive]	10
	Total	**60**

Record Notebooks for Practical Examination

Candidates taking the practical examination should submit a prescribed Bonafide Record Notebook for the practical examination; failing which the candidate will not be permitted to take the practical examination.

In case of failures in Practical Examination, the marks awarded for the Record at the time of first appearance of the Practical Examination shall remain the same at the subsequent appearance also by the candidate.

16.3. Evaluation of Project Work

16.3.1 The project work shall carry a maximum of 100 marks.

(CIA - 40 and ESE – 60)

The distribution of marks for the Continuous Internal Assessment (CIA) is given below:

Maximum Marks: 40

S. No.	Category	Maximum Marks
1.	Problem Selection	10
2.	Progress of the work (3 reviews X 5 marks)	15
3.	Presentation of the work (3 reviews X 5 marks)	15
	Total	**40**

The distribution of marks for the End Semester Examination is given below:

Maximum Marks: 60*

S. No.	Category	Maximum Marks
1.	Project Report	30
2.	Project Presentation	20
3.	Viva Voce	10
	Total	**60***

***Combined valuation of Internal and External Examiners.

16.3.2 The project report prepared according to the approved guidelines and duly signed by the supervisor(s) shall be submitted to HoD.

16.3.3 The evaluation of the project will be based on the project report submitted and a *viva-voce* examination by a team consisting of the supervisor, who will be the Internal Examiner and an External Examiner who shall be appointed by the Controller of Examination. In case the supervisor is not available, the HoD shall act as an Internal Examiner for the same.

16.3.4 If a candidate fails to submit the project report on or before the specified date given by the Examination Section, the candidate is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.

If a candidate fails in the respective viva-voce examinations he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. The resubmitted report shall be evaluated in the subsequent semester.

16.3.5 A Copy of the approved project report after the successful completion of *viva-voce* examination shall be kept in the KAHE library.

17. PASSING REQUIREMENTS

17.1 Passing minimum: A candidate needs to secure a minimum of 20 marks out of 40 marks in CIA and 30 marks out of 60 marks in ESE. The overall passing minimum in each course is 50 marks out of 100 marks.

17.2 If a candidate fails to secure a pass in a particular course (either CIA or ESE or Both) as per clause 17.1, it is mandatory that the candidate has to register and reappear for the examination in that course during the subsequent semester when examination is conducted for the same till, he / she receives pass both in CIA and ESE (vide Clause 2.1).

17.3 The CIA marks secured by the candidate in the first passed attempt shall be retained by the Office of the Controller of Examinations and considered valid for all subsequent attempts till the candidate secures a pass in ESE.

17.4 Candidate failed in internal assessment will be permitted to reappear to pass the internal assessment in the subsequent semesters by writing tests and by re-submitting Assignments/ Seminars.

The distribution of marks for this test shall be as given below.

S. No.	Category	Maximum Marks
1.	Assignment	5
2.	Attendance (Retained from the respective semester)	5
3.	Seminar	5
4.	Test*	25
	Total	40

* Tests shall be conducted in the ESE pattern for 100 marks and converted to 25 marks.

The examination should be completed within 6 weeks after reopening of the subsequent semester.

17.5 A Candidate who is absent in ESE in a Course / Practical / Project Work after having enrolled for the same shall be considered to have Absent (AAA) in that examination.

18. ONLINE EXAMINATIONS

The students who are going for Project / Internship / Coursework at National level are permitted to write their CIA test through Online Mode and ESE in Offline/Online mode. When they go for an International Project / Internship / Coursework, both the CIA and ESE shall be conducted through online mode.

19. IMPROVEMENT OF MARKS IN THE COURSES ALREADY PASSED

The Candidates desirous to improve the marks secured in a course which they passed in their first attempt, shall reappear once (**only in ESE**) in the subsequent semester. **The improved marks shall be considered for classification but not for ranking.** If there is no improvement, there shall be no change in the marks awarded earlier.

20. AWARD OF LETTER GRADES

All the assessments of a course will be done on an absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

Letter grade	Marks Range	Grade Point	Description
O	91-100	10	OUTSTANDING
A+	81 - 90	9	EXCELLENT
A	71 - 80	8	VERY GOOD
B+	61 - 70	7	GOOD
B	56 - 60	6	AVERAGE
C	50 - 55	5	PASS
RA	Below 50	-	REAPPEARANCE
AAA	-	-	ABSENT

21. GRADE SHEET

After the declaration of the results, Grade Sheets will be issued to each student which will contain the following details:

i. The list of courses enrolled during the semester and the grade scored.

ii. The Grade Point Average (**GPA**) for the semester and

iii. The Cumulative Grade Point Average (**CGPA**) of all courses enrolled from first semester onwards.

iv. Remark on Extension Activities (only in the 6th Semester Grade Sheet)

GPA of a Semester and CGPA of a programme will be calculated as follows.

GPA of a Semester $\frac{\sum_i CiGPi}{\sum_i Ci}$ = Sum of the product of the GP by the ---------- Sum of the credits of the courses of that Semester

i.e. **GPA** of a Semester = $\frac{\sum_i CiGPi}{\sum_i Ci}$

CGPA of the entire programme = Sum of the product of the GPs by the corresponding credits of the courses offered for the entire programme ---------- Sum of the credits of the courses of the entire programme

i.e. **CGPA** of the entire programme = $\frac{\sum_n \sum_i CniGPni}{\sum_n \sum_i Cni}$

where,

Ci is the credit fixed for the course 'i' in any semester
GPi is the grade point obtained for the course 'i' in any semester
'n' refers to the Semester in which such courses are credited.

Note: RA grade will be excluded for calculating **GPA** and **CGPA**.

22. REVALUATION

A candidate can apply for revaluation or re-totaling of his / her semester examination answer script (**theory courses only**), within 2 weeks from the date

of declaration of results on payment of a prescribed fee. The prescribed application has to be sent to the Controller of Examinations through the HoD. **A candidate can apply for revaluation of answer scripts not exceeding 5 courses at a time.** The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate through the HoD concerned**.** Revaluation is not permitted for Supplementary Examinations.

23.TRANSPARENCY AND GRIEVANCE COMMITTEE

Revaluation and Retotaling are allowed on representation (clause 22). Students may get the Xerox copy of the answer script on payment of prescribed fee, if he / she wishes. The student may represent the grievance, if any, to the Grievance Committee, which consists of Dean of the Faculty, (if Dean is HoD, the Dean of another Faculty nominated by the KAHE), the HoD of Department concerned, the faculty of the course and Dean from other discipline nominated by the KAHE and the CoE. If the Committee feels that the grievance is genuine, the script may be sent for external valuation and the marks awarded by the External examiner will be final. The student has to pay the prescribed fee for the same.

24. ELIGIBILITY FOR THE AWARD OF THE DEGREE

A student shall be declared to be eligible for the conferment of the Degree if he / she

24.1 Successfully completed all the components prescribed by Curriculum and Credit Framework for Undergraduate Programme of UGC and earned the minimum required credits as specified in the curriculum corresponding to his / her programme within the stipulated period (vide clause 2.1).

24.1 No pending disciplinary enquiry/ action against him/her

24.2 The award of the degree must be approved by the Executive Council.

25.CLASSIFICATION OF THE DEGREE AWARDED

25.1 Candidates who qualify for the award of the Degree (vide clause 24) having passed the examination in all the courses in their first appearance, within the specified minimum number of semesters and securing a **CGPA not less than 8** shall be declared to have passed the examination in the **First Class with Distinction.**

25.2 Candidates who qualify for the award of the Degree (vide clause 24) having passed the examination in all the courses within the specified maximum number of semesters (vide clause 2.1), securing a **CGPA not less than 6.5** shall be declared to have passed the examination in the **First Class**.

25.3 Candidates (not covered in clauses 25.1 and 25.2) who qualify for the award of the degree (vide Clause 24) shall be declared to have passed the examination in the **Second Class**.

26. RANKING

Candidates who qualify for the UG Degree programme passing all the Examinations in the first attempt, within the minimum period prescribed for the programme of study from Semester I through Semester VI/VIII to the programme shall be eligible for ranking. Such ranking will be confined to 10% of the total number of candidates qualified in that particular programme of study subject to a maximum of 10 ranks.

27. SUPPLEMENTARY EXAMINATION

Supplementary Examination will be conducted only for the final semester students within ten days from the date of publication of results for students who have failed in one theory course only. This is applicable only for the ESE component of the course which the student failed. Such students shall apply with prescribed fee to the Controller of Examinations within the stipulated time.

28. DISCIPLINE

28.1 If a student indulges in malpractice in any of the Internal / External Examinations he / she shall be liable for punitive action as prescribed by the KAHE from time to time.

28.2 Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the KAHE. The erring students will be referred to the disciplinary committee constituted by the KAHE, to enquire into acts of indiscipline and recommend the disciplinary action to be taken.

29. KAHE ENTRANCE EXAMINATION

At the end of Sixth/Eighth Semester, the KAHE Entrance Examinations will be conducted for those candidates who are aspiring for Higher Education (PG).

30. REVISION OF REGULATION AND CURRICULUM

Karpagam Academy of Higher Education may from time-to-time revise, amend or change the Regulations, Scheme of Examinations and Syllabi, if found necessary.

Annexure – I

S.No.	Programme	Subject	Eligibility
1.	B. Sc.	Biotechnology	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Biology, Botany, Zoology, or Chemistry** as subjects at the Higher Secondary level.
2.	B. Sc.	Computer Science	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, or those who hold a 3-year diploma after 10th grade, with **Computer Science or Mathematics** as one of the subjects.
3.	B. Sc.	Microbiology	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Biology, Botany, Zoology, or Chemistry** as subjects at the Higher Secondary level.
4.	B. Sc.	Information Technology	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, or those who hold a 3-year diploma after 10th grade, with **Computer Science or Mathematics** as one of the subjects.
5.	B. Sc.	Computer Technology	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, or those who hold a 3-year diploma after 10th grade, with **Computer Science or Mathematics** as one of the subjects.
6.	B.Sc.	Computer Science (Cognitive Systems)	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, or those who hold a 3-year diploma after 10th grade, with **Computer Science or Mathematics** as one of the subjects.

7.	B.Sc.	Computer Science (Artificial Intelligence and Data Science)	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, or those who hold a 3-year diploma after 10th grade, with **Computer Science or Mathematics** as one of the subjects.
8.	BCA	Computer Application	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, or those who hold a 3-year diploma after 10th grade, with **Computer Science or Mathematics** as one of the subjects.
9.	B. Com.	Commerce	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Commerce** as a subject under the academic or vocational stream at the Higher Secondary level.
10.	B.Com (CA)	Commerce with Computer Applications	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Commerce** as a subject under the academic or vocational stream at the Higher Secondary level.
11.	B. Com. (PA)	Commerce with Professional Accounting	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Commerce** as a subject under the academic or vocational stream at the Higher Secondary level.
12.	B. Com. (BPS)	Commerce with Business Process Services	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Commerce** as a subject under the academic or vocational stream at the Higher Secondary level.
13.	B.B.A.	Business Administration	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Commerce** as a subject under the academic or vocational stream at the Higher Secondary level.

14.	B. Com	Financial Analytics	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Commerce** as a subject under the academic or vocational stream at the Higher Secondary level.
15.	B. Com	International Accounting and Finance	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Commerce** as a subject under the academic or vocational stream at the Higher Secondary level.
16.	B. Com	Information Technology	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Commerce** as a subject under the academic or vocational stream at the Higher Secondary level.
17.	B. Sc.	Computer Science (Cyber Security)	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, or those who hold a 3-year diploma after 10th grade, with **Computer Science or Mathematics** as one of the subjects.
18.	B. Com	FinTech.	Candidates who have passed Higher Secondary Education (XII) or any equivalent examination conducted by a State Government, University, or Board under the 10+2 pattern, with **Commerce** as a subject under the academic or vocational stream at the Higher Secondary level.

Karpagam Innovation and Incubation Council (KIIC)

(A Section 8 Company)

Based on the 2019 National Innovation and Startup Policy and the 2019–2023 Tamil Nadu Startup Policy, KIIC has recommended to the KAHE students who are affiliated with the KIIC that it be incorporated in the university Program Regulations 2023-24 and implement from this academic year.

Norms to Student Start-Ups

a) Any (UG/PG /(Ph.D.) Research scholars, student, right from the first year of their program is allowed to set a startup (or) work part time/ full time in a startup or work as intern in a startup

b) Any (UG/PG / (Ph.D.) Research scholars) student right from the first year of their program is allowed to earn credit for working on Innovative prototypes/business Models/ Pre incubation (case to case basis).

c) Start Up activities will be evaluated based on the guidelines being given by the expert committee of the KIIC

d) Student Entrepreneurs may use the address of incubation center (KIIC) to register their venture while studying in KAHE.

e) Students engaged in startups affiliated with the KIIC or those who work for them may be exempted from KAHE's attendance requirements for academic courses under current regulations, up to a maximum of 30% attendance per semester, including claims for ODs and medical emergencies Potential Students who have been incubated at KIIC may be permitted to take their University semester exams even if their attendance is below the minimum acceptable percentage, with the proper authorization from the head of the institution.
(On case-to-case basis depends upon the applicability strength, societal benefits and quality of the Innovation and Subsequent engagement of the students with the/ her business)

f) Any Students Innovators/entrepreneurs are allowed to opt their startup in place mini project /major project, /seminar and summer training etc. (In plant training, Internship, value added Course.). The area in which the student wishes to launch a Startup may be interdisciplinary or multidisciplinary.

g) Student's startups are to be evaluated by Expert committee, formed by KIIC and KAHE

Guide lines to award Credits/ Marks to a Student startup

Student's startup stages are divided into five phases and these startup phases can be considered equally in place of the course title as mentioned below with the same credits allotted to the course title in a University curriculum.

Sl. No.	Description/Startup phases	In place of the Subject / Course title	Grades/Credits /Marks
1	**Idea stage/Problem Identification**	**Seminar**	**Same Marks/Credits can be awarded that are listed in the course title's curriculum for the respective startup phases.**
2	**Proof of Concept (POC) /Solution development**	**In-plant training /Internship**	
3	**Product Development (Lab scale) /Prototype Model/ Company Registered**	**Mini Project/ Value added Course**	
4	**Validation/Testing**	**Main Project phase I**	
5	**Business Model/Ready for Commercialization/Implementation**	**Main Project phase II,**	

PREAMBLE

The ‘small is not only beautiful but also selfless’

Microorganisms, being the established colonizers of this planet, have come to stay as a sophisticated firm of highly compatible organisms. These organisms have a major contact on all aspects of life. Diseases caused by microbes are well-known and can involve viruses, bacteria and protozoa. Our understanding of these organisms is directly linked to the control and prevention of infectious diseases. Immunology plays a key role in understanding how humans and animals respond to the challenge of these disease-causing organisms. Activities of microorganisms are very important to almost every sector of concern to mankind. The scope and significance of microbiology has enlarged manifold, particularly when importance of environment. In the context of microbial enzymes, chemotherapeutic agents and bacterial metabolism, microbes are gaining momentum in view of their role as Mini biofactories. Importance of this branch lies due to the fact that about 30% of the total Nobel Prizes given in the field of physiology and medicine are awarded to those working on problems related to microbiology.

Microbiology is a discipline of enormous importance in basic and applied science and the course has been restructured to suit an increasing number of students of diverse educational backgrounds. Point of reference of this course is also towards basic and applied research in microbiology, providing opportunity to the talented students with an aspiration of becoming scientists of international standard and offers some of the most exhilarating and demanding careers.

Objectives of the department are

- to promote understanding of advancements and various emerging areas in microbiology.
- to provide a quality educational experience in a field of laboratory science.
- to make the students expertise in terms of its practical applicability.
- to study useful and disease producing microorganisms.
- to study the biological activities of microbes.
- to make students to think critically and to engage in a deeper understanding of their microbial environment.
- to prepare students for further studies, helping in their bright career.
- to prepare and also to expertise the students to accept the challenges in Life Sciences.
- to develop skills required in research labs, diagnostic labs and in various other microbiology labs.
- to develop skills required in various industries and in the field of human health.
- to allow our students to be qualified in the field of Microbiology for work anywhere in the world.

PROGRAMME OUTCOMES (PO)

PO1: Discipline Knowledge: Acquire knowledge and understand the concepts in Microbiology and related disciplines such as Biochemistry, Immunology, Molecular Biology, Tissue culture rDNA technology and Bioinformatics

PO2: Communication skills: Communicate effectively to share the concepts in Microbiology orally and in writing; and present major and important ideas on Microbiology lucidly to different groups.

PO3: Critical thinking: Develop self-critical skills, improve critical thinking and critically analyse the data and ideas on epidemic diseases and environmental issues, provide suggestions on alternative therapies and remediation.

PO4: Problem solving: Identify the real-life problems, execute various experiments and apply the knowledge and skills in using latest tools and techniques in Microbiology, Immunology, Biochemistry and Molecular Biology for resolving the health and environmental problems.

PO5: Analytical reasoning: Analyse, evaluate and interpret theories, claims, evidences and results in the arena of Microbiology and envisage the remedial measures for implementation on the society.

PO6: Research related skills: Read and discuss research articles, ask relevant questions, define problems, formulate and test hypothesis, execute research, analyse and report the inferences of the research work.

PO7: Cooperation/Team work: Function effectively in a team with peers and demonstrate a commitment to the process of developing skills in Microbiology.

PO8: Scientific reasoning: Develop scientific logics, adopt techniques in Microbiology, analyse critically, infer the outcomes of data obtained and to apply the results in various sectors like food, health, energy and environment.

PO9: Reflective thinking: Contemplate consequences of pandemic communicable diseases with current experiences and apply the knowledge to find solutions.

PO10: Information and Digital literacy: Use and analyse Bioinformatics tools to draw information on Biologicals and to apply Omics in the sectors of medicine and food.

PO11: Self-directed learning: Cultivate independent learning skills, work independently to evaluate diagnostic tests and assays and to generate experiment kits for various analyses in Microbiology

PO12: Multicultural competence: Develop multidisciplinary knowledge in microbiology, molecular biology and biochemistry through the programme and involve and interact with different work groups

PO13: Moral and Ethical awareness/reasoning: Apply ethical values and oblige to ethics in the profession and responsibilities in practicing Microbiology techniques and in performing research related health using Microbiological techniques.

PO14: Leadership readiness/qualities: Develop planning and administrative skills, comprehend the responsibilities and tasks in Microbiology related works, lead a work team, frame an exciting vision for the organization.

PO15: Lifelong learning: Update the knowledge in Microbiology, apply for long time in in the context of technology transformation, to prepare for and meet long term challenges in the working organization and to develop skills for entrepreneurship.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1: To make students acquire knowledge on the concepts and to develop practical skills and techniques in Basic Microbiology

PSO 2: To prepare students to get exposed to the concepts to Applied Microbiology pertaining to Industrial applications i.e., Medical, Environment, Agriculture, Food and Energy

PROGRAMME EDUCATIONAL OUTCOMES (PEO)

PEO 1: Graduates will demonstrate lectures on core and minor courses in Microbiology and experiments related to Microbiology

PEO 2: Graduates will develop human resource and entrepreneurs in Microbiology with the ability to independently start their own ventures or small units in the field of Microbiology.

PEO 3: Graduates will esteem public policy, bioethics, bio-safety, and intellectual property rights issues related to microbiology applications nationally and globally.

Mapping of POs and PEOs

PEOs	Programme Objectives (PO)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
PEO1	x			x	x	x	x	x	x	x					
PEO2											x			x	x
PEO3													x		

DEPARTMENT OF MICROBIOLOGY
FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT
UG PROGRAM (CBCS) – B. Sc –MICROBIOLOGY (FULL TIME)
(2025–2026 Batch and onwards)

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER I												
25LTU101G/ 25LHU101G/ 25LMU101G/ 25LSU101G/ 25LFU101G	Language: Tamil - I/Hindi - I/ Malayalam - I/ Sanskrit - I/ French - I	AEC 1	1,2,3,7,12	-	4	0	0	3	40	60	100	16
25ENU101G	English I	MDC 1	1, 4, 5, 8, 13	1	3	0	0	3	40	60	100	31
25MBU101	Introduction to Microbiology and Microbial Diversity	MAJOR 1	1, 4, 5, 8, 11, 13	1	6	0	0	4	40	60	100	33
25MBU102	Biochemistry- I	MINOR 1	1, 4, 8, 10, 11,15	1, 2	5	0	0	3	40	60	100	35
25MBU111	Introduction to Microbiology and Microbial Diversity Practical	SEC 1	1, 5, 8	1, 2	0	0	5	2	40	60	100	37
25MBU112	Biochemistry - I Practical	MINOR 2	1, 3, 4, 8, 10,11, 15	1, 2	0	0	5	2	40	60	100	39
25VAC101G	Yoga for Youth Empowerment	VAC 1	1,3,4, 5,6, 7, 9, 10, 11, 14, 15	1,2	2	0	0	2	100	-	100	41
Semester Total					**20**	**0**	**10**	**19**	**340**	**360**	**700**	-

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER II												
25LTU201G/ 25LHU201G/ 25LMU201G/ 25LSU201G/ 25LFU201G	Language: Tamil - II/Hindi - II/ Malayalam - II/ Sanskrit - II/ French - II	AEC 2	1,2,3,7,9,12	-	4	0	0	3	40	60	100	43
25ENU201G	English II	MDC 2	2, 3, 5, 7, 14	1	3	0	0	3	40	60	100	56
25MBU201	Microbial Physiology and Metabolism	MAJOR 2	1, 3, 4, 6, 8	1, 2	6	0	0	4	40	60	100	58
25MBU202	Biochemistry - II	MINOR 3	1, 3, 4, 6, 8	1, 2	5	0	0	4	40	60	100	60
25MBU211	Microbial Physiology and Metabolism Practical	MAJOR 3	1, 4, 6, 15	1, 2	0	0	5	2	40	60	100	62
25MBU212	Biochemistry - II Practical	SEC 2	1, 6, 8, 12, 15	1	0	0	5	2	40	60	100	64
25VAC201G	Environmental Studies	VAC 2	1,8,9,11,12,13,15	1.2	2	0	0	2	100	-	100	66
Semester Total					**20**	**0**	**10**	**20**	**340**	**360**	**700**	

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER III												
25LTU301G/ 25LHU301G/ 25LMU301G/ 25LSU301G/ 25LFU301G	Language: (Tamil - III/Hindi - III/ Malayalam - III/ Sanskrit - III/ French - III)	AEC 3	1,2,3,4	-	4	0	0	3	40	60	100	68
25ENU301G	English III	MDC 3	2	2	3	0	0	3	40	60	100	83
25MBU301	Virology and Parasitology	MAJOR 4	1, 3, 4, 5, 8	1	5	0	0	4	40	60	100	85
25MBU302	Microbial Genetics	MAJOR 5	1, 4, 5, 8, 9	1, 2	4	0	0	4	40	60	100	87
25MBU303A	Microbes In Sustainable Agriculture and Development	MINOR 4	1,3, 4, 5,6,8,10,11,15	1, 2	3	0	0	3	40	60	100	89
25MBU303B	Biosafety, Bioethics and Intellectual Property Rights	MINOR 4	1,5,6,8,13	1								91
25MBU311	Virology and Genetics practical	MAJOR 6	1, 3, 4,5, 6, 8, 9	1, 2	0	0	5	2	40	60	100	93
25MBU312A	Microbes in Sustainable Agriculture and Development Practical	MINOR 5	1,4,5,6, 8, 11,15	1, 2	0	0	4	1	40	60	100	95
25MBU312B	Biosafety, Bioethics and Intellectual Property Rights - Practical	MINOR 5	1,4,5,8,13	1, 2								97
25VAC301G	Community Engagement and Social responsibility	VAC 3	4,5,13,15	1	2	0	0	2	100	-	100	99
25MBU391	Internship - I	Summer Internship	-	-	0	0	0	2	100	-	100	102
Semester Total					**21**	**0**	**09**	**24**	**480**	**420**	**900**	

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER IV												
25LTU401G/ 25LHU401G/ 25LMU401G/ 25LSU401G/ 25LFU401G	Language: Tamil -IV /Hindi - IV / Malayalam - IV / Sanskrit - IV / French - IV	AEC 4	1,2,3,4	-	4	0	0	3	40	60	100	103
25ENU401G	English IV	SEC 3	2	1	3	0	0	3	40	60	100	115
25MBU401	Immunology	MAJOR 7	1, 4, 5, 8	2	5	0	0	4	40	60	100	117
25MBU402	Medical Bacteriology and Mycology	MAJOR 8	1, 3, 4, 5, 7, 9, 10, 11	2	5	0	0	3	40	60	100	119
25MBU403A	Molecular Biology	MINOR 6	1, 4, 8, 15	1	3	0	0	3	40	60	100	121
25MBU403B	Plant and Animal Tissue Culture	MINOR6	1,8,13	1, 2								123
25MBU411	Immunology Practical	MAJOR 9	1, 4, 8, 11, 15	1, 2	0	0	4	2	40	60	100	125
25MBU412	Medical Bacteriology and Mycology Practical	MAJOR 10	1, 3, 4, 8, 9, 11	1, 2	0	0	4	1	40	60	100	127
25VAC401BG	Cyber Security and Universal Human Values	VAC 4	3,4,5,7, 15	1	2	0	0	1	100	-	100	129
Semester Total					**22**	**0**	**08**	**20**	**380**	**420**	**800**	-

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER V												
25MBU501	Industrial Microbiology and Microbial Biotechnology	MAJOR 11	1,3,4,8,9	2	5	0	0	4	40	60	100	132
25MBU502	Recombinant DNA Technology	MAJOR 12	1, 4, 5, 8, 10, 11	2	5	0	0	4	40	60	100	134
25MBU503	Microbial Omics and Biotechniques	MAJOR 13	1,3,4,5,8,9,10	1,2	5	0	0	4	40	60	100	136
25MBU504A	Introduction to Forensic Microbiology	MINOR 7	1,3,4,5,8, 10,11	2	5	0	0	3	40	60	100	138
25MBU504B	Diagnostic Microbiology	MINOR 7	1,3,4,8,10	1,2								140
25MBU511	Industrial Microbiology and rDNA Technology Practical	MAJOR 14	1,4,8	2	0	0	5	3	40	60	100	142
25MBU512	Microbial Omics Practical	MAJOR 15	1, 3, 4, 5, 8, 9, 13, 15	1,2	0	0	5	2	40	60	100	144
25MBU591	Internship - II	Summer Internship	-	-	0	0	0	2	100	-	100	146
Semester Total					**20**	**0**	**10**	**22**	**340**	**360**	**700**	-

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER VI												
25MBU601	Food and Dairy Microbiology	MAJOR 16	1,3,4,5,7,8,10	1,2	5	0	0	4	40	60	100	147
25MBU602	Environmental Microbiology	MAJOR 17	1,4,5,8,10,11,13	1,2	5	0	0	4	40	60	100	149
25MBU603A	Biopharmacy	MINOR 8	1,3,4,8	2	5	0	0	3	40	60	100	151
25MBU603B	Bionanotechnology	MINOR 8	1,4,8,10,	2								153
25MBU603C	Biofertilizer	MINOR 8	1,4,8,10	1,2								155
25MBU611	Food and Dairy Microbiology - Practical	MAJOR 18	1,3,4,7,8,11,15	2	0	0	4	1	40	60	100	157
25MBU612	Environmental Microbiology - Practical	MAJOR19	1,3,4,5,8	2	0	0	4	1	40	60	100	159
25MBU691	Project and Viva Voce	MAJOR 20	-	-	0	0	7	6	80	120	200	160
25ECU601G	ECA/NCC/NSS/ SPORTS/General Interest etc.,	-	-	-	0	0	0	-	100	-	100	161
Semester Total					**15**	**0**	**15**	**19**	**380**	**420**	**800**	-
Programme Total					**118**	**0**	**62**	**124**	**2260**	**2340**	**4600**	-

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER VII												
25MBU701	Textile Microbiology	MAJOR 21	1,3,4,5, 8,11	2	6	0	0	5	40	60	100	164
25MBU702	Poultry and Veterinary Microbiology	MAJOR 22	1,3,4,5,8	1,2	6	0	0	5	40	60	100	166
25MBU703A	Drug Design and Development	MINOR 9	1,3,4,8,11	2	5	0	0	4	40	60	100	168
25MBU703B	Bioproduct Development and Entrepreneurial Microbiology	MINOR 9	1,3,4,5,8,11	2								170
25MBU704A	Advanced Cell Biology	MINOR 10	1,4,5,8,9	1,2	4	0	0	3	40	60	100	172
25MBU704B	Biostatistics and Research Methodology	MINOR 10	1,3,4,5,6,8,11	1,2								174
25MBU711	Textile Microbiology - Practical	MAJOR 23	3,4,5,6,8, 11	1,2	0	0	3	1	40	60	100	176
25MBU712A	Drug Design and Development - Practical	MINOR 11	1,3,4,5,8,10	2	0	0	3	1	40	60	100	178
25MBU712B	Bioproduct Development and Entrepreneurial Microbiology - Practical	MINOR 11	1,3,4,8, 11,15	2	0	0	3					180
Semester Total					**21**	**0**	**09**	**19**	**240**	**360**	**600**	-

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER VIII A (HONOURS)												
25MBU801A	Bioprocess Engineering	MAJOR 24	1,3,4,5,8, 11	2	5	0	0	4	40	60	100	182
25MBU802A	Microbial Enzymology	MINOR 12	1,3,5,8	1,2	5	0	0	3	40	60	100	184
25MBU803A	Marine Microbiology	MAJOR 25	1,4,5,8, 11	1,2	5	0	0	4	40	60	100	186
25MBU804A	Laboratory Animal Management	MAJOR 26	1,5,6,8, 11,13	1,2	5	0	0	4	40	60	100	188
25MBU805A	Medical Coding and Pharmacovigilance	MINOR 13	1,3,4,5,8, 10,13	1,2	5	0	0	4	40	60	100	190
25MBU811A	Bioprocess Engineering - Practical	MAJOR 27	1,4,8,11	2	0	0	5	2	40	60	100	192
Semester Total					**25**	**0**	**05**	**21**	**240**	**360**	**600**	-
Grand Total					**164**	**0**	**76**	**164**	**2740**	**3060**	**5800**	-

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER VIII B (HONOURS WITH RESEARCH)												
25MBU801B	Bioprocess Engineering	MAJOR 24	1,3,4,5,8, 11	2	5	0	0	4	40	60	100	182
25MBU802B	Microbial Enzymology	MINOR 14	1,3,5,8	1,2	5	0	0	3	40	60	100	184
25MBU811B	Bioprocess Engineering - Practical	MAJOR 27	1,4,8,11	2	0	0	4	2	40	60	100	192
25MBU891	Research Project	MAJOR 28			0	0	16	12	80	120	200	194
Semester Total					**10**	**0**	**20**	**21**	**200**	**300**	**500**	-
Grand Total					**149**	**0**	**91**	164	2700	**3000**	5700	-
I/II/III/IV/V	MOOC	-	-	-	-	-	-	4	-	-	-	-
Total (up to Semester VI) = 124+4 = 128 credits												
Total (up to Semester VIII) = 164 credits												
Minimum 124+4 = 128 Credits to earn the degree (for III years) **Minimum 164 = 164 Credits to earn the degree (for IV years)**												

MAJOR COURSES			
Semester	**Course code**	**Name of the course**	**Credit(s)**
I	25MBU101	Introduction to Microbiology and Microbial Diversity	4
II	25MBU201	Microbial Physiology and Metabolism	4
	25MBU211	Microbial Physiology and Metabolism Practical	2
III	25MBU301	Virology and parasitology	4
	25MBU302	Microbial Genetics	4
	25MBU311	Virology and Genetics practical	2
IV	25MBU401	Immunology	4
	25MBU402	Medical Bacteriology and Mycology	3
	25MBU411	Immunology Practical	2
	25MBU412	Medical Bacteriology and Mycology Practical	1
V	25MBU501	Industrial Microbiology and Microbial Biotechnology	4
	25MBU502	Recombinant DNA Technology	4
	25MBU503	Microbial Omics and Biotechniques	4
	25MBU511	Industrial Microbiology and RDNA technology Practical	3
	25MBU512	Microbial Omics Practical	2
VI	25MBU601	Food and Diary Microbiology	4
	25MBU602	Environmental Microbiology	4
	25MBU611	Food and Diary Microbiology Practical	1
	25MBU612	Environmental Microbiology Practical	1
VII	25MBU701	Textile Microbiology	5
	25MBU702	Poultry and Veterinary	5

	25MBU711	Textile Microbiology Practical	1
VIII	25MBU801A/ 25MBU801B	Bioprocess Engineering	4
	25MBU811A/ 25MBU811B	Bioprocess Engineering Practical	2
	25MBU803	Marine Microbiology	4
	25MBU804	Laboratory Animal Management	4
TOTAL			82

MINOR COURSES			
Semester	**Course code**	**Name of the course**	**Credit(s)**
I	25MBU102	Biochemistry - I	3
	25MBU111	Biochemistry - I Practical	2
II	25MBU202	Bio Chemistry - II	4
III	25MBU303A/ 25MBU303 B	Microbes in sustainable Agriculture and Development/ Biosafety and Intellectual Property Rights	3
	25MBU312A/ 25MBU312B	Microbes in sustainable Agriculture and Development Practical/ Biosafety and Intellectual Property Rights Practical	1
IV	25MBU403A/ 25MBU403B	Molecular Biology/ Plant Tissue and Animal Tissue Culture	3
V	25MBU504A/ 25MBU504B	Introduction to Forensic Microbiology/ /Diagnostic Microbiology	3
VI	25MBU603A/ 25MBU603B /25MBU603C	Biopharmacy / Bionanotechnology /Biofertilizers	3
VII	25MBU703A/ 25MBU703B	Drug Design and Development / Bioproduct Development and Entrepreneurial Microbiology	4
	25MBU704 A/ 25MBU704 B	Advanced Cell Biology / Biostatistics and Research Methodology	3
	25MBU712A / 25MBU712B	Drug Design and Development Practical / Bioproduct Development and Entrepreneurial Microbiology Practical	1
VIII	25MBU802	Microbial Enzymology	3

	25MBU805	Medical Coding and Pharmacovigilance	4
		TOTAL	**37**

MULTI - DICIPLINARY COURSES			
Semester	**Course code**	**Name of the course**	**Credit(s)**
I	25ENU101G	English - I	3
II	25ENU201G	English - II	3
III	25ENU301G	English - III	3
		TOTAL	**9**
ABILITY ENHANCEMENT COURSES			
Semester	**Course code**	**Name of the course**	**Credit(s)**
I	25LTU101G/ 25LHU101G/ 25LMU101G/ 25LSU101G/ 25LFU101G	Language I (Tamil I/Hindi I/ Malayalam I/ Sanskrit I/ French I	3
II	25LTU201G/ 25LHU201G/ 25LMU201G/ 25LSU201G/ 25LFU201G	Language II (Tamil II/Hindi II/ Malayalam II/ Sanskrit II/ French II	3
III	25LTU301G/ 25LHU301G/ 25LMU301G/ 25LSU301G/ 25LFU301G	Language III (Tamil III/Hindi III/ Malayalam III/ Sanskrit III/ French III	3
IV	25LTU401G/ 25LHU401G/ 25LMU401G/ 25LSU401G/ 25LFU401G	Language IV (Tamil IV/Hindi IV/ Malayalam IV/ Sanskrit IV/ French IV	3
		TOTAL	**12**
		SKILL ENHANCEMENT COURSES	

Semester	**Course code**	**Name of the course**	**Credit(s)**
I	25MBU111	Introduction to Microbiology and Microbial Diversity Practical	2
II	25MBU212	Bio Chemistry - II Practical	2
IV	25ENU401G	English IV	3

VI	25ECU601G	ECA/NCC/NSS/ SPORTS/General Interest etc.,	-
		TOTAL	**07**

VALUE ADDED COURSES			
Semester	**Course code**	**Name of the course**	**Credit(s)**
I	25VAC101 G	Yoga and Youth Empowerment	**2**
II	25VAC201 G	Environmental Studies	2
III	25VAC301 G	Community Engagement and Social Responsibility	2
IV	25VAC401G	Cyber Security and Universal Human Values	1
		TOTAL	**7**

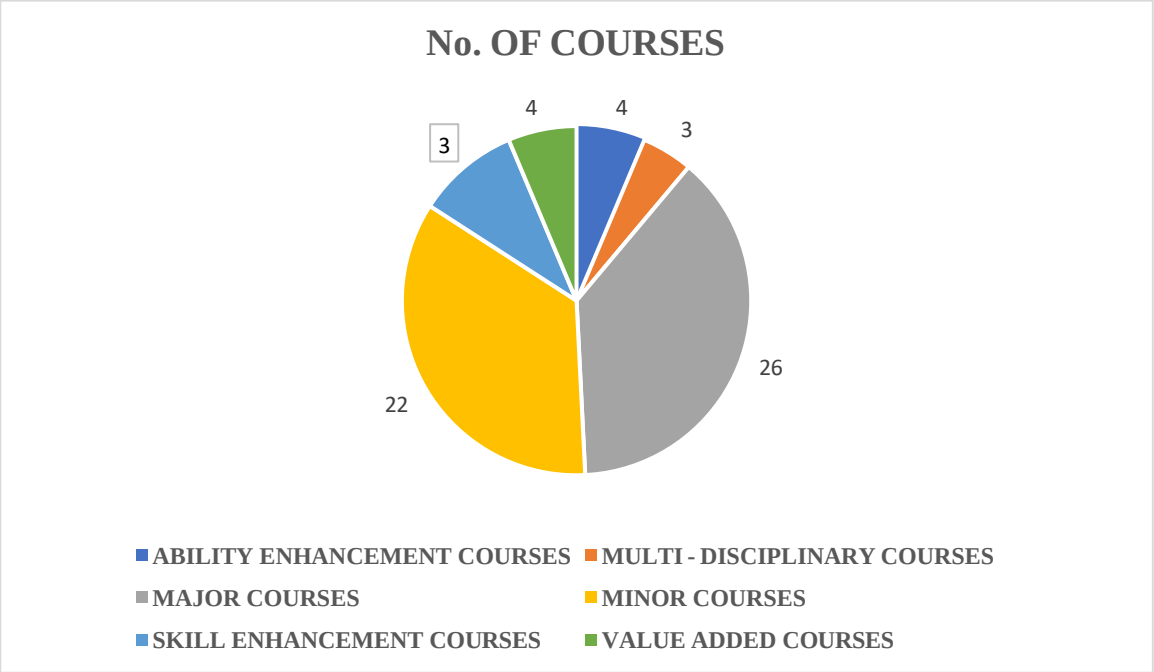
INTERNSHIP

Semester	**Course code**	**Name of the course**	**Credit(s)**
III	25MBU391	Internship (Summer Internship)	2
VI	25MBU591	Internship (Summer Internship)	2
		TOTAL	**4**

PROJECTS			
Semester	**Course code**	**Name of the course**	**Credit(s)**
VI	25MBU691	Project	**6**
VIII	25MBU891	Research Project	12
		TOTAL	18

S.NO.	**CATEGORIES**	**NO. OF COURSES**
1	**ABILITY ENHANCEMENT COURSES**	4
2	**MULTI - DISCIPLINARY COURSES**	3
3	**MAJOR COURSES**	26
4	**MINOR COURSES**	22

5	**SKILL ENHANCEMENT COURSES**	**3**
6	**VALUE ADDED COURSES**	4



25LTU101G	Language : Tamil - I	SEMESTER I 4H - 3C
Instruction Hours/week : L : 4 T : 0 P:0		Marks: Internal : 40 External : 60 Total : 100 End Semester Exam : 3 Hours
	இலக்கிய நெறிகள்	

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும், மேம்படுத்துதல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்; திறனாய்வு நோக்கை மேம்படுத்துதல்.
- இலக்கியங்களின் வழி மனித வாழ்வியலை உணர்த்துதல்.
- இன்புறுத்தல் மற்றும் அறிவுறுத்தல் நிலைகளில் இலக்கியங்களின் பங்களிப்பை உணர்த்துதல்.
- இளைய தலைமுறையினருக்கு அற உணர்வு மற்றும் வாழ்வியல் மதிப்புகளை அறிவுறுத்துதல்.

பாடத்திட்டப் பயன்விளைவு

- இந்தியக் குடியுரிமைப்பணி முதலான போட்டித் தேர்வுகளில் இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகத்தை அடைதல்.
- தொல்லியல், கல்வெட்டியல் மற்றும் ஓலைச்சுவடியியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வு மனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
- 'அறிவியல் தமிழ்' ; 'இணையத் தமிழ்' போன்ற தமிழின் வளர்ச்சித் துறைகள் சார்ந்த திறன் மேம்பாடு பெற்றிருத்தல்.
- வேலைவாய்ப்புக்குரிய வகையில் படைப்பாக்கத்திறன் முதலான மொழி ஆளுமை பெற்றிருத்தல் ;
- சமூக வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக உள்ள இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி.

தாள்கள் வரிசையும் தேர்வுச் செயல் திட்டமும்

பகுதி-I தமிழ்

இளநிலைப்பட்ட அறிவியல் மற்றும் கலையியல் வகுப்புகள்

பருவம்	தாள்	கற்பிக்கும் நேரம்/வாரம்	தேர்வு மணிகள்	மதிப்பெண் அகமதிப்பீடு/பருவ எழுத்துத் தேர்வு	மொத்தம்	மதிப்புப் புள்ளிகள்
ஒன்று	I	4	3	40 / 60	100	3

25LTU101G	LANGUAGE : TAMIL - I	SEMESTER I 4H - 3C
Instruction Hours/week : L : 4 T : 0 P:0 Total : 100		Marks: Internal : 40 External : 60 End Semester Exam : 3 Hours

இலக்கிய நெறிகள்

அலகு – I **10 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - முச்சங்கங்கள் அறிமுகம் – சங்க இலக்கியத்தின் தோற்றுவாய் - பத்துப்பாட்டு அறிமுகம்

சங்க இலக்கியம் - முல்லைப்பாட்டு – "பால்போல" முதல் "குறுநீர்" வரை (1-58)

அற இலக்கியம் - திருக்குறள் - பெரியாரைத் துணைக்கோடல் (அதிகாரம் 45), அறன் வலியுறுத்தல் (அதிகாரம் 4).

காப்பியம் - சிலப்பதிகாரம் – அ) புகார்க்காண்டம் – மங்கல வாழ்த்துப் பாடல் - "நாகநீள் நகரொடு" முதல் "புகார் நகர் அது தன்னில்" வரை (21 - 22)
மனையறம் படுத்த காதை – "வார் ஒலி கூந்தலை" முதல் "கண்ணகி தனக்கு என்" வரை (84 - 90)
ஆ) மதுரைக்காண்டம் – கொலைக்களக் காதை – "இரு முதுகுரவர் ஏவலும்" முதல் "என் செய்தனை" வரை (67 - 70)
"வினை விளை காலம்" முதல் "அச் சிலம்பு கொணர்க ஈங்கு" வரை (148-153)
கட்டுரை காதை – "கடி பொழில்" முதல் "கட்டுரை கேள் நீ" வரை (138 - 170)
வழக்குரை காதை – "அல்லவை செய்தார்க்கு" முதல் " உண்டளவே தோற்றான் உயிர்" வரை (82 - 93)
இ) வஞ்சிக்காண்டம் – நடுகல் காதை - "மதுரை மூதூர்" முதல் "வடதிசை வணக்கிய மன்னவர் ஏறு" (218-234)
வாழ்த்துக் காதை – "என்னே! இஃது என்னே!" முதல் "மீவிசும்பில் தோன்றுமால்" வரை (9)

இலக்கணம் - அகத்திணைகள், புறத்திணைகள்

அலகு- 2 **08 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - எட்டுத்தொகை அறிமுகம்

சங்க இலக்கியம் - நற்றிணை - "விளையாடு ஆயமொடு" - (172)

சங்க இலக்கியம் - குறுந்தொகை - "நோமென் னெஞ்சே" – தலைவி கூற்று – (202) - "ஈதலுந் துய்த்தலு" - தலைவன் கூற்று – (63)

அற இலக்கியம் - நாலடியார் - கூடா நட்பு – "செறிப்பில்" முதல் "செய்யாது செய்து" வரை (1 முதல் 5 பாடல்கள்),
சினம் இன்மை – "மதித்து இறப்பாரும்" முதல் "இளையான்" வரை (1 முதல் 5 பாடல்கள்), சுற்றம் தழால் – "வயாவும்" முதல் இன்னர் வரை" (1 முதல் 5 பாடல்கள்).

காப்பியம் - மணிமேகலை - பாத்திரம் பெற்ற காதை - "போதிநீழல்" முதல் "நல்அறம்கண்டனை" வரை (73-98)

இலக்கணம் - முதலெழுத்து - சார்பெழுத்து – விளக்கம்

அலகு– 3 **10 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - அற இலக்கியங்கள் அறிமுகம்

சங்க இலக்கியம் - ஐங்குறுநூறு - வேட்கைப்பத்து – "வாழி ஆதன் வாழி அவினி" எனத் தொடங்கும் முதல் ஐந்து பாடல்கள்.

சங்க இலக்கியம் - பதிற்றுப்பத்து – ஏழாம்பத்து - "எறிபிணம் இடறிய செம்மறுக்" (65)

அற இலக்கியம் - நான்மணிக்கடிகை - எள்ளற்க என்றும் (1) - புகழ் செய்யும் (2) - சிறந்தார்க்கு (3) - கொடுப்பின் (4) – நல்லார்க்கும் (5) - (தேர்ந்தெடுத்த ஐந்து பாடல்கள்)

காப்பியம் - கம்பராமாயணம் – தேர்ந்தெடுக்கப்பட்ட பாடல்கள் (18) – மன்னவன் (1604), பின்னும் பகர்வாள் (1752), பஞ்சி ஒளிர் (2762), மயில் உடை (3151), ஆண்டு, ஆயிடை (3390), மற்று இனி (3812), கண்டனன் (5249), வேலையுள் (6037), மண்ணொடும் (6038), வாங்கிய ஆழி (6049), இங்கு உள (6051), கண்டனென் (6031), பைய பையப் (6053), அந்நெறி (6058), குகனொடும் (6507), கூவி இன்று (7004), ஆள் ஐயா! (7271), கார்நின்ற (10043)

சிற்றிலக்கியம் - கலிங்கத்துப்பரணி – போர்க்களக்காட்சிகள் – "தேவாசுரம் (472), உடலின்மேல் (475),நெடுங்குதிரை (476),விருந்தினரும் (477), தரைமகள் (483), பொருதடக்கை (484), வெயில்தாரை (488)".

இலக்கணம் - சொல் – பெயர் - வினை, இடை, உரிச்சொல் – விளக்கமும் பயிற்சியும்.

இலக்கணம் - மூவிடம் மற்றும் பெயர் விகுதிகள்.

அலகு– 4 **10 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - காப்பியங்கள் - தோற்றமும் வளர்ச்சியும்

சங்க இலக்கியம் - பரிபாடல் - வையை - (பாடல் – 6) "நிறைகடல் முகந்து உராய்" முதல் "சேறு ஆடுபுனலது செலவு" வரை (1-50 அடிகள்).

சங்க இலக்கியம் - கலித்தொகை - "சுடர்தொடீஇக் கேளாய்" (51)

அற இலக்கியம் - ஆசாரக்கோவை - 5 பாடல்கள் (நன்றியறிதல் (1), பிறப்பு (2), தக்கணை (3), வைகறை (4), எச்சிலார் (5)).

காப்பியம் - தேம்பாவணி - நகர்வளம் 15 பாடல்கள் (மெய்வழி (97) முதல் – ஈரும் வாள் (106) வரை).

சிற்றிலக்கியம் - தமிழ்விடு தூது – "சீர்கொண்ட" முதல் – "மஞ்சள்" வரை (1 முதல் 25 கண்ணிகள்)

இலக்கணம் - தொடர் வகை – வினா விடை வகைகள்

அலகு – 5 **10 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - சிற்றிலக்கியங்கள் தோற்றமும் வளர்ச்சியும்

சங்க இலக்கியம் - அகநானூறு - "ஈன்று புறம் தந்த எம்மும் உள்ளாள்" – பாலை - நற்றாய் கூற்று (35).

சங்க இலக்கியம் - புறநானூறு – "புலவரை இறந்த புகழசால் தோன்றல்" – (21)

அற இலக்கியம் - பழமொழி நானூறு - (5 பாடல்கள்) 1. அவையறிதல் – கேட்பாரை நாடி (17), 2. அறிவுடைமை - அறிவினால் (26), 3. ஒழுக்கம் – விழுத் தொடையர் (34), 4.இன்னா செய்யாமை - பூ உட்கும் (43), 5. வெகுளாமை - இறப்பச் சிறியவர் (51).

காப்பியம் - சீறாப்புராணம் - மானுக்குப் பிணை நின்ற படலம் - அரியினஞ் (2), குழை குழைத் (70), கொடியிடம் (12), நிறைவளஞ் (16), வல்லவ (17), என்னுயி (18), தனியெனென் (20), வலையிடத் (25), என வினவ (29), வேட்டுவனுரைப்ப (48) என்னும் (10 பாடல்கள்).

சிற்றிலக்கியம் - முத்துக்குமாரசாமி பிள்ளைத்தமிழ் – காப்புப் பருவம் - பூமேவு கற்பகப் பொங்கரிற், (முதல் பாடல்), செங்கீரைப் பருவம் – இருக்கோல் இடும்பரிபுரக் கோல, (முதல் பாடல்), தாலப்பருவம்-பில்கும் பசுந்தேன் (முதல் பாடல்)

இலக்கணம் - வேற்றுமை உருபுகள்.

மொத்த மணிநேரம் - 48

TEXT BOOK T1 - **கற்பகச் சோலை – தமிழ்ப்பாட நூல், இலக்கிய நெறிகள்,** தமிழ்த்துறை வெளியீடு, கற்பகம் உயர்கல்விக்கழகம், கோயம்புத்தூர் – 21.

பார்வை நூல்கள்

R1 - **தமிழ் இலக்கிய வரலாறு, முனைவர் கா.கோ. வேங்கடராமன்,** கலையக வெளியீடு, நாமக்கல்.

R2 - **வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு, முனைவர் பாக்யமேரி**, பூவேந்தன் பதிப்பகம், சீனிவாசா சாலை, மயிலாப்பூர், சென்னை.

இணையதளம்

W1-www.tvu.org.in

W2- www.maduraitamilproject.com

இதழ்கள்

J1- International Research Journal of Indian Literature, irjil.in

J2 - International Tamil Research Journal, iorpress.in

வினாத்தாள் கட்டமைப்பு

இடைத்தேர்வு - மொத்த மதிப்பெண்கள் 60

பகுதி – அ (இரு மதிப்பெண் வினாக்கள்) 6 X 2 = 12 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – ஆ (ஆறு மதிப்பெண் வினாக்கள்)3 X 6 = 18 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – இ (பத்து மதிப்பெண் வினாக்கள்) 3 X 10 =30 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பருவத்தேர்வு - மொத்த மதிப்பெண்கள் 100

பகுதி – அ (இரு மதிப்பெண் வினாக்கள்) 10 X 2 = 20 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – ஆ (ஆறு மதிப்பெண் வினாக்கள்) 5X 6 = 30 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – இ (பத்து மதிப்பெண் வினாக்கள்) 5X 10=50 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Language : Hindi - I	SEMESTER I
25LHU101G	**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**
	End Semester Exam: 3 Hours
(PROSE, NON-DETAILED, NIBANDH, GRAMMAR)	

PREREQUISITE:
Not Required

COURSE OBJECTIVES(CO):

- Understand the text styles and grammatical elements
- Discuss the content of a reading passage
- Develop an interest in the appreciation of short stories

COURSE OUTCOMES(COs) :

- Develop an interest in the appreciation of literature.
- Discuss and respond to content of a reading passage.
- Learning the literacy knowledge of Hindi specially reading and writing .
- Learning the literary knowledge specially reading and understanding of Hindi short Stories
- Learning the history of Hindi literature.

UNIT -I a) Prose - Bharathiya Sangrah **9 HOURS**

b) Non-Detailed - Naya Mehman

c) Nibandh - Anushasan

d) Grammar - Bhasha Aur Vyakaran

UNIT -II a) Prose - Pahtha Pani Nirmal **9 HOURS**

b) Non-Detailed - Eakankki ki Visheshatha

c) Nibandh - Onam

d) Grammar – Varna Vichar , Sangya

UNIT -III a) Prose – Rashtriya Pitha Mahathma **10 HOURS**

b) Non-Detailed – Maha Bharat ki Eak Sanjh

c) Nibandh – Eakatha Ka Mahathva

d) Grammar – Sarvanam , Gender

UNIT-IV a) Prose – Gapshap **10 HOURS**

b) Non-Detailed – Yahang Sona Mana Hai

b) Nibandh – Ganga Pradhushan Ki Samasya c) Grammar – Number , Karak , Visheshan

UNIT-V a) Prose – Nindha Ras **10 HOURS**

b) Non – Detailed Eakanki ki Katha Vasthu

c) Nibandh – Paropkar

c) Nibandh – Paropkar

d) Grammar - Kriya , Kriya Visheshan

TOTAL: 48 HOURS

REFERENCE BOOKS:

I. Jayaprakash, **(**2002**)**. Nuthan Gathya Sangrah **(**Lesson - 1, 5, 6, 8, 9**),** Sumithra Prakasan**,** 16/5**.** Hasting Road, Illahabad - 211001**.**

II. Tiwari,S.M. Dr**., (**2008**).** Naveen Ekhanki Sangrah**,** Sumithra Prakashan**,** 204. Leela Apartment**,** Ashok Nagar**,** Illahabad - 211001.

III. Sing,B.K.P.D Dr**., (**2018**).** Nibandh : Subod Hindi Nibandh**,**

Manoj Publication**,** 1583 - 84 Dariba Kala**,** Chandni Chouk**,** Delhi - 110006.

IV. Pro,V.D.S., & Dharmapal**, (**2005**).** Sugam Hindi Vyakaran**,** Shiksha Bharathi**,** Kashmir Gat**,** Delhi - 110006**.**

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Language : Malayalam - I	**Semester I** **4H-3C**
25LMU101G	
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100** **End Semester Exam:** 3 Hours

COURSE OBJECTIVE:(CO)

- Improves grammatical knowledge
- Will continue to read and learn about articles and think about them
- It is possible to read and understand short stories and understand the thoughts and life of the people of this state.

COURSE OUTCOME: (COs)

- Understand the text styles and grammatical elements
- Discuss the content of a reading passage
- Develop an interest in the appreciation of short stories
- Comprehend the grammatical structures and sentence making
- Understand the language and developing English to Malayalam translation skill

	MALAYALAM: PAPER - I	
Unit No.		**HOURS**
I	Novel – Pathummayude Aadu - Vaikam Muhammed Basheer	**10**
II	Novel- - Pathummayude Aadu - Vaikam Muhammed Basheer	**10**
III	Short Story - Ente Priyappeta Kadhakal – Akbar Kakkattil)	**09**
IV	Short Story - Ente Priyappeta Kadhakal – Akbar Kakkattil)	**10**
V	Composition &Translation(English to Malayalam)	**09**
	TOTAL	**48**

Text Books:

1. Basheer.V.M, (1959),*PathummayudeAadu*, D.C.Books, Kottayam, Kerala
2. Akbar Kakkattil ,(2022), *Ente Priyappeta Kadhakal*,D.C. Books, Kottayam, Kerala 3. Expansion of ideas, General Eassay and Translation. (A simple passage)

Reference Books:

1..Tharakan K.M ,(2023),Malayala Novel SahithyaCharitram, B.C.Book,Kerala Sast Rasahitya,Kerala

2..Achuyuthan, M (2023),Cherukatha Innale Innu,D.C Books, Kottayam, Kerala

3. George K.M ,(2013)Sahithya CharitramPrasthanangalilude-, D.C.Books, Kottayam Kerala

4. Sukumar Azheekode ,(2018)MalayalaSahithyaVimarsam,D.C.Books,Kottayam,Kerala

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

LANGUAGE : SANSKRIT - I	**SEMESTER I**
25LSU101G	**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**
	End Semester Exam: 3 Hours
(POETRY, GRAMMAR AND TRANSLATION)	

COURSE OBJECTIVES(CO):

- The fundamental objective of the curriculum is to impart effective science education at the undergraduate level, exposing them to recent trends and developments in the subject.
- Creating scientific temper is another major objective of this curriculum.
- Another major thrust given here is to develop an environmental concern in all activities of the students. 'Go green', the motto of the syllabus emphasizes the urgent need to conserve nature without destruction of natural resources.

COURSE OUTCOMES(COs) :

- **Critical Thinking** :Take informed actions after identifying the assumptions that frame students' thinking and actions.
- **Problem Solving**: Understand and solve problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired.
- **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development.
- **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

UNIT – I **10 HOURS**

Introduction to Poetry, Definition of Poetry

UNIT – II **10 HOURS**

Five Maha Kavyas

UNIT – III **10 HOURS**

Text Prescribed : Raghuvamsa (Canto – 1) First Ten Slokas

UNIT – IV **09 HOURS**

Text Prescribed : Raghuvamsa (Canto – 1) Slokas Eleven to Thirty

UNIT – V **09 HOURS**

Text Prescribed : Raghuvamsa (Canto – 1) Slokas Thirty One to Fifty

TOTAL: 48 HOURS

Grammar: Text prescribed : Sanskrit Self Teacher
By Dr.V.Varadhachari
(Present tense and Declension of endingnouns (Masculine)

Texts Available at

- *Raghuvamasa* **(**Canto - I**), (**2019). R.S. Vadhyar and Sons Palghat**,** Kerala**.**

- Varadhachari,v.s, **(**2014). *Sanskrit Self Teacher* 32, Tank Bunk Road, Near Loyola College, Nungambakkam, Chennai - 600 034.

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Language : French - I	SEMESTER I
25LFU101G	**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60** Total**:100**
	Semester Exam: 3 Hours
(LEÇON, COMMUNICATION, GRAMMAIRE, VERBES, LEXIQUE, CULTURE)	

PREREQUISITE:
Not Required

COURSE OBJECTIVES (CO):
The objectives of this course are:

- To enable the learner to communicate effectively and appropriately.
- To develop and integrate the use of the four language skills.
- To train students to acquire proficiency in French by reading different genres of literature and learning grammar.

COURSE OUTCOMES (COs):
At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	retrieve fundamentals of French language to construct error free sentences.	Apply
CO2	construct and maintain social relationships.	Analyze
CO3	construct business letters, proposals and E-Mail communication	Apply
CO4	Adopt the skills of planning, structuring, and delivery techniques in group discussions and presentations.	Understand
CO5	classify communication skills in business environment	Understand

Unite – I **9 HOURS**

a) Leçon – Bienvenue

b) Communication – Un cours de francais,Entrer en contact saluer,

c) Verbes – être ou avoir

d) Lexique – Les couleurs, l' alphabet

e) Culture – La France

Unité - II **9 HOURS**

a) Leçon – Bonjour ça va ?

b) Communication – Demander et dire,Comment ça va

c) Verbes – Les verbes réguliers en –er.

d) Lexique – Les Pays et les nationalités , Les animaux domestiques, Les jours de la semaine. e) Culture – La France et la Francophonie

Unité - III **10 HOURS**

a) Leçon – Salut ! Je m'appelle Agnès

b) Communication – Se présenter et présenter quelqu'un Demander et dire la date

c) Grammaire – Les pronoms personnels sujets ,Les verbes être et avoir , Les articles définis et indéfinis

d) Verbes – Les verbes aller et venir

e) Lexique – Les mois de l'année, Les nombres de 0 à 69 » La famille (1)

f) Culture – La France physique et politique

Unité IV **10 HOURS**

a) Leçon - Qui est-ce ? Dans mon sac, j ' ai

b) Communication - Demander et répondre poliment ,Demander des informations Personnelles

c) Grammaire - La formation du feminine, La formation du pluriel , Le adjectifs possessifs

d) Verbes -Les verbes ir et re

e) Lexique -Les professions ,Quel ques objets ,La fiche d'identité

f) Culture -Les symbols de la France,

Unité V **10 HOURS**

a) Leçon - Il est comment ? Allô ?

b) Communication - Décrire l'aspect physique et le caractère Parler au telephone

c) Grammaire - La formation du féminin , La phrase interrogative Qu'est-ce que... ? La phrase négative

d) Verbes - Le verbe Faire

e) Lexique - L'aspect physique , Le caractère, Les prépositions de lieu , Les nombres à partir de 70

f) Culture- Les frontiers de la france,les villes connues en france.

TOTAL: 48 HOURS

REFERENCE BOOKS:

1. Cocton ,M-N, (2015, December), ***Saison 1: méthode de français,*** Volume 89, Number 2, Johns Hopkins University Press, Difier Paris.
2. Alcaraz,M,Escoufier, D., Gomy, C., Landier, M., Quéméner, FI., Ripaud, 2014, ***Saison 1- Cahier d'activites,*** Dider, Paris.
3. Akvüz A., Bernadette Bazelle-Shahmaei, Joëlle Bonenfant, Marie-Françoise Gliemann, 24 Aug. 2005, ***Les 500 Exercices De Grammaire Avec Corrigés,*** Hachette Francais Langue Etrangere, Paris.

4. Beaulieu C,2011, ***Je Pratique Exercice De Grammaire A1,*** French, Goyal Publishers, Paris.
5. Bié N.,Philippe Santinan, April 2014, ***Grammaire pour adolescents 250 exercices,*** French, CLE INTERNATIONAL, Paris

WEBSITES :

1. http:// enseigner.tv5 monde.com/
2. bonjourdumonde.com /exercises/contenu/le – francais-du- tourisme.html
3. http://www.bonjurdefrance.com/
4. https://www.lepointdufle.net/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

25ENU101G **English -I** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE: Not required

COURSE OBJECTIVES(CO):

- To enable the learner to communicate effectively and appropriately.
- To develop and integrate the use of the four language skills.
- To train students to acquire proficiency in English by reading different genres of literature and learning grammar.

COURSE OUTCOMES (COs):

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

COs	Course Outcomes	Blooms Level
CO1	Use English grammar to create error-free sentences.	Apply
CO2	Build and maintain social relationships through effective communication.	Remember
CO3	Construct business letters, proposals and E-Mail communication	Remember
CO4	Plan and deliver group discussions and presentations.	Understand
CO5	Classify communication skills in business environment	Understand

UNIT - I **8 HOURS**

LISTENING: Listening –Types of Listening
SPEAKING: Basics of Pronunciation
READING: Reading – Types of Reading
COMPOSITION WRITING: Jumbled Sentences
LITERATURE: Poem- Mending Wall- Robert Frost
GRAMMAR: Articles

UNIT - II **7 HOURS**

LISTENING: Principles of Listening Skills
SPEAKING: Self-Introduction
READING: Reading Techniques
COMPOSITION WRITING: Paragraph Writing
LITERATURE: Prose- On Running After One's Hat- G. K. Chesterton
GRAMMAR: Types of Sentences

UNIT - III **7 HOURS**

LISTENING: Barriers of Listening

SPEAKING: Telephone Conversations
READING: Reading Comprehension Passages
COMPOSITION WRITING: Precis Writing
LITERATURE: Short Story - The Bet - Anton Chekov
GRAMMAR: Articles

UNIT - IV **7 HOURS**

LISTENING: Story Narrations
SPEAKING: Group Discussion
READING: Reading Reports and profiles
COMPOSITION WRITING: Letter Writing
LITERATURE: One-act play- The Death Trap - H.H. Munro
GRAMMAR: Tenses

UNIT - V **7 HOURS**

LISTENING: Listening Strategies
SPEAKING: Interview Skills
READING: Tips for MOC- Anchoring
COMPOSITION WRITING: Circular Writing and Summary Writing
LITERATURE: Short story- The Snake Song by R K Narayan
GRAMMAR: Subject Predicate, Framing Questions and Question Tags

TOTAL: 36 HOURS

TEXT BOOK:

Board of Editors, *Acrostic I* (2024*)*. Karpagam Academy of Higher Education

REFERENCE BOOKS:

1.*Martin's, St* (2013). *Oxford Handbook of Writing: Handbook of Writing*. Cambridge University Press.
2.Julian Treasure, Sound *Business*, (2012). Oxford University Press
3.Hornby, A, S. (1975). *The Guide to patterns and usage in English:* oxford university Press.
4.Ellis, R. (1990). *Instructed second language acquisition*, Oxford: oxford university Press New York:Pergamon Press.

WEB SITES:

1. https://www.poemhunter.com/
2. https://hearthandfield.com/on-running-after-ones-hat-gk-chesterton-1915/
3. https://www.eastoftheweb.com/short-stories/UBooks/Bet.shtml
4. https://mastanappa.blogspot.com/2018/09/the-death-trap-h-h-munro-saki.html
5. https://shorturl.at/ud8rp

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Average	-	**3**	**3**	-	-	-	**3**	-	-	-	-	**2**	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

25MBU101 Introduction to Microbiology and Microbial Diversity 6H- 4C

Instruction Hours/week: L:6 T:0 P:0 **Marks: Internal:40 External:60 Total:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide knowledge about history of microbiology and classification of microorganisms
- To understand the working principle, components, types and applications of microscope
- To provide an overview on algae, virus and protozoa

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the contributions of various scientists for development of microbiology field and skills associated with it.	Understand
CO2	Explain the diversity of microbes and their applications.	Understand
CO3	Discuss the working principle, components, types and applications of microscope	Analyze
CO4	Interpret the viral genome, Replication and Cultivation	Understand
CO5	Compare the features of algae, fungi, virus and protozoa	Analyze

UNIT I History of microbiology **15 HOURS**

Development of microbiology as a discipline, spontaneous generation vs biogenesis. Contribution of Anton von Leewenhoek, Golden era of Microbiology Louis Pasteur, Robert Koch, Joseph Lister, Alexander Flemming. Germ theory of disease, Establishment of fields of medical microbiology and immunology through the work of Paul Ehrlich, Ellie Metchnikoff, Edward Jenner. Role of microorganism in fermentation, Application in industries, medicine, agriculture, biotechnology and biology.

UNIT II Microbial Techniques **12 HOURS**

Microscope – principles and application – simple and compound microscope – dark field –phase contrast, sterilization methods, media preparation and staining techniques.

UNIT III Classification of microorganisms **15 HOURS**

Bergey's Manual, Binomial Nomenclature. Classification system: Phenetic and Phylogenetic, Whittaker's Five Kingdom and Carl Woese's three kingdom classification system and their utility. Difference between prokaryotic and eukaryotic microorganism. Major diversity of microbial life. General characteristics of Bacteria, Bacterial ultra-structure and Nutrients. General characteristics of Actinobacteria.

UNIT IV Bacteria, Algae and Fungi **15 HOURS**

General characteristics of algae including algal cell ultra-structure. Algal cell cultivation and preservation Application of Algae in agriculture, industry, environment and food. General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra- structure. Economic importance of fungi. Virulence factors of fungi causing infection.

UNIT V Virus & Parasites **15 HOURS**

General properties of viruses – Structure, Genome, Replication and Cultivation. Morphology, classification, characteristics of Protozoa, Platyhelminthes – Amoeba.

Total: 72 HOURS

TEXT BOOKS:

1. Duby, R.C. (2014) *Textbook of Microbiology*. 5th edition. S. Chand Publishing.
2. Madigan, M.T., Martinko J.M., Dunlap, P.V., and Clark, D.P. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson International Edition.
3. Pelczar, M.J., Chan, E.C.S., and Krieg, N.R. (1993). *Microbiology*. 5th edition. McGraw Hill Book Company.
4. Wiley, J.M., Sherwood, L.M., and Woolverton, C.J. (2013*). Prescott's Microbiology*. 9th edition. McGraw Hill International.

REFERENCE BOOKS:

1. Tortora, G.J., Funke, B.R., and Case CL. (2014). *Microbiology: An Introduction*. 9thedition. Pearson Education.
2. Atlas, R.M. (1997). *Principles of Microbiology*. 2ndedition. WM.T. Brown Publishers.
3. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L., and Painter, P.R (2005). *General Microbiology*. 5th edition. McMillan.
4. Talaro., Kathleen, P.T., Chess., and Berry, C., (2018). *Foundations in Microbiology*. (10thEd). McGraw-Hill Higher Education, UNITed States.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	2	-	-	3	-	1	-	-	3	-
CO2	3	-	-	-	2	-	-	2	-	-	-	-	-	-	-	3	-
CO3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-		-	-	-	-	-	-	-	-	-	-	-	3	-
Average	**3**	**-**	-	**2**	**2**	-	-	**2**	-	-	**3**	-	**1**	-	-	**3**	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

25MBU102 **Biochemistry - I** **5H–3C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To understand about storage and structural polysaccharides and lipids
- To summarize the structure and classification of proteins and enzymes
- To state the Structure and types of DNA and RNA and functions and properties of vitamins

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Gain information on the structures and functions of carbohydrates	Understand
CO2	Explain the types and structure of lipids	Understand
CO3	Comprehend the structure and functions of proteins and amino acids	Understand
CO4	Discuss the structure, classification of enzymes and specificity of enzymes	Understand
CO5	Understand the nucleic acids' structure and types and vitamin functions	Understand

UNIT I Carbohydrates **10 HOURS**

Monosaccharides-stereo isomerism, epimers, Mutarotation and anomers. Forms of glucose and fructose, Fischer and Haworth projection. Sugar derivatives. Disaccharides- occurrence, concept of reducing and non-reducing sugars. Polysaccharides-storage and structural polysaccharides; Bacterial cell polysaccharides.

UNIT II Lipids **10 HOURS**

Classification and functions of lipids. Storage lipids- structure of fatty acids. Saturated and Unsaturated fatty acids. Triacylglycerols, waxes. Saponification. Structural lipids - structure, functions and properties of phosphoglycerides. sterols;

UNIT III Proteins **10 HOURS**

Structure of amino acids. Classification of amino acids. Concept of zwitterion. Ninhydrin reaction. Non protein amino acids, Peptides-Ramachandran Plot; Levels of protein structure- Primary and Secondary structure of proteins- alpha helix, beta pleated sheet. Tertiary and quaternary structures of proteins.

UNIT IV Enzymes **12 HOURS**

Introduction to enzymes. Classification of enzymes, properties of enzymes. specificity of enzymes, enzyme catalysis. Enzyme kinetics – Pre-steady kinetics, Michaelis-Menten equation, Enzyme inhibition- reversible and non-reversible. Allosteric enzyme and its mechanism. Isoenzymes, Multienzyme complex.

UNIT V Nucleic Acids **10 HOURS**

Nucleic Acids- structure of Purines and Pyrimidines nucleotides, Secondary structure of DNA- Watson and Crick model, DNA replication., RNA- Types of RNA: mRNA, rRNA, tRNA, Vitamins and its types.

Total: 48 HOURS

TEXT BOOKS:

1. David L Nelson, Michael M cox, WH Freeman (2022). *Leininger Principles of Biochemistry*, 8th edition.
2. Chakarapani. V, Sathyanarayana V. (2020). *Biochemistry*, 5th edition, Elsevier.
3. Campbell, M.K. (2012). *Biochemistry*, 7th edition. Published by Cengage Learning.

REFERENCE BOOKS:

1. Campbell, P.N., and Smith, A.D., (2011). *Biochemistry Illustrated*, 4thedition. Published by Churchill Livingstone.
2. Tymoczko, J.L., Berg, J.M., and Stryer, L. (2012). *Biochemistry: A short course*, 2nd edition. W.H. Freeman.
3. Berg, J.M., Tymoczko, J.L., and Stryer, L. (2011). *Biochemistry*, W.H. Freeman and Company.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	-	-	-	1	-	-	-	1	2	3
CO2	3	-	-	-	-	-	-	2	-	-	-	-	-	-	-	2	3
CO3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	3
CO4	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	3
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	2	-
Average	3	-	-	2	-	-	-	2	-	3	1	-	-	-	1	2	3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

25MBU111 Introduction to Microbiology and Microbial Diversity Practical 5H–2C

Instruction Hours/week: L:0 T:0 P:5 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Introduction To Microbiology and Microbial Diversity (25MBU101)

COURSE OBJECTIVES (CO):

- To learn techniques and methods used in the cultivation and isolation of bacteria.
- To learn about bacterial specialized structure using staining methods
- To learn the bacterial special structure capsule and spore

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	**Course Outcomes**	**Blooms Level**
CO1	Learn and practice practical skills in staining procedures	Understand /Apply
CO2	Prepare culture media for microbes	Apply
CO3	Perform microbial culture techniques to obtain isolation of pure cultures of bacteria	Apply
CO4	Differentiate Bacterial endospore and capsule	Analyze
CO5	Analyze the bacterial structure, capsule and spore, motility	Analyze

EXPERIMENTS **48 HOURS**

1. Preparation of different media: synthetic media BG-11, Complex media - Nutrient agar, Mac Conkey agar, EM Bagar.
2. Examination of bacterial colony with morphological features.
3. Estimation of Colony Forming UNIT (CFU) count by spread plate method/pour plate method.
4. Isolation of pure cultures of bacteria by streaking method - Quadrant, Continuous and T-streaking.
5. Preservation of bacterial cultures by various techniques - Agar slants and deeps - Mineral Oil, Glycerol stocks
6. Micrometry.
7. Motility by hanging drop method.
8. Simple staining
9. Negative staining
10. Gram’s staining
11. Acid fast staining – demonstration permanent slide only.
12. Capsule staining
13. 13. Endospore staining.

TEXT BOOKS: **Total :48 HOURS**

1. Madigan, M.T., Kelly, S.B., Daniel, H.B, Mathew, S and David, A.S (2017). *Brock Biology of Micro- organisms*. 15th edition. Parker J. Prentice Hall International, Inc.
2. Cappucino, J., and Sherman. N. (2010). *Microbiology: A Laboratory Manual.* 9th edition. Pearson Education Limited
3. Benson's Microbiological Applications Laboratory Manual-Complete Version, (2015). 13th Edition, McGraw Hill.

REFERENCE BOOKS:

1. Willey, J.M., Sherwood, L.M., and Woolverton, C.J. (2019). *Prescott's Microbiology*. 11th edition. McGraw Hill.
2. Talaro., Kathleen, P.T., Chess., and Berry, C., (2018). *Foundations in Microbiology*, 10th Ed., McGraw Hill.
3. Kathleen Park Talaro and Barry Chess, (2018). *Foundations in Microbiology: Basic Principles*, 10th Edition, Mc Graw Hill.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	-	2	-	-	3	-	-	-	-	-	-	-	3	-
CO2	-	-	-	-	3	-	-	2	-	-	-	-	-	-	-	3	-
CO3	2	-	-	-	3	-	-	2	-	-	-	-	-	-	-	3	3
CO4	-	-	-	-	3	-	-	2	-	-	-	-	-	-	-	3	-
CO5	3	-	-	-	2	-	-	2	-	-	-	-	-	-	-	3	-
Average	2	-	-	-	3	-	-	2	-	-	-	-	-	-	-	3	3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

25MBU112 **Biochemistry I - Practical** **5H–2C**

Instruction Hours/week: L:0 T:0 P:5 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Biochemistry I (25MBU112)

COURSE OBJECTIVES (CO):

- To familiarize the students with numerical problems in molarity and normality
- To expertise in Qualitative/Quantitative tests of carbohydrates, reducing sugars, Protein and lipids and vitamins
- To study the effect of temperature, pH and heavy metals on enzyme activity.

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Solve the numerical problems in molarity and normality	Apply
CO2	Analyse the qualitative estimation of biomolecules	Analyze
CO3	Practice the quantitative estimation of biomolecules	Apply
CO4	Examine the effects of various factors in enzyme activity	Analyze
CO5	Apply techniques in the estimation different vitamins	Apply

EXPERIMENTS **48 HOURS**

1. Properties of water, concept of pH and buffers, preparation of buffers and numerical problems to explain the concepts of molarity, normality and their calculation.
2. Numerical problems on calculations of standard free energy change and equilibrium constant.
3. Qualitative tests for carbohydrates, reducing sugars, and non-reducing sugars.
4. Qualitative tests for lipids and proteins.
5. Quantitative tests for carbohydrates.
6. Quantitative tests for proteins.
7. Study effect of temperature, pH and heavy metals on enzyme activity.
8. Estimation of any four vitamins.

TEXT BOOKS: **Total: 48 HOURS**

1. David L Nelson, Michael M cox, WH Freeman 2022. *Lehninger Principles of Biochemistry*, 8th edition.

2. Chakarapani. V, Sathyanarayana V 2020. *Biochemistry*, 5th edition, Elsevier.

3. Campbell, M.K. (2012). *Biochemistry*, 7th edition. Published by Cengage Learning

REFERENCE BOOKS:

1. Campbell, P.N., and Smith, A.D., (2011). *Biochemistry Illustrated*, 4th edition. Published by Churchill Livingstone.

2. Tymoczko, J.L., Berg, J.M., and Stryer, L. (2012). *Biochemistry: A short course*, 2nd edition. W.H.Freeman.
3. Berg, J.M., Tymoczko, J.L., and Stryer, L. (2011). *Biochemistry*, W.H. Freeman and Company.
4. Nelson, D.Land Cox, M.M. (2008). *Lehninger Principles of Biochemistry*, 5thedition. W.H. Freeman and Company.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	-	-	-	1	-	-	-	1	3	-
CO2	-	-	-	2	-	-	-	2	-	-	-	-	-	-	-	3	-
CO3	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	3	3
Average	**3**	**-**	**1**	**2**	**-**	**-**	**-**	**2**	**-**	**3**	**1**	**-**	**-**	**-**	**1**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

25VAC101G **Yoga for Youth Empowerment** **SEMESTER I**
2H–2C

Instruction Hours / Week: L:2 T:0 P:0 **Marks: Internal:100**

PREREQUISITE:

Not Required

COURSE OBJECTIVES(CO):

- Create awareness about Yoga and Physical Health.
- Providing value education to improve the student's character, understanding the greatness of life force and the Mind.
- Know about five aspects of life and develop good Qualities and eliminate bad ones.
- Learning introspection practices like analysis of Thought, Moralization of Desires, Neutralization of Anger, and Eradication of Worries, Diversity in men (Why Men Differ)
- To understand yoga, life, and practice Yoga asanas

COURSE OUTCOMES(COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the concepts of about Yoga and Physical Health	Understand
CO2	Study the concepts the greatness of Life Force and Mind	Understand
CO3	Learn the aspects of Personality Development - Sublimation	Understand
CO4	Practices Human Resource Development	Apply
CO5	Understand about the yoga, life and Law of Nature	Apply

UNIT I YOGA AND PHYSICAL HEALTH **5 HOURS**

Manavalakalai (SKY) Yoga: Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - greatness of education yoga for youth empowerment. Simplified physical exercises hand, leg, breathing, eye exercises, kapalabathi, makarasana part 1, Makarasana part 2, body massage, acupressure relaxation exercises and its benefits Yogasanas: Suryanamaskar 12 cycle pranayama, Asanas. [sitting and standing] meditation – Agna, explanation of initiation practice and its benefits

UNIT II GREATNESS OF LIFE FORCE AND MIND **5 HOURS**

Kayakalpa, Aim of kayakalapa, philosophy, physical body, sexual vital fluid life force bio magnetism mind. Maintaining youth fullness, postponing old age, food transformation into seven minerals, the importance of sexual vital fluid measure and method of five aspects of life controlling undue passion. Kayakalpa Practice: Aswini Mudra, Ojas Breath, benefits of Kayakalpa, Sex and Spirituality, Development of mind in ten stages. Mental frequencies: Meditation-five essential qualities acquired through meditation, Types of meditation, Agna, Shanthi, Thuriya, and its Benefits .

UNIT III PERSONALITY DEVELOPMENT – SUBLIMATION **5 HOURS**

Purpose and philosophy of life- Needs protection, Ethics, and wisdom. Introspection: importance of thought, maneuvering of the six Temperaments, Analysis of Thought and six roots for thought, moralization of Desires. Neutralization of Anger.

UNIT IV HUMAN RESOURCE DEVELOPMENT **4 HOURS**

Eradication of worries: Reasons for worries, four types of worries, Practice for eradication of worries. Benefits of Blessings: effect of good vibration self blessing (Auto suggestion), Family blessing others, world blessing, Divine protect,

Human Values: greatness of Friendship, Individual peace to World Peace

UNIT V LAW OF NATURE **5 HOURS**

Unified force, cause and effect system, gentle Center, Purification of gentile center, Love and Compassion. Culture values: Types of Education Non violence and five fold moral culture, Truth, honesty, patience. Excuse, self control, obedience, consistent effort, No feeling jealousy, pleasant and polite, see good in everything.

YOGA PRACTICES: Thandasana Chakrasana (sideways) Vruchasana Thirikonasana Vakkarasana

TOTAL: 24 HOURS

TEXT BOOK:

1. Yoga for Youth Empowerment-Value Education, ThathuvagnaniVethathiri Maharishi,WCSC, Aliyar

REFERENCE BOOKS:

1. Kayakapam Thathuvagnani Vethathiri Maharishi
2. Light on yoga BKS.lyenger
3. Manavalakala Part-1-Thathuvagnani Vethathiri Maharishi.
4. Manavalakala part-2-Thathuvagnani Vethathiri Maharishi
5. Mind ThathuvagnariVethathir Maharishi
6. Simplified Physical Exercises- ThathuvagnaniVethathiri Maharishi
7. Sound Health through yoga - Dr. Chandrasekaran
8. The world order of Holistic UNITy- ThathuvagnaniVethathiri Mahanshi
9. Thirukkural-Rev. Dr.G.U. pope.
10. Yoga for modern age ThathuvagnaniVethathin Maharishi

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	-	-	-	-	-	2	-	-	-	1	-	-	-	-	1	2
CO2	3	-	3	3	-	-	1	-	-	-	1	-	-	-	-	1	1
CO3	3	-	-	-	-	2	-	-	-	3	2	-	-	-	-	-	2
CO4	3	-	-	2	2	-	-	-	-	-	3	-	-	-	-	1	2
CO5	3	-	3	3	2	1	-	-	1	-	3	-	-	2	3	2	-
AVG	3	-	3	2.6	2	1.5	1.5	-	1	3	2	-	-	2	3	1.2	1.7

3-Strong; 2-Medium; 1-Low, '_' - No Correlation

25LTU201G	Language : Tamil - II	SEMESTER II 4H - 3C
Instruction Hours / week : L : 4 T : 0 P : 0		Marks : Internal : 40 External : 60 Total :100 End Semester Exam : 3 Hours

இலக்கிய இன்பம்

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும், மேம்படுத்துதல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்; திறனாய்வு நோக்கை மேம்படுத்துதல்.
- இலக்கியங்களின் வழி மனித வாழ்வியலை உணர்த்துதல்.
- இன்புறுத்தல் மற்றும் அறிவுறுத்தல் நிலைகளில் இலக்கியங்களின் பங்களிப்பை உணர்த்துதல்.
- இளைய தலைமுறையினருக்கு அற உணர்வு மற்றும் வாழ்வியல் மதிப்புகளை அறிவுறுத்துதல்.

பாடத்திட்டப் பயன்விளைவு

- இந்தியக் குடியுரிமைப்பணி முதலான போட்டித் தேர்வுகளில் இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகத்தை அடைதல்.
- தொல்லியல், கல்வெட்டியல் மற்றும் ஓலைச்சுவடியியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வு மனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
- 'அறிவியல் தமிழ்' ; 'இணையத் தமிழ்' போன்ற தமிழின் வளர்ச்சித் துறைகள் சார்ந்த திறன் மேம்பாடு பெற்றிருத்தல்.
- வேலைவாய்ப்புக்குரிய வகையில் படைப்பாக்கத்திறன் முதலான மொழி ஆளுமை பெற்றிருத்தல் ;
- சமூக வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக உள்ள இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி.

தாள்கள் வரிசையும் தேர்வுச் செயல் திட்டமும்

பகுதி-I தமிழ்

இளநிலைப்பட்ட அறிவியல் மற்றும் கலையியல் வகுப்புகள்

பருவம்	தாள்	கற்பிக்கும் நேரம்/வாரம்	தேர்வு மணிகள்	மதிப்பெண் அகமதிப்பீடு/பருவ எழுத்துத் தேர்வு	மொத்தம்	மதிப்புப் புள்ளிகள்
இரண்டு	II	4	3	40 / 60	100	3

25LTU201G	LANGUAGE : TAMIL - II	SEMESTER II 4H - 3C
Instruction Hours / week : L : 4 T : 0 P : 0		Marks : Internal : 40 External : 60 Total :100 End Semester Exam : 3 Hours

இலக்கிய இன்பம்

அலகு – I **11 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - தமிழிலக்கிய வரிசையில் திருமுறைகள்,
பன்னிரு திருமுறைகள் அறிமுகம்,
திருமுறை ஆசிரியர்களின் இலக்கியப் பங்களிப்பு.

பக்தி இலக்கியம் - சைவம் – பெரியபுராணம் - திருமூலநாயனார் புராணம் –
(தேர்ந்தெடுக்கப்பட்ட 15 பாடல்கள்) - அந்தியிளம்
பிறைக்கண்ணி (1) – மற்றவர்தாம் (2), காவிரிநீர் (9) –
அந்நிலைமை (10), அந்தணர்தஞ் (11) – மற்றவன்றன் (12),
இவன் உயிர் (13), பாய்த்தியபின் (14) – வெய்யசுடர் (16) –
அங்கவளும் (18) – பித்துற்ற (20) – இந்தநிலை (22) –
ஆவடுதண் (25) – ஊனுடம்பில் (26) – முன்னிய (27)

கவிதை - கண்ணன் என் சீடன் (1-150 வரிகள்) - மகாகவி பாரதியார்

கவிதை - பெண்களின் உரிமைகள்(பெண்மை) - கவிமணி

கவிதை - செருப்புடன் ஒரு பேட்டி- கவிஞர் மேத்தா

சிறுகதை - கடவுளும் கந்தசாமிப் பிள்ளையும் –
எழுத்தாளர் புதுமைப்பித்தன்

கட்டுரை - ஆளுமைத்திறன் அறிவோம் (தன்னம்பிக்கை மாத இதழ்)

படைப்பிலக்கியப் பயிற்சி - கட்டுரைப் படைப்பாக்கத்திறன்

அலகு – 2 **10 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - பன்னிரு ஆழ்வார்கள் வரலாறு

பக்தி இலக்கியம் - நாச்சியார் திருமொழி
(வாரணம் எனத் தொடங்கும் 11 பாடல்கள்) – ஆண்டாள்.

கவிதை - மலையாளக்காற்று - கவிஞர் சிற்பி பாலசுப்பிரமணியம்.

கவிதை - கம்ப்யூட்டர் கையில் நாம் - கவிஞர் ஈரோடு தமிழன்பன்

சிறுகதை - நந்தவனத்தில் ஒரு ஆண்டி- எழுத்தாளர் ஜெயகாந்தன்

கட்டுரை - அறிவியல் தமிழ் ஆக்கம் – இற்றை நிலை –
டாக்டர். வா.செ. குழந்தைசாமி

படைப்பிலக்கியப் பயிற்சி - கவிதைப் படைப்பாக்கத்திறன்

அலகு – 3 **10 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - தமிழ்ப் புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும்

பக்தி இலக்கியம் - திருவருட்பா - அஞ்சாதே நெஞ்சே (10 கண்ணிகள்) – இராமலிங்க அடிகளார்.

கவிதை - கனவுகள் +கற்பனைகள் = காகிதங்கள் - கவிஞர் மீரா

கவிதை - மின்மினிகளால் ஒரு கடிதம் - கவிஞர் அப்துல்ரகுமான்

கவிதை - ஒட்டடை- கவிஞர் தாமரை

சிறுகதை - நாற்காலி – எழுத்தாளர் கி. ராஜநாராயணன்

கட்டுரை - உயர்தனிச் செம்மொழி - முனைவர் இரா. குணசீலன்

இலக்கணம் - வல்லினம் மிகும், மிகா இடங்கள்

படைப்பிலக்கியப் பயிற்சி - சிறுகதைப் படைப்பாக்கத்திறன்

அலகு- 4 **10 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - தமிழ்ச் சிறுகதையின் தோற்றமும் வளர்ச்சியும்.

கவிதை - இயேசு காவியம் - கசப்புறு பாத்திரம் – "வானி லங்கு நிலவு" முதல் "நேர மின்று நெருங்கியே" (1 முதல் 8 பாடல்கள்) - கவிஞர் கண்ணதாசன்.

கவிதை - அதோ அந்த அவர்கள் - கவிஞர் வாலி.

கவிதை - ஏழை இங்கொருவருமில்லை - கவிஞர் குலோத்துங்கன்.

சிறுகதை - சுயநலம்- கவிஞர் விந்தன்.

கட்டுரை - கங்கை வேடனும் காளத்தி வேடனும் - சொல்லின் செல்வர் ரா.பி. சேதுப்பிள்ளை.

ஆளுமைத்திறன் மேம்பாடு - பேச்சுக்கலை

அலகு -5 **07 மணிநேரம்**

தமிழ் இலக்கிய வரலாறு - தமிழ் உரைநடையின் தோற்றமும் வளர்ச்சியும்

கவிதை - தவத்தின் மேன்மை - கவிஞர் குணங்குடி மஸ்தான் சாகிபு

கவிதை - சின்னச் சின்ன பிரளயங்கள் - கவிஞர் வைரமுத்து

கவிதை - சுயம் - கவிஞர் சல்மா

சிறுகதை - மீன் - எழுத்தாளர் பிரபஞ்சன்

கட்டுரை - வீரச்சுவை – நாவலர் ந.மு.வேங்கடசாமி நாட்டார்

மொழித்திறன் மேம்பாடு - பிழையின்றி எழுதுதல் பயிற்சி.
மரபுத்தமிழ் – திணைமரபு – உயர்திணை, அஃறிணை, அறிவியல் கலைச்சொற்கள்.

மொத்த மணிநேரம் - 48

TEXT BOOK T1 - **கற்பகச் சோலை – தமிழ்ப்பாட நூல், இலக்கிய இன்பம்,** தமிழ்த்துறை வெளியீடு, கற்பகம் உயர்கல்விக்கழகம், கோயம்புத்தூர் – 21.

பார்வை நூல்கள்

R1 - **தமிழ் இலக்கிய வரலாறு, முனைவர் கா.கோ. வேங்கடராமன்,** கலையக வெளியீடு, நாமக்கல்.

R2 - **பெரியபுராணம் தொகுதி-1 பன்னிருதிருமுறை ஆய்வுமைய வெளியீடு,** கற்பகம் உயர்கல்விக்கழகம், கோவை-21

இணையதளம்

W1-www.tvu.org.in

W2- www.maduraitamilproject.com

இதழ்கள்

J1- International Research Journal of Indian Literature,irjil.in

J2 - International Tamil Research Journal, iorpress.in

வினாத்தாள் கட்டமைப்பு

இடைத்தேர்வு - மொத்த மதிப்பெண்கள் 60

பகுதி – அ (இரு மதிப்பெண் வினாக்கள்) 6X 2 = 12 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – ஆ (ஆறு மதிப்பெண் வினாக்கள்) 3 X 6 = 18 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – இ (பத்து மதிப்பெண் வினாக்கள்) 3 X 10 =30 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பருவத்தேர்வு - மொத்த மதிப்பெண்கள் 100

பகுதி – அ (இரு மதிப்பெண் வினாக்கள்) 10 X 2 = 20 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – ஆ (ஆறு மதிப்பெண் வினாக்கள்) 5X 6 = 30 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – இ (பத்து மதிப்பெண் வினாக்கள்) 5X 10=50 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Language : Hindi - II	SEMESTER II
25LHU201G	**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**
	End Semester Exam: 3 Hours
(MODERN POETRY, DRAMA, NOVEL, GRAMMAR)	

PREREQUISITE:
Not Required

COURSE OBJECTIVES(CO):

- Understand the text styles and grammatical elements
- Discuss the content of a reading passage
- Develop an interest in the appreciation of short stories

COURSE OUTCOMES(COs) :

- Basic knowledge of Hindi language will be improved.
- Knowledge of glossaries will increase.
- Hindi language expression will rise.
- Learners will enrich their grammar in Hindi.
- The desire to read literature, such as the essay on a poem, develops.

UNIT-I	a) Poetry – Nagarjun	**9 HOURS**
	b) Drama -Dhruva Swamini	
	c) Novel - Nirmala , Thotharam	
	d) Grammar – Kaal , Theen Prakar	
UNIT-II	a) Poetry – Sita , Ram	**9 HOURS**
	b) Drama – Mandhakini , Koma	
	c) Novel – Mansaram , Jiyaram	
	d) Grammar – Upsarg, Prathyay	
UNIT-III	a) Poetry – Lakshman, Valmiki	**10HOURS**
	b) Drama – Ramaguptha , Chandhraguptha	
	c) Novel – Sudha, Bhuvan Mohan Singh	
	d) Grammar – Sabda Vyutpathi	
UNIT-IV	a) Poetry -Vishvaamithra, Thrijada	**10HOURS**
	b) Drama –Sikhar Swami,Shakraj	
	c) Novel – Udhaybanulaal, Siyaram	
	d) Grammar – Sambandh Chochak	
UNIT-V	a) Poetry – Bhagirath , Sagar	**10HOURS**
	b) Drama – Khingal , Mihirdev , Prohith	
	c) Novel – bhalchandra Sinha,Kalyani, Rangili Bai	
	d) Samuchchaybodhak, Vishmayathibodhak	**TOTAL: 48 HOURS**

REFERENC BOOKS:

I. Nagarjun, (2018). Bhoomija , Radha Krishna Publication, New Delhi - 110051.

II. Jaysankar Prasad, (1933). Dhruva Swamini, Sakshi Publication, S 16, Naveen Shahdhara, Delhi - 110032.

III. Premchandh**, (**2020**).** Nirmala**,** Prabhath Prakashan**,** 4/19 Asaf Ali Road**,** New Delhi - 110002.

IV. V.shidhar Pro. & Dharmapal, (2005). Sugam Hindi Vyakaran, Shiksha Bharathi, Madharsa Road, Delhi - 110006.

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

	Language : Malayalam - II	**Semester II**
		4H-3C
25LMU201G		
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**	
	End Semester Exam: 3 Hours	

COURSE OBJECTIVE:(CO)

- A basic understanding of contemporary poetry can be gained and the nature of modern poetry can be realized.
- Realizing the nature of drama and its nature and improving the knowledge of reading and understanding the nature of contemporary plays.
- Understands the benefits of correspondence and can enhance the correspondence you need.

COURSE OUTCOME: (COs)

- Get a basic understanding of Memories
- It will create basic knowledge about Environmental Psychology.
- It will create awareness about our environment.
- Knowledge is gain about our country, culture etc.
- It will be an eye opener to the students towards our Mother Earth.

	MALAYALAM – II	
Unit No.		**Hours**
I	Novel –Enmakaje	**10**
II	Novel – Enmakaje	**10**
III	Memmories – Neermaathalam Pootthakaalam	**10**
IV	Memmories – Neermaathalam Pootthakaalam	**9**
V	Translation (English to Malayalam)	**9**
	TOTAL	**48**

Text Books:

1. Ambikasuthan, (2024*), Emakaje* –DC Books Kottayam,Kerala
2. Madhavikutty (2021), *Neermaathalam Pootthakaalam* , DC Books Kottayam, Kerala

Reference Books:

1. Vijayalam Jayakumar (1998), Athmakathasahithyam Malayalathil,N.B.S.Kottayam,Kerala 2. Tharakan K.M (2023), Malayala Novel SahithyaCharitram, Kerala Sast Rasahitya,Kerala 3. George K.M (2013) SahithyaCharitramPrasthanangalilude, D.C.Books, Kottayam, Kerala 4. Sukumar Azheekode, (2018, MalayalaSahithyavimarsam, D.C.Books, Kottayam,Kerala

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

LANGUAGE : SANSKRIT- II	SEMESTER II
25LSU201G	**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**
	End Semester Exam: 3 Hours
(PROSE, GRAMMAR AND TRANSLATION)	

COURSE OBJECTIVES(CO):

- The fundamental objective of the curriculum is to impart effective science education at the undergraduate level, exposing them to recent trends and developments in the subject.
- Creating scientific temper is another major objective of this curriculum.
- Another major thrust given here is to develop an environmental concern in all activities of the students. 'Go green', the motto of the syllabus emphasizes the urgent need to conserve nature without destruction of natural resources.

COURSE OUTCOMES(COs) :

- **Critical Thinking** :Take informed actions after identifying the assumptions that frame students' thinking and actions.
- **Problem Solving**: Understand and solve problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired.
- **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development.
- **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

UNIT-I **10 HOURS**

Introduction to Sanskrit Prose, Important prose works in Sanskrit

UNIT – II **10 HOURS**

Balaramayana – Balakanda

UNIT – III **10 HOURS**

Balaramayana – Ayodhyakanda

UNIT – IV **09 HOURS**

Balaramayana – Aranyakanda

UNIT – V **09 HOURS**

Athmanepada Declension of ending nouns (feminine)

Passages from Sanskrit Self Teacher (Simple sentences)

TOTAL: 48 HOURS

Prose text book available at :

- Balaramayana - A Simple Prose Version**, (**2019). R.S. Vadhyar and Sons**,** Palghat**,** Kerala

CO, PO, PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**	**PSO1**	**PSO2**
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

	Language : French - II	**SEMESTER II**
25LFU201G		**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100** **End Semester Exam:** 3 Hours	
(LEÇON, COMMUNICATION, GRAMMAIRE, VERBES, LEXIQUE, CULTURE)		

PREREQUISITE:
Not Required

COURSE OBJECTIVES (CO):
The objectives of this course are:

- To make the students to speak and write errors free French.
- To help the students develop their listening, speaking, reading and writing skills.
- Introducing literary works to the students to enhance their analytical and aesthetic skills.

COURSE OUTCOMES (COs):
At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	strengthen the foundation of the language.	Remember
CO2	standardize and demonstrate understanding of LSRW skills.	Understand
CO3	utilize fundamentals of language for reading, writing and effective communication.	Apply
CO4	enhancing the reading skill to build the leadership quality.	Apply
CO5	Develop the moral and aesthetic values.	Evaluate

Unité - I	a) Leçon	- Les loisirs	**9 HOURS**
	b) Communication	- Parler de ses goûts et de ses préférences	
	c) Grammaire	- Les adjectifs interrogatifs , Les nombres ordinaux, L'heure, Les pronoms personnels COD	
	d) Verbes	-savoir et connaitre	
	e) Lexique	- Les loisirs, Les activités quotidiennes ,Les matières	
	f) Culture	- les grands fleuves de france.	
Unité - II	a) Leçon	- La routine	**9HOURS**
	b) Communication	- Décrire sa journée	
	c) Grammaire	- Les verbes pronominaux, Les verbes du premier groupe en -e_er, -é_er, -eler, -eter, Le verbe prendre	

	d) Verbes	- manger, boire	
	e) Lexique	- Le temps et l'heure ,La fréquence	
	f) Culture	- les bandes dessinees.	
Unité - III	a) Leçon	-Où faire ses courses	**10 HOURS**
	b) Communication	- Au restaurant : commander et commenter	
	c) Grammaire	- Les articles partitifs, Le pronom en (la quantité) très ou beaucoup ? La phrase négative	
	d) Verbes	- les verbs irregulliers	
	e) Lexique	- Les aliments, Les quantités, Les commerces et les commerçants	
	f) Culture	-Les plats francais	
Unité -IV	a) Leçon	- Decourvez et dégustez	**10 HOURS**
	b) Communication	- Inviter et répondre ,à une invitation	
	c) Grammaire	- L'impératif ,Il faut, c'est/ il est,future proche	
	d) Verbes	- Les verbes devoir, pouvoir, savoir, vouloir	
	e) Lexique	- Demander et dire le prix, Les services, Les moyens de paiement	
	f) Culture	- Le festival du mot	
Unité - V	a) Leçon	- Tout le monde s'amuse, Les ados au quotidien	**10 HOURS**
	b) Communication	- Décrire une tenue , Écrire un message amical	
	c) Grammaire	- Les adjectifs demonstratives, La formation du féminin Le pronom indéfini on, passé compose'.	
	d)	- Verbes - Les verbes du premier groupe en –yer, Les verbes voir et sortir	
	e) Lexique	- Les sorties Situer dans le temps, La famille ,(2) Les vêtements et les accessoires	
	f) Culture	- Le pays des gourmands	

TOTAL: 48 HOURS

REFERENCE BOOKS:

1. Marie-Noëlle Cocton, December 2015, ***Saison 1: méthode de français,*** Volume 89, Number 2, Johns Hopkins University Press, Difier Paris
2. Marion Alcaraz, Dorothée Escoufier, Camille Gomy, Mathilde Landier, Francine Quéméner, Delphine Ripaud, 2014, ***Saison 1- Cahier d'activites,*** Dider, Paris.
3. Anne Akvüz, Bernadette Bazelle-Shahmaei, Joëlle Bonenfant, Marie-Françoise Gliemann, 24 Aug. 2005, ***LES 500 EXERCICES DE GRAMMAIRE AVEC CORRIGÉS,*** Hachette Francais Langue Etrangere, Paris.
4. Christian Beaulieu, 2011, ***Je Pratique Exercice De Grammaire A1,*** French, Goyal Publishers, Paris.
5. Nathalie Bié, Philippe Santinan, April 2014, ***Grammaire pour adolescents 250 exercices,*** French, CLE INTERNATIONAL, Paris.

WEBSITES :

1. http:// enseigner.tv5 monde.com/
2. bonjourdumonde.com /exercises/contenu/le – francais-du- tourisme.html
3. http://www.bonjurdefrance.com/
4. https://www.lepointdufle.net/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.8**	**2.6**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

25ENU201G **English - II** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:
Not required

COURSE OBJECTIVES(CO):

- To make the students to speak and write errors free English.
- To help the students develop their listening, speaking, reading and writing skills.
- Introducing literary works to the students to enhance their analytical and aesthetic skills.

COURSE OUTCOMES (COs):
At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	Strengthen the foundation of the language.	Remember
CO2	Standardize and demonstrate understanding of LSRW skills.	Remember
CO3	Utilize fundamentals of language for reading, writing and effective communication.	Apply
CO4	Enhancing the reading skill to build the leadership quality.	Understand
CO5	Develop the moral and aesthetic values.	Understand

UNIT - I **8 HOURS**
LISTENING: Listening to Different Accents and Intonation
SPEAKING : Preparing for Small Talks
READING : Syllabification
COMPOSITION WRITING: Developing a story with pictures
LITERATURE: Refuge Mother and Child by Chinua Achebe (Poetry)
GRAMMAR: Subject, verb, agreement

UNIT - II **7 HOURS**
LISTENING: Listening in Different Contexts
SPEAKING: Oral Presentation
READING: Reading Passages
COMPOSITION WRITING: Hints Development
LITERATURE: Prose: My Childhood- Dr. A.P.J. Abdul Kalam
GRAMMAR: Phrases and Clauses

UNIT - III **7 HOURS**
LISTENING: Listening to Buisness stories/Tedtalks

SPEAKING: Public speaking and secrets of good delivery
READING : Note Making
COMPOSITION WRITING: Rearranging Paragraphs
LITERATURE: Poem: A Gift of India - Sarojini Naidu
GRAMMAR: Voice

UNIT - IV **7 HOURS**
LISTENING: Listening to instructions and announcements
SPEAKING: Debating
READING : Close Reading
COMPOSITION WRITING: Writing Agenda, Memos, Minutes and Notices
LITERATURE: Play: Dance Like a Man - Mahesh Dattani
GRAMMAR: Degrees of Comparison

UNIT - V **7 HOURS**
LISTENING: Listening to Product Description-Labelling and Gap Filling Exercises
SPEAKING: Developing Argument and Closing Argument
READING : Reading Comprehension/ Summary Writing
COMPOSITION WRITING : Dialogue Writing
LITERATURE: Short- story: The Bear Hunt- Leo Tolstoy
GRAMMAR: Direct and indirect speech

TOTAL: 36 HOURS

TEXT BOOK:

1. Board of Editors (2024), Acrostic II. Karpagam Academy of Higher Education

REFERENCE BOOKS:

1. *Martin's, St* (2013). *Oxford Handbook of Writing: Handbook of Writing.* Cambridge University Press.
2. Julian Treasure, *Sound Business*, (2012). Oxford University Press
3. Hornby, A, S. (1975). *The Guide to patterns and usage in English*: oxford university Press.
4. Ellis, R. (1990). *Instructed second language acquisition*. Oxford: oxford university Press.

WEB SITES:

1. https://allpoetry.com/
2. https://ncert.nic.in/textbook/pdf/iebe106.pdf
3. https://poets.org/poem/gift-india
4. https://shorturl.at/4sgld
5. https://sportingclassicsdaily.com/leo-tolstoy/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Average	--	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

25MBU201 **Microbial Physiology and Metabolism** **6H–4C**

Instruction Hours/week: L:6 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Introduction To Microbiology and Microbial Diversity (25MBU101)

COURSE OBJECTIVES (CO):

- To explain photosynthesis and photosynthetic bacteria
- To study the structure, function, growth, and regulatory mechanisms of microorganisms.
- To learn about the metabolic diversity and growth of the microorganism.

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the concepts of microbial nutrition and physiology	Understand
CO2	Analyze the microbial growth and fermentation processes	Analyze
CO3	Discuss carbohydrate metabolism Prokaryotes and Eukaryotes	Understand
CO4	Paraphrase Physiology of nitrogen cycle and mechanism of nitrogen fixation	Understand
CO5	Explain bacterial Phototrophic metabolism	Understand

UNIT I Microbial nutrition **15 HOURS**

Microbial nutrition– Nutritional groups of microorganisms, (Carbon, energy and electron source), Nutrient requirements: Macro and micronutrients with their physiological functions. Uptake of nutrients by cell – Passive, Facilitated diffusion, Active transport- Uniport, Symport, Antiport. Group translocation and Iron uptake.

UNIT II Microbial growth **15 HOURS**

Growth; bacterial cell division, Growth curve - Different phases of growth curve - generation time, growth rate and growth kinetics. Methods of measuring microbial growth. Batch, fed-batch, Continuous and Synchronous culture, Diauxic growth, Influence of environmental factors on growth (Temperature, pH, solute, water activity, oxygen and pressure).

UNIT III Carbohydrate metabolism **13 HOURS**

Carbohydrate metabolism – EMP, ED, Pentose phosphate pathway, TCA cycle, Aerobic respiration, oxidative phosphorylation, electron transport chain (Prokaryotic and Eukaryotic), substrate level phosphorylation. Uncouplers, inhibitors and ionophores. Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways), concept of linear and branched fermentation pathways.

UNIT IV Nitrogen metabolism **14 HOURS**

Nitrogen Fixation – Nitrogen fixers, Physiology of nitrogen cycle and mechanism of nitrogen fixation- Symbiotic and non symbiotic Assimilatory and dissimilatory nitrate reduction, biological nitrogen fixation. Anaerobic respiration with special reference to dissimilatory nitrate reduction – Denitrification.

UNIT V Phototrophic metabolism **15 HOURS**

Phototrophic metabolism- Photosynthesis – bacteria and blue green algae: anoxygenic (Purple, green bacteria) and oxygenic (cyanobacterial) photosynthesis. Photosynthetic pigments: action and absorption spectrum, type, structure and location, physiology of bacterial photosynthesis: light reactions, cyclic and non-cyclic photophosphorylation.

Total: 72 HOURS

TEXT BOOKS:

1. Madigan, M.T., Kelly, S.B., Daniel, H.B, Mathew, S and David, A.S (2017). *Brock Biology of Micro-organisms*. 15th edition. Parker J. Prentice Hall International, Inc.
2. Willey, J.M., Sherwood, L.M., and Woolverton, C.J. (2019).
3. *Prescott's Microbiology*. 11th&12th edition. McGraw Hill.

REFERENCE BOOKS:

1. Talaro., Kathleen, P.T., Chess., and Berry, C., (2018). *Foundations in Microbiology*, 10th Ed., McGraw Hill.
2. Benson's Microbiological Applications Laboratory Manual Complete Version, 2015,13th Edition, Mc Graw Hill.
3. Moat, A. G., and Foster, J.W. (2002). *Microbial Physiology*. 4thedition. John Wiley& Sons. Reddy,
4. S.R., and Reddy, M. (2007). *Microbial Physiology*. Scientific Publishers India

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	2	-	2	-	-	-	-	-	-	-	3	-
CO2	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	3	-	2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	-	2	-	-	-	-	-	-	-	-	-	3	-
Average	**3**	-	**2**	**3**	-	**2**	-	**2**	-	-	-	-	-	-	-	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

25MBU202 **Biochemistry - II** **5H–4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Biochemistry I (25MBU102)

COURSE OBJECTIVES (CO):

- To study the various metabolic pathways and energy generation.
- To understand the free energy and electron carriers
- To gain knowledge on carbohydrate, lipid and protein metabolism

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

Cos	Course Outcomes	Blooms Level
CO1	Understand and analyse the thermodynamics concepts and metabolism	Understand /Analyze
CO2	Explain the carbohydrate metabolism and regulation.	Understand
CO3	Analyze lipid metabolism and biosynthesis	Analyze
CO4	Describe the synthesis of various amino acids	Understand
CO5	Interpret nucleic acid metabolism and synthesis	Analyze

UNIT I Introduction to metabolism **12 HOURS**

Anabolism and catabolism - Definition. Bioenergetics - Thermodynamics principles, Concepts of free energy, Standard free energy, Mitochondrial Electron Transport Chain: electron carriers, chemiosmotic theory and ATP production, High Energy phosphate compounds, Inhibitors of electron transport chain and Redox potential and uncouplers of oxidative phosphorylation.

UNIT II Carbohydrate metabolism **12 HOURS**

Glycolysis, TCA cycle, Glycogenesis, Glycogenolysis, HMP shunt, Gluconeogenesis, Glucuronic acid pathway. Regulation of glycogen metabolism. Oxidative Phosphorylation.

UNIT III Lipid metabolism **12 HOURS**

Fatty acid oxidation – α, β, ω oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of cholesterol, triglycerides and ketone bodies.

UNIT IV Protein metabolism **12 HOURS**

Synthesis of Aliphatic and aromatic amino acids. Degradation of proteins: Deamination, Transamination and Decarboxylation, Urea cycle. Synthesis of ketogenic and glucogenic amino acid.

UNIT V Nucleic acid metabolism and biological oxidation **12 HOURS**

Biosynthesis and degradation of purine and pyrimidine nucleotides. Interconversion of nucleotides. Inherited metabolic disorders such as phenylketonuria, Gaucher disease, Maple syrup urine disease and Gout.

Total: 60 HOURS

TEXT BOOKS:

1. Jain, J.L. (2004). *Fundamentals of Biochemistry*, Chand publications.

2. Nelson, David l. and Cox, M.M. (2000). *Lehninger's Principles of Biochemistry*. Macmillan /Worth, NY.
3. K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, *Harper's Biochemistry* Robert. 24th edition, Prentice Hall International Inc.

REFERENCE BOOKS:

1. Geoffrey L. Zubay, (1995). *Principles of Biochemistry*, 3rd edition William W. Parson, Dennis E. Vance, W.C. Brown Publishers.
2. Lubert Stryer, (1995). *Biochemistry*, 4th edition, W.H. Freeman & Co.
3. Donald Voet, Judith G. Voet and Charlotte W Pratt. (1999). Biochemistry. John Wiley & Sons, NY.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	2	-	2	-	-	-	-	-	-	-	3	-
CO2	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	3	-	2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	3	-
Average	**3**	**-**	**2**	**3**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

25MBU211 **Microbial Physiology and Metabolism - Practical** **5H–2C**

Instruction Hours/week: L:0 T:0 P:5 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Microbial Physiology and Metabolism (25MBU201)

COURSE OBJECTIVES (CO):

- To improve their skills in handing of microorganisms
- To analyze the growth condition of the bacteria.
- To demonstrate the fermentation technique

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Analyze the bacterial growth and growth conditions	Analyze
CO2	Identify the various factors for optimal growth of *E. coli*.	Analyze
CO3	Utilize various techniques for microbial identification	Apply
CO4	Experiment with carbohydrate fermentation methods	Apply
CO5	Perform alcoholic fermentation method for alcohol production	Apply

EXPERIMENTS **48 HOURS**

1. Perform plot the growth curve and Calculations of generation time of E. *coli* by turbidimetric and standard plate count methods.
2. Effect of temperature on growth of E. *coli*
3. Effect of pH on growth of E. *coli*
4. Effect of carbon and nitrogen sources on growth of E. *coli*
5. Effect of NaCl on growth of E. *coli*
6. Biochemical Characterization:
7. IMViC test
8. TSI Test
9. Nitrate reduction Test
10. Urease production Test
11. Catalase Test
12. Oxidase Test
13. Carbohydrate fermentation Test
14. Demonstration of the thermal death time and decimal reduction time of E. *coli*.

Total: 48 HOURS

TEXT BOOKS:

1. Madigan, M.T., Kelly, S.B., Daniel,H.B, Mathew, S and David, A.S. (2017). *Brock Biology of Micro- organisms.* 15th edition. Parker J. Prentice Hall International, Inc.
2. Willey, J.M., Sherwood, L.M., and Woolverton, C.J. (2019). *Prescott's Microbiology*. 11th edition. McGraw Hill.

REFERENCE BOOKS:

1. Talaro., Kathleen, P.T., Chess., and Berry, C. (2018). *Foundations in Microbiology*, 10th Ed., McGraw Hill.
2. Benson's Microbiological Applications Laboratory Manual- (2015). Complete Version, 13th Edition, McGraw Hill.
3. Reddy, S.R., and Reddy, S.M. (2007). *Microbial Physiology*. Scientific Publishers India.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	3	-	-	-	-	-	-	-	-	-	-	1	3	-
CO2	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	3
Average	3	-	-	3	-	3	-	-	-	-	-	-	-	-	1	3	3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

25MBU212 **Biochemistry II - Practical** **5H–2C**

Instruction Hours/week: L:0 T:0 P:5 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Biochemistry II (25MBU202)

COURSE OBJECTIVES (CO):

- To gain knowledge with these techniques used for separation of biomolecules
- To know principle behind the compound purification
- To measure the protein, cholesterol, chlorophyll and phosphorous

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Learn and practice separation of biomolecules using chromatography	Apply
CO2	Experiment with estimation of biomolecules	Apply
CO3	Analyze measurement of cholesterol and phosphorous	Analyze
CO4	Practice extraction of starch	Apply
CO5	Apply techniques for estimation of chlorophyll in plant tissue	Apply

EXPERIMENTS **48 HOURS**

1. Separation of sugar by paper chromatography
2. Separation of amino acid by thin layer chromatography
3. Separation of plant pigments by thin layer / column chromatography
4. Estimation of carbohydrate by anthrone method
5. Estimation of Protein by Lowry's method
6. Estimation of Cholesterol by Zak's method
7. Estimation of RNA by Orcinol reaction.
8. Isolation of Casein from milk
9. Estimation of Phosphorus by Fiske Subbarow method
10. Estimation of starch.

Total: 48 HOURS

TEXT BOOKS:

1. S. Sadasivam and A. Manickam. (1992). *Biochemical Methods*, Second Edition, New Age International Publishers, New Delhi.
2. J. Jayaraman, (1981). *Laboratory Manual in Biochemistry*, New Age International publishers, New Delhi.
3. Shivaraja Shankara. (2013). *Laboratory Manual for Practical Biochemistry*, 2nd Edition. Jaypee Publishers.

4.Akhtar Inam. (2012). *A Laboratory Manual of Plant Physiology, Biochemistry and Ecology*. Agrobios Publisher, India.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	-	-	-	-	2	-	3	-	-	-	1	-	-	1	3	-
CO2	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO3	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-	3	-
Average	2	-	-	-	-	2	-	3	-	-	-	1	-	-	1	3	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

25VAC201G **Environmental Studies** **2H–2C**

Instruction Hours/week: L:2 T:0 P:0 **Marks:** Internal**:100** External**: - T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE: Not required

COURSE OBJECTIVES (CO):

- To create awareness about structure and functions of various ecosystems.
- To learn about the environment, resources available, biodiversity and its conservation.
- To understand the current scenarios- to find ways for protection and betterment of or habitat.

COURSE OUTCOMES (COs):

On completion of the course, students are able to

COs	Course Outcomes	Blooms Level
CO1	Define the structure and functions of various ecosystems	Understand
CO2	Learn the ethical, cross-cultural, and historical context of natural resources and the methods for conservation	Understand
CO3	Predict current scenarios and find ways for the protection and betterment of habitat	Analyze
CO4	Analyze the interactions between social and environmental problems	Apply
CO5	Develop systems concepts and methodologies to analyze and understand interactions between social and Environmental processes	Create

UNIT I INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS: 5 HOURS

Environment Definition, Scope and Importance; Ecosystem, Structure, classification, and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Forest ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE RESOURCES: 5 HOURS

Natural resources - Renewable and Non–renewable resources. Land resources, Land degradation, desertification. Forest resources – Deforestation: Causes and impacts due to mining. Water resources- Use and over-exploitation of surface and groundwater.

UNIT III BIODIVERSITY AND ITS CONSERVATION: 5 HOURS

Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity. Values of Biodiversity - Ecological, economic, social, ethical, aesthetic value. Bio-geographical classification of India. Hot-spots of biodiversity. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.

UNIT IV ENVIRONMENTAL POLLUTION: 4 HOURS

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution. Nuclear hazards and human health risks.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT: 5 HOURS

Concept of sustainability and sustainable development. Climate change, global warming, ozone layer depletion, acid rain and its impacts on human commUNITies and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act).

Total: 24 HOURS

TEXT BOOKS:

1. Anonymous. 2004. *A Text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research*, New Delhi.
2. Anubha Kaushik., and Kaushik, C.P.(2008). *Perspectives in Environmental Studies*, 3rd Edition, New Age International Pvt. Ltd. Publications, New Delhi.
3. Arvind Kumar,(2009). *A Textbook of Environmental Science*, APH Publishing Corporation, New Delhi.
4. Mishra, D.D,(2010). *Fundamental Concepts in Environmental Studies*. S. Chand & Company Pvt. Ltd., New Delhi.
5. Odum, E.P., Odum, H.T. and Andrews, J. (1971*). Fundamentals of Ecology*, Philadelphia: Saunders.
6. Sing, J.S., Sing. S.P. and Gupta, S.R.(2014). *Ecology, Environmental Science and Conservation*, S. Chand & Publishing Company, New Delhi.
7. Tripathy. S.N., and Sunakar Panda. (2011). *Fundamentals of Environmental Studies*, 3rd Edition, Vrianda Publications Private Ltd, New Delhi.
8. Uberoi, N.K. (2010). *Environmental Studies*, 2nd Edition, Excel Books Publications, New Delhi.

REFERENCE BOOKS:

1. Botkin., and Keller, (2014). *Environmental Science: Earth as a Living Planet*. 9th Edition, Wiley
2. Rajagopalan, R. (2016). *Environmental Studies: From Crisis to Cure*, Oxford University Press.
3. Singh, M.P., Singh, B.S., and Soma, S. Dey, (2004). *Conservation of Biodiversity and Natural Resources*, Daya Publishing House, New Delhi.
4. Verma, P.S., and Agarwal V.K(2016). *Environmental Biology (Principles of Ecology).* S. Chand and Company Ltd, New Delhi.
5. Bruce Rittmann and Perry Mc Carty, *Environmental Biotechnology: Principles and Applications*, (2020). 2nd Edition.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
CO2	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
CO3	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
CO4	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
CO5	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
Avg	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2

1-Low; 2-Medium; 3-High; '-' No correlation

25LTU301G	**Language : Tamil - III**	**SEMESTER III** **4H - 3C**
Instruction Hours/week : L : 4 T : 0 P : 0	**Marks : Internal : 40 External : 60 Total : 100** **End Semester Exam: 3 Hours**	
போட்டித் தேர்வு நோக்கில் தமிழிலக்கியங்கள்		

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும், மேம்படுத்துதல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்; திறனாய்வு நோக்கை மேம்படுத்துதல்.
- இலக்கியங்களின் வழி மனித வாழ்வியலை உணர்த்துதல்.
- இன்புறுத்தல் மற்றும் அறிவுறுத்தல் நிலைகளில் இலக்கியங்களின் பங்களிப்பை உணர்த்துதல்.
- இளைய தலைமுறையினருக்கு அற உணர்வு மற்றும் வாழ்வியல் மதிப்புகளை அறிவுறுத்துதல்.

பாடத்திட்டப் பயன்விளைவு

- இந்தியக் குடியுரிமைப்பணி முதலான போட்டித் தேர்வுகளில் இடம்பெறுகின்ற, 'தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகத்தை அடைதல்.
- தொல்லியல், கல்வெட்டியல் மற்றும் ஓலைச்சுவடியியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வு மனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
- 'அறிவியல் தமிழ்' ; 'இணையத் தமிழ்' போன்ற தமிழின் வளர்ச்சித் துறைகள் சார்ந்த திறன் மேம்பாடு பெற்றிருத்தல்.
- வேலைவாய்ப்புக்குரிய வகையில் படைப்பாக்கத்திறன் முதலான மொழி ஆளுமை பெற்றிருத்தல் ;
- சமூக வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக உள்ள இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி.

தாள்கள் வரிசையும் தேர்வுச் செயல் திட்டமும்

பகுதி-I தமிழ்

இளநிலைப்பட்ட அறிவியல் மற்றும் கலையியல் வகுப்புகள்

பருவம்	தாள்	கற்பிக்கும் நேரம்/வாரம்	தேர்வு மணிகள்	மதிப்பெண் அகமதிப்பீடு/பருவ எழுத்துத் தேர்வு	மொத்தம்	மதிப்புப் புள்ளிகள்
மூன்று	III	4	3	40 / 60	100	3

25LTU301G	LANGUAGE : TAMIL - III	SEMESTER III 4H - 3C
Instruction Hours/week : L : 4 T : 0 P : 0	Marks : Internal : 40 External : 60 Total : 100	
	End Semester Exam: 3 Hours	

போட்டித் தேர்வு நோக்கில் தமிழிலக்கியங்கள்

அலகு – 1 **10 மணிநேரம்**

அற இலக்கியம் – **திருக்குறள் -** தெரிந்து தெளிதல் - கூடா நட்பு.

நாலடியார் - பெரியாரைப் பிழையாமை – (பாடல் 161 முதல் 165 வரை பொறுப்பர் என்றெண்ணி, பொன்னே கொடுத்தும், அவமதிப்பும், விரிநிற நாகம், எம்மை அறிந்திலீர்)

பழமொழி நானூறு - (பாடல் 151 முதல் 155 வரை – (வேளாண்மை செய்து, ஒன்றால் சிறிதால், இனி யாரும் இல்லாதார், தற்றூக்கி, வீங்குதோள்)

இனியவை நாற்பது - (பாடல் 31 முதல் 35 வரை) – (அடைந்தார் துயர்கூறா, கற்றறிந்தார் கூறும், ஊர்முனியா, எல்லிப் பொழுது, ஒற்றினான் ஒற்றி)

சிறுபஞ்சமூலம் - பூவாது காய்க்கும் (20) – பூத்தாலும் காயா மரம் உள (21).

ஏலாதி (1 முதல் 5 பாடல்கள் வரை - சென்ற புகழ், கொலை புரியான், தவம் எளிது, இடர் தீர்த்தல், தனக்கு என்னும்)

மூதுரை – (11 முதல் 15 வரை) – (பண்டு முளைப்பது, மடல் பெரிது, கவையாகி கொம்பாகி, கான மயிலாட, வேங்கை வரிப்புலி) முதலான பாடல்களைத் திறனாய்தல்.

அலகு – 2 **08 மணிநேரம் காப்ப**

ியங்கள்

- ஐம்பெருங்காப்பியங்கள்
- சிலப்பதிகார வழக்குரைகாதை
- ஐஞ்சிறு காப்பியங்கள்
- சூளாமணி அரசியற் சருக்கம்
- பிற்கால இலக்கியங்கள்

(பாரதசக்தி மகாகாவியம், இராவண காவியம்)

சிற்றிலக்கியங்கள் - குற்றாலக்குறவஞ்சி - பிள்ளைத்தமிழ் – பரணி – தூது – உலா முதலான இலக்கியங்களைத் திறனாய்தல்.

அலகு – 3 **10 மணிநேரம்**

தமிழின் தொன்மை - திராவிடமொழிகள் தொடர்பான செய்திகள்

தமிழ் வளர்த்த சான்றோர் – உ.வே.சாமிநாதர் – தெ.பொ.மீனாட்சி சுந்தரனார் – சி. இலக்குவனார் ஆகியோரின் தமிழ்ப்பணி – தேவநேயப்பாவாணர் – அகரமுதலி – பாவலரேறு பெருஞ்சித்திரனார் – ஜி.யு.போப் – வீரமாமுனிவர் ஆகியோரின் தமிழ்த்தொண்டு.

அலகு – 4 **10 மணிநேரம்**

தமிழ்வளர்த்த சான்றோர் - மகாகவி பாரதியார் – பாவேந்தர் பாரதிதாசன் – கவியரசு கண்ணதாசன் - பட்டுக்கோட்டை கல்யாணசுந்தரனார் – கவிஞர் முடியரசன் – நாமக்கல் கவிஞர் - சிலம்புச் செல்வர் ம.பொ.சிவஞானம் ஆகியோரின் தமிழ்ப்பணி – சாகித்ய அகாதெமி விருது பெற்ற இலக்கியங்கள்.

அலகு – 5 **10 மணிநேரம்**

கடிதப்பயிற்சி - 1. நண்பனுக்குப் பாராட்டுக் கடிதம்

2. தமிழ் மன்ற நிகழ்வை நாளிதழில் வெளியிட வேண்டி பதிப்பாசிரியருக்கு விண்ணப்பம்

3. கருத்தரங்கப் பங்கேற்பிற்கான அனுமதி வேண்டி விண்ணப்பம்

4. வேலை வேண்டி விண்ணப்பம்

இலக்கணம் - எழுத்து – குறில்,நெடில் வேறுபாடு – லகர,ளகர, ழகர வேறுபாடு – னகர,ணகர வேறுபாடு - ரகர,றகர வேறுபாடு அறிதல்.

பேச்சு வழக்குத் தொடரிலுள்ள பிழை திருத்தம் –

(எ.கா.) நேத்து மழ பேஞ்சுது – நேற்று மழை பெய்தது.

மொத்த மணிநேரம் - 48

TEXT BOOK T1 - **கற்பகச் சோலை – தமிழ்ப்பாட நூல், இலக்கிய இன்பம்,** தமிழ்த்துறை வெளியீடு, கற்பகம் உயர்கல்விக்கழகம், கோயம்புத்தூர் – 21.

பார்வை நூல்கள்

R1- **தமிழ் இலக்கிய வரலாறு, முனைவர் கா.கோ. வேங்கடராமன்,** கலையக வெளியீடு, நாமக்கல்.

R2 - **வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு,** முனைவர் **பாக்யமேரி**, பூவேந்தன் பதிப்பகம், சீனிவாசா சாலை, மயிலாப்பூர், சென்னை.

இணையதளம்

W1-www.tvu.org.in

W2- www.maduraitamilproject.com

இதழ்கள்

J1- International Research Journal of Indian Literature, irjil.in

J2 - International Tamil Research Journal, iorpress.in

வினாத்தாள் கட்டமைப்பு

இடைத்தேர்வு - மொத்த மதிப்பெண்கள் 60

பகுதி – அ (இரு மதிப்பெண் வினாக்கள்) 6X 2 = 12 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – ஆ (ஆறு மதிப்பெண் வினாக்கள்) 3 X 6 = 18 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – இ (பத்து மதிப்பெண் வினாக்கள்) 3 X 10 =30 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பருவத்தேர்வு - மொத்த மதிப்பெண்கள் 100

பகுதி – அ (இரு மதிப்பெண் வினாக்கள்) 10 X 2 = 20 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – ஆ (ஆறு மதிப்பெண் வினாக்கள்) 5X 6 = 30 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – இ (பத்து மதிப்பெண் வினாக்கள்) 5X 10=50 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Language : Hindi - III	SEMESTER III
25LHU301G	**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**
	End Semester Exam: 3 Hours
(Story, History of Hindi Literature, Novel, Letter Writing)	

PREREQUISITE:
Not Required

COURSE OBJECTIVES(CO):

- Knowledge of contemporary drama contents of Hindi literature
- Learn novels and its techniques. The ability to read novels and express criticism about it and the ability to express social thoughts will improve
- There will also be litigation messages in Hindi and news on speech techniques

COURSE OUTCOMES(COs):

- Develop an interest in the appreciation of literature.
- Discuss and respond to content of a reading passage.
- Learning the literacy knowledge of Hindi specially reading and writing .
- Learning the literary knowledge specially reading and understanding of Hindi short Stories
- Learning the history of Hindi literature

UNIT-I a) Story – Bade Ghar Ki Beti **9HOURS**

b) Hindi Bhasha Ka Vikas

c) Novel – Ramnath,Jalpa

d) bLetter Writing –Personal Letter

UNIT-II a) Story – Puraskar **9HOURS**

b) Kaal Vibhajan , Char Prakar

c) Ramesh Babu ,Devdeen

d) Letter Writing – Leave Letter

UNIT-III a) Story – Usne Kaha Tha **10HOURS**

b) Literature – Adhikaal

c) Indhubhooshan, Rathna,Johra

d) Letter Writing – Letter for the Publisher

UNIT-IV a) Story – Paanchminte **10HOURS**

b) Poorva Madhya Kaal

c) Manibhooshan,Dhayanath,Rameshwari d) Letter Writing – Application for job

UNIT-V a) Story – kafan **10HOURS**

b) Reethi Kaal,Adhunik Kaal

c) Dheen Dhayal,Manaki,

d) Letter Writing – Complaint Letter

TOTAL: 48 HOURS

REFERENCE BOOKS

I. Hindi Prachar Sabha D.B, (2003). Kahani Manjari**,** T.Nagar**,** Chennai - 600017**.**

II. Sharma,R. A.**, (**1972**).** Hindi Sahithya ka Saral Ithihas**,** History of Hindi**,** Vinoth Pusthak Mandir**,** Aagra - 02.

III. Premchandh**, (**2013**).** Gaban**,** Rajkamal Prakashan**,** New Delhi - 110002.

IV. Sharan**,. (**2004**).** Sumitha Hindi Nibandh Aur Pathra Lekhan**,** Kalda Publication**,** Mukhar Ji Nagar**,** Delhi - 09**.**

CO, PO, PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**	**PSO1**	**PSO2**
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

	Language : Malayalam - III	**Semester III** **4H-3C**
25LMU301G		
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100** **End Semester Exam:** 3 Hours	

COURSE OBJECTIVE:(CO)

- May have knowledge of the contents of primitive poetry
  Learn about contemporary poetry and its techniques.
- Interest in reading poetry and the ability to express social thoughts will improve
- This will help you to understand the basics of Malayalam Poetry and to understand Malayalam literature properly

COURSE OUTCOME: (COs)

- Get a basic knowledge of the history of Malayalam literature.
- Enhances the art and taste of Malayalam literary works
- Literary genres can be learned
- Create more to read and enjoy Malayalam poetry
- Get the basic Knowledge of poetry techniques

Unit No	MALAYALAM - III	Hours
I	Poetry – Chintha vishtayaya Seetha	**10**
II	Poetry – Chintha vishtayaya Seetha	**10**
III	Poetry – Mrugasikshakan-(Murgasikshakan,Kausalya,Varavu,Vittupoku Ekalavyan,Mazha) 6 poetries	**10**
IV	Poetry – Mrugasikshakan-(Kayal,Karkkadakam,Bhagavatham,Vazhivakkile naikutty,Edavelayil oru nimisham,Verumoru kathu) 6 poetries	**09**
V	Poetry – Aayisha	**09**
	TOTAL	**48**

Text Books:

1. Kumaranasan,(1919) *Chinthavishtayaya Seetha*, Kerala Book Store Publishers. Kottayam
2. Vijayalakshmi, (2017) *Mrugasikshakan* ,DC Books, Kottayam
3. Vayalar Rama varma,(1903) *Aayisha* , Kerala Book Store Publishers, Kerala

Reference Books:

1. Dr..Leelavathi M ,(2015),Kavitha SahithyaCharitram,Kerala SahithyaAcademy,Trichur
2. Dr..Leelavathi M ,(2023),Kavitha Dwani,D.C.Books, Kottayam
3. Dr..George K.M,(2013),Aadhunika SahithyacharithramPrasthanangalilude,D.C.Books, Kottayam
4. Chummar T.M,(1936),Padya SahithyaCharithram,Kerala SahithyaAcademy,Trichur

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

	LANGUAGE : SANSKRIT- III	**SEMESTER III**
25LSU301G		**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**	
	End Semester Exam: 3 Hours	
(Drama and History of Sanskrit Literature)		

COURSE OBJECTIVES(CO):

- The fundamental objective of the curriculum is to impart effective science education at the undergraduate level, exposing them to recent trends and developments in the subject.
- Creating scientific temper is another major objective of this curriculum.
- Another major thrust given here is to develop an environmental concern in all activities of the students. 'Go green', the motto of the syllabus emphasizes the urgent need to conserve nature without destruction of natural resources.

COURSE OUTCOMES(COs):

- **Critical Thinking**: Take informed actions after identifying the assumptions that frame students' thinking and actions.
- **Problem Solving**: Understand and solve problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired.
- **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development.
- **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

UNIT-I **10 HOURS**

History of Sanskrit Drama and its origin.

UNIT – II **10 HOURS**

Important Sanskrit Dramas and important authors.

UNIT – III **10 HOURS**

Text Prescribed: "Dutavakyam" of Bhasa, (First half)

UNIT – IV **09 HOURS**

Text Prescribed: "Dutavakyam" of Bhasa, (Second half)

UNIT – V

Translation: From the known passages of the above text. **09 HOURS**

TOTAL: 48 HOURS

Drama text book available at:

- *Dutavakyam of Bhasa***,** **(**2017**).** R.S. Vadhyar and Sons**,** Palghat**,** Kerala

CO, PO, PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**	**PSO1**	**PSO2**
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Language : French - III	SEMESTER III
25LFU301G	**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**
	End Semester Exam: 3 Hours
(HISTOIRE, HISTOIRE DE LA LITTÉRATURE FRENCAIS, ROMAN, RÉDACTION DE LETTRES)	

PREREQUISITE:
Not Required

COURSE OBJECTIVES (CO):
The objectives of this course are

- To enable students to recognizenative accent and usage of French language.
- To help students to become autonomous and self-directed French language learners.
- To produce entrepreneurs among students by making them French language trainers and take communicative French to schools and colleges around.

COURSE OUTCOMES (COs):
At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	Identify new words by employing vocabulary building techniques.	Apply
CO2	Build correct sentence structures and grammatical patterns in oral and written communication	Apply
CO3	develop the ability to speak French language with the way of pronunciation.	Understand
CO4	Follow leadership, work ethics and management principles	Analyze
CO5	express values and skills gained through effective communication to other disciplines.	Analyze

Unite – I **9 HOURS**

a) Leçon – Vivre la ville,,Visiter une ville

b) Communication - Indiquer le chemin

c) Grammaire - La comparaison,Les prépositions avec les noms

géographiques,Les pronoms personnels COI

d) Lexique –La ville, Les lieux de la ville, Les transports

e) Culture – Le français : une ouverture sur le monde

Unité – II **9 HOURS**

a. Leçon -• On vend ou on garde ?

b. Communication -Demander des renseignements touristiques

c. Grammaire - Le pronom y (le lieu), La position des pronoms compléments Les verbes du premier groupe en -ger et -cer,

d. Les verbes ouvrir et accueillir

e. Lexique - Les points cardinaux,Les prépositions de lieu (2)

f. Culture –Le français : une ouverture sur le monde

Unité – III **10 HOURS**

a. Leçon

b. Communication- permetter,defendre.

c. Grammaire -La formation du pluriel (2)

d. Les adjectifs de couler,Les adjectifs beau, nouveau, vieux

e. Lexique - Les couleurs, Les formes,Les me

f. culture – les grandes fleuves en Francais.

Unite – IV **10 HOURS**

a. Leçon – Félicitations !

b. Communication - Décrire un objet

c. Grammaire - Les pronoms relatifs qui et que,

d. L'imparfait, Les verbes connaître, écrire, metteet vendre

e. Lexique – Les mesures, L'informatique

f. DIRE, LIRE, ECRIRE , Les sons [E] / [O] / [Œ]

g. Culture –Les lieux de la ville.

Unité - V **10 HOURS**

a. Leçon -En voyage !

b. Communication -• Présenter ses vœux, Faire une réservation

c. Grammaire - Les pronoms démonstratifs,La question avec Inversion,Les adverbes de manière, d.

Lexique -Les voyages,L'aéroport et l'avion,Les fêtes

e. Culture –Noël **TOTAL: 48 HOURS**

REFERENCE BOOKS:

1. Marie-Noëlle Cocton, 2015, ***Saison 1: méthode de français,*** Volume 89, Number 2, Johns Hop , Difier Paris.

2. Marion Alcaraz, Dorothée Escoufier, Camille Gomy, Mathilde Landier, Francine Quéméner, Delphine Ripaud, 2014, ***Saison 1- Cahier d'activites,*** Dider, Paris.

3. Anne Akvüz, Bernadette Bazelle-Shahmaei, Joëlle Bonenfant, Marie-Françoise Gliemann, 24 Aug. 2005, ***LES 500 EXERCICES DE GRAMMAIRE AVEC CORRIGÉS,*** Hachette Francais Langue Etrangere, Paris.

4. Christian Beaulieu, 2011, ***Je Pratique Exercice De Grammaire A1,*** French, Goyal Publishers, Paris.

5. Nathalie Bié, Philippe Santinan, April 2014, ***Grammaire pour adolescents 250 exercices,*** French, CLE INTERNATIONAL, Paris.

WEBSITES :

- http:// enseigner.tv5 monde.com/
- bonjourdumonde.com /exercises/contenu/le – francais-du- tourisme.html
- http://www.bonjurdefrance.com/
- https://www.lepointdufle.net/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25ENU301G **English- III** **3H–3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To enable students to recognizenative accent and usage of English language.
- To help students to become autonomous and self-directed English language learners.
- To produce entrepreneurs among students by making them English language trainers and take communicative English to schools and colleges around.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Identify new words by employing vocabulary building techniques.	Apply
CO2	Build correct sentence structures and grammatical patterns in oral and written communication	Apply
CO3	develop the ability to speak English language with the correct pronunciation.	Understand
CO4	Follow leadership, work ethics and management principles	Analyze
CO5	express values and skills gained through effective communication to other disciplines.	Analyze

UNIT I **8 HOURS**

Listening: Listening Comprehension-Listening for Specific Information- Interpreting Charts and Diagrams

UNIT II **7 HOURS**

Speaking: Essentials of effective Communication- Telephone Skills: Understanding Telephone Conversation - Handling Calls-Leaving Messages-Making Requests-Giving Instructions and Orders.

UNIT III **7 HOURS**

Reading: Reading with a purpose-Skimming and Scanning-Locating Main Points- Reading Critically-Sequencing of Sentences-Reading Comprehension

UNIT IV **7 HOURS**

Writing: Descriptive and Narrative-Safety Instructions- Suggestions-Expansion of Abbreviations-Spellings Rules Translation- Translating Short Sentences and Passages from English to Tamil

UNIT V **7 HOURS**

Vocabulary: Synonyms-Antonyms-Prefixes-Suffixes- Idioms- Different Types of English-Homonyms and Homophones (British and American)

Total: 36 HOURS

TEXT BOOKS

1. Board of Editors (2024). *Proficiency in Communication I*. Karpagam Academy of Higher Education

REFERENCE BOOKS:

1. Martins St. (2013). *Oxford Handbook of Writing: Handbook of Writing* Cambridge University Press.
2. Wren & Martin, (2008). *High School English Grammar & Composition*, S. Chand & Company Ltd, Board of Editors,
3. Krashen, Stephen D. (1982). Principles and practice in second language acquisition. New York: Pergamon Press.

WEB SITES:

1. https://www.scribbr.com/

2. https://www.quora.com/

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2.5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25MBU301 **Virology and Parasitology** **5H–4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Introduction to Microbiology and Microbial Diversity (25MBU101)

COURSE OBJECTIVES (CO):

- To study general aspects of viruses, classification, replication, interactions and immUNITy to virus
- To explain the virus classification based on host, genome, mode of replication and structure or shape
- To study the vaccine development, antiviral drug and interferons in therapy

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand of types of virus that infect plant, microbes and animals	Understand
CO2	Describe virus entry, gene expression and regulation	Apply
CO3	Comprehend the intricate interaction between viruses and host cells	Understand
CO4	Explain mechanisms of antiviral drugs, interferons and immunotherapy	Understand
CO5	Learn and practice viral vaccines and vaccine development	Apply

UNIT I History of viruses, virus multiplication and replication **10 HOURS**

History of viruses. Properties of virus. Origin of virus. Structure, Classification, nomenclature of viruses. Viral replication strategies as per Baltimore classification. DNA virus, RNA virus and retrovirus replication. Study of following diseases – Causative agents, Mode of transmissions, Pathogenicity, Symptoms and prophylaxis of Hepatitis, Dengue, AIDS, Influenza Adeno virus, Ebola, Chikungunya, Coronavirus (COVID-19) and omicron virus.

UNIT II Bacteriophages **10 HOURS**

Diversity, classification, one step multiplication curve, lytic and lysogenic life cycle of lambda phage, Genome of lambda phage, F2 phage, Ff phage concept of early and late proteins, regulation of transcription in lambda phage.

UNIT III Transmission of virus, genome organization of virus **10 HOURS**

Modes of viral transmission in plant and animals. Viral genome size and organization. Salient features of viral nucleic acid (unusual bases, overlapping genes, splicing genes, terminal redundancy, cohesive ends, capping and tailing).

UNIT IV Unconventional virusOncogenic virus, and anti-viral therapy **15 HOURS**

Oncogenic viruses and its types, General characters, epidemiology, pathogenicity, disease caused mechanism. Concept of viroids, virusoids, satellite viruses, Virophage and Prions. Antiviral compounds and their mode of action. Interferon and their mode of action. Viral vaccines and vaccine development. Applications of gene therapy and phage display in disease control.

UNIT VParasitology **15 HOURS**

The detailed study of following diseases– Causative agents, Mode of transmissions, Pathogenicity, Symptoms and prophylaxis, diagnosis of Amoebiasis, Giardiasis, Elephantiasis, Taeniasis, Malaria, Kala-azar.

Total: 60 HOURS

TEXT BOOKS:

1. Dimmock, N.J., Easton., A.L., Leppard, K.N. (2007). *Introduction to Modern Virology*. 6th edition, Blackwell Publishing Ltd.
2. Wagner, E.K., Hewlett, M.J. (2004). *Basic Virology*. 2nd edition. Blackwell Publishing.
3. Nayud, M.V. (2008). *Plant Viruses*. Tata McGraw Hill, India.
4. Ananthanarayanan R and CK Jayaram Panicker. (2017). *Textbook of Microbiology* 10th Ed. Orient Longman.

REFERENCE BOOKS:

1. Carter J., and Saunders, V. (2007). *Virology: Principles and Applications*. John Wiley and Sons.
2. Flint, S.J., Enquist, L.W., Krug, R.M., Racaniello, V.R., Skalka, A.M. (2004). *Principles of Virology, Molecular biology, Pathogenesis and Control*. 2nd edition. ASM press Washington DC.
3. Levy, J.A., Conrat, H.F., Owens, R.A. (2000). *Virology*. 3rd edition. Prentice Hall publication, New Jersey.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	3	-
CO3	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	-	3	3	-	-	-	3	-	-	-	-	-	-	-	3	-
Average	**2**	**-**	**3**	**3**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25MBU302 Microbial Genetics 4H–4C

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Introduction to Microbiology and Microbial Diversity (25MBU101)

COURSE OBJECTIVES (CO):

- To discuss the microbial genes, genomes, and expression in microorganism
- To understand the Transcription and Translation Process.
- To impart knowledge about the transposable elements and their importance.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the Molecular Biology with unique reference to microbial genome.	Understand
CO2	Describe the nature of molecular world and its application in modern Microbiological sectors.	Understand
CO3	Comprehend the process of Mutation and mutagenesis.	Understand
CO4	Acquire knowledge about the central dogma of biology.	Understand
CO5	Explain the concepts of genetic recombination techniques.	Apply

UNIT I History of genetics **9 HOURS**

DNA as a genetic material, Experimental evidence: Griffith's Experiment, very, MacLeod, and McCarty Experiment: DNA as the Transforming Principle. Hershey-Chase Experiment. Experimental Evidence for RNA as Genetic Material. DNA structure, models of DNA, RNA structure and types.

UNIT II Prokaryotic and Eukaryotic chromosomes **9 HOURS**

Organization of Prokaryotic and Eukaryotic chromosomes. Chromatin organization.Solenoid model.Nucleosomes and histones. Complexity of genome. Human DNA sequence organization. Satellite, minisatellite, LINEs, SINEs, mitochondrial DNA.

UNIT III Genome- Replication, transcription, translation **9 HOURS**

Central dogma of biology Replication, transcription, translation and Protein synthesis.virology and Post transcriptional and translational modification. Operon concept- Lactose, tryptophan. Genetic recombination in bacteria- Conjugation, Transformation-Transduction and its types.

UNIT IV Mutations **9 HOURS**

Mutations and mutagenesis, types of mutations and mutagens. Identification of mutants- Ames test, Luria Delbruck experiments. DNA repair mechanisms and its types.

UNIT V Transposons **12 HOURS**

Transposons-definition, types of Transposons, mechanism of transposition and application. Mu transposon elements and eukaryotic transposable elements and applications.

Total: 48 HOURS

TEXT BOOKS:

1. Klug, W.S., Cummings, M.R., Spencer, C., Palladino, M. (2011). *Concepts of Genetics*,10th edition, Benjamin Cummings.
2. Gardner, E.J., Simmons, M.J., Snustad, D, P. (2018). *Principles of Genetics*. 8th edition, Wiley- India.

REFERENCE BOOKS:

1. Krebs, J., Goldstein, E., Kilpatrick, S. (2013). *Lewin's Essential Genes*, 3rd edition, Jones and Bartlett Learning.
2. Pierce, B.A. (2011). *Genetics: A Conceptual Approach*, 4th edition, Macmillan Higher Education Learning.
3. Watson, J, D., Baker, T.A., Bell, S.P., et al. (2008). *Molecular Biology of the Gene*, 6th edition, Benjamin Cummings.
4. David P. Clark, Michelle R. McGehee, and Nanette J. Pazdernik. *Molecular genetics* 3RD edition.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	3	2	-	-	-	2	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-	3	3
Average	**3**	**-**	**-**	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25MBU303A **Microbes in Sustainable Agriculture And Development** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Microbial Physiology and Metabolism (25MBU201)

COURSE OBJECTIVES (CO):

- To be aware of the role of microbes which make crop output more and increase the fertility of crops.
- To gain the knowledge of physiological processes that advocating microbial development and evolution
- To make them to understand issues related to plant nutrition, quality improvement, environmental adaptation, transgenic crops and their use in agriculture

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Comprehend the role of microbes in soil fertility and other parameters	Understand
CO2	Make use of microbes as and biocontrol agents and for Bioconversion of organic wastes	Apply
CO3	Produce biofertilizers using various microorganisms	Create
CO4	Develop novel combinations of microbes as biofertilizers	Create
CO5	Explore microbes for Biotech feed, Silage, Bio manure, biogas, biofuels and in transgenics	Apply

UNIT I **7 HOURS**

Soil as Microbial Habitat, Soil profile and properties, Soil formation, Role of microbes in soil fertility, Factors influencing the microbial density in the soil, Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus, phosphate, nitrate, silica and potassium.

UNIT II **7 HOURS**

Role of microbes in production and control of carbon dioxide, methane, nitrous oxide and nitric oxide, Microbial interactions- Mutualism, Protocooperation, Commensalism, Neutralism, Competition, Amensalism, Parasitism, Predation, Syntrophism,

UNIT III **8 HOURS**

Biocontrol mechanisms and ways- direct antagonism, indirect antagonism and mixed path antagonism Microorganisms used as biocontrol agents against Microbial plant pathogens, Insects, Weeds. Recycling of agriculture waste, Bioconversion of organic wastes-sugarcane wastes. Role of microbes in composting process –coir-pith composition-composting, principles and applications.

UNIT IV **7 HOURS**

Plant growth promoting bacteria, biofertilizers – symbiotic (*Bradyrhizobium, Rhizobium, Frankia*, VAM, potash solubilizer), Non-Symbiotic (*Azospirillum, Azotobacter*, Mycorrhizae, MHBs, Phosphate solubilizers, algae), Novel combination of microbes as biofertilizers, PGPRs, Marine resource biofertilizers, vermicomposting.

UNIT V **7 HOURS**

Biotech feed, Silage, Bio manure, biogas, biofuels – advantages and processing parameters, GM crops, Bt crops, golden rice, transgenic animals.

Total: 36 HOURS

TEXT BOOKS:

1. Stephen Burchett, Sarah Burchett (2018) *Plant Pathology*, 1st Edition, Garland Science.
2. Sangita Sahni, Bishun Deo Prasad, Prasant Kumar (2017) *Plant Biotechnology*, Volume 2: Transgenics, Stress Management, and Biosafety Issues, 1st Edition, Apple Academic Press.
3. Pradeep Kumar, Jayanta Kumar Patra, Pranjal Chandra (2018) *Advances in Microbial Biotechnology: Current Trends and Future Prospects*, 1st Edition, Apple Academic Press.
4. Tanya E. Cheeke, David C. Coleman, Diana H. Wall (2012) *Microbial Ecology in Sustainable Agroecosystems*, 1st Edition, CRC Press.

REFERENCE BOOKS:

1. Ching T. Hou, Jei-Fu Shaw (2019). *Biocatalysis and Agricultural Biotechnology*, 1st Edition, CRC Press.
2. Parmjit S. Panesar, Satwinder S. Marwaha (2017). *Biotechnology in Agriculture and Food Processing: OpportUNITies and Challenges*, 1st Edition, CRC Press.
3. Noureddine Benkeblia (2019). *Sustainable Agriculture and New Biotechnologies*, 1st Edition CRC Press.
4. Allen I. Laskin (2017). *Microbial Ecology*, 1st Edition, CRC Press.
5. Glick BR, Pasternak JJ, and Patten CL (2010). *Molecular Biotechnology*, 4th Edition, ASM Press.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-		-	2	-	-	-	-	-	-	-	2	-
CO2	-	-	-	3	-	3	-	-	-	-	3	-	-	-	2	-	3
CO3	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3
CO4	2	-	1	2	-	3	-	-	-	-	3	-	-	-	2	-	3
CO5	2	-		2	-	3	-	2	-	-	-	-	-	-	-	-	3
Average	**2**	**-**	**1**	**2.25**	**-**	**3**	**-**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**2**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25MBU303B **Biosafety, Bioethics and Intellectual Property Rights** **3H–3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To learn the basic handling of microorganisms.
- To emphasize on IPR issues and need for knowledge in patents in biotechnology.
- To gain knowledge on steps of a patenting process and the role of biosafety committee.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand safety aspects in biological laboratory.	Understand
CO2	Comprehend Biosafety guidelines and regulations of international standard	Understand
CO3	Criticize agreements and Treaties on safety aspects	Evaluate
CO4	Acquire in-depth knowledge in Intellectual Property Rights and its importance	Understand
CO5	Analyze the principles of quantitative and qualitative patenting methods for paten filing.	Analyze/Apply

UNIT I Biosafety: **7 HOURS**

Definition and importance, secondary handling in lab. Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms.

UNIT II Biosafety Guidelines: **7 HOURS**

Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of International Agreements - Cartagena Protocol. Bio Rap, safety regulation for handling lab microbes.

UNIT III AERB/RSD/RES guidelines **7 HOURS**

AERB/RSD/RES guidelines for using radioisotopes in laboratories and precautions. Agreements and Treaties: GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement; WIPO Treaties; Buda pest Treaty on international recognition of the deposit of microorganisms; UPOV& Berne conventions; Patent Co-operation Treaty (PCT); Indian Patent Act 1970 & recent amendments.

UNIT IV Introduction to Intellectual Property **7 HOURS**

Introduction to Intellectual Property: Patents, Types, Trademarks, Copyright & Related Rights, Industrial Design and Rights, Traditional Knowledge, Geographical Indications-importance of IPR– patentable and nonpatentable– patenting life–legal protection of biotechnological inventions–World Intellectual Property Rights Organization (WIPRO).

UNIT V Grant of Patent **8 HOURS**

Grant of Patent and Patenting Authorities: Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; An introduction to Patent Filing Procedures; Patent licensing and agreement; Patent infringement -meaning, scope, litigation, case studies, Rights and Duties of patent owner.

Total: 36 HOURS

TEXT BOOKS:

1. Bare Act, (2007). *Indian Patent Act 1970 Acts & Rules*, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
2. Kankanala C . (2007). *Genetic Patent Law & Strategy*,1st Edition, Manupatra Information Solution Pvt. Lt d. New Delhi.
3. Mittal, D.P. (1999). *Indian Patents Law*, Taxmann, Allied Services (p) Ltd.
4. Singh K K. (2015). *Biotechnology and Intellectual Property Rights*: Legal and Social Implications, Springer India.

WEBSITES:

1. https://biorrap.gov.in/Home/FAQ

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	-	-		-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	2	-	-	-	-	-	-	2	-	-	-	-
CO5	2	-	-	-	2		-	1	-	-	-	-	-	-	-	-	-
Average	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25MBU311 **Virology and Genetics - Practical** **5H–2C**

Instruction Hours/week: L:0 T:0 P:5 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Virology (25MBU301**)**
- Microbial Genetics (25MBU302)

COURSE OBJECTIVES (CO):

- To demonstrate general aspects of virus structure and classification
- To teach the students about the virus isolation, propagation of various viruses.
- To study isolation and quantification of DNA.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Demonstrate the structure of plants, animal, bacteria viruses using electron micrographs	Understand
CO2	Practice isolation, propagation of various viruses.	Apply
CO3	Perform isolation and quantification of DNA	Apply
CO4	Distinguish the viruses according to their characteristic features.	Evaluate
CO5	Use techniques for bacterial conjugation, transformation and transduction.	Apply

EXPERIMENTS **60 HOURS**

1. Isolation and enumeration of bacteriophages (PFU) from water/sewage sample using double agar layer technique.
2. Isolation, purification and assay of virus - Demonstration.
3. Preparation of Master and Replica Plates.
4. Perform Bacterial Conjugation.
5. Perform bacterial transformation.
6. Perform transduction with bacteriophage.
7. Isolation of total DNA from environmental sample.
8. Quantification of DNA using agarose gel electrophoresis.
9. Studying isolation and propagation of animal viruses by chick embryo technique. (Demo)
10. Study of cytopathic effects of viruses using photographs.
11. Perform local lesion technique for assaying plant viruses.

TEXT BOOKS: **Total: 60 HOURS**

1. Klug, W.S., Cummings, M.R., Spencer, C., Palladino, M. (2011). *Concepts of Genetics*,10th edition, Benjamin Cummings.
2. Wagner, E.K., Hewlett, M.J. (2004). *Basic Virology*. 2nd edition. Blackwell Publishing.
3. Ananthanarayanan R and CK Jayaram Panicker. (2017). *Textbook of Microbiology* 10th Ed. Orient Longman.

REFERENCE BOOKS:

1. David P. Clark, Michelle R. McGehee, and Nanette J. Pazdernik. *Molecular genetics* 3rd edition.
2. Flint, S.J., Enquist, L.W., Krug, R.M., Racaniello, V.R., Skalka, A.M. (2004). *Principles of Virology, Molecular biology, Pathogenesis and Control*. 2nd edition. ASM press Washington DC.
3. Levy, J.A., Conrat, H.F., Owens, R.A. (2000). *Virology*. 3rd edition. Prentice Hall publication, New Jersey.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3
CO2	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO4	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	1	-	3	2	-	-	-	2	1	-	-	-	-	-	-	-	3
Average	**2**	**-**	**3**	**2**	**2**	**2**	**-**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25MBU312A **Microbes in Sustainable Agriculture and Development Practical** **4H-1C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Microbes in Sustainable Agriculture and Management (25MBU602)

COURSE OBJECTIVES (CO):

- To evaluate the application of ecological principles and concepts in sustainable agriculture system.
- To know the role of microbes which make crop output more and increase the fertility of crops**.**
- To design a biogas plant.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Study the microflora of different types of soils and its physical and chemical properties	Analyze
CO2	Learn and practice biofertilizer production and develop entrepreneur skill related to agriculture field.	Apply
CO3	Device biogas plant	Create
CO4	Practice techniques in isolation of urea decomposers and nitrate utilizers	Apply
CO5	Learn and Isolate various degrading microorganisms like PHB; analyse soil microbe activity	Apply

EXPERIMENTS **(48 HOURS)**

1. Isolation of microorganisms from soil
2. Isolation of microorganisms from Rhizosphere soil.
3. Preparation of compost
4. *Rhizobium* and *Azotobacter* as soil inoculants characteristics
5. Design and functioning of a biogas plant
6. Isolation of cellulose degrading organisms, urea decomposers and nitrate utilizers
7. Screening of bacterial isolates for PHB production by using “Sudan black B” method
8. Estimation of soil microbial activity- CO_2 evolution method

TEXT BOOKS: **Total: 48 HOURS**

1. Sangita Sahni, Bishun Deo Prasad, Prasant Kumar (2017) *Plant Biotechnology*, Volume 2: Transgenics, Stress Management, and Biosafety Issues, 1st Edition, Apple Academic Press.
2. Allen I. Laskin (2017) *Microbial Ecology*, 1st Edition, CRC Press.
3. Tanya E. Cheeke, David C. Coleman, Diana H. Wall (2012) *Microbial Ecology in Sustainable Agro ecosystems*, 1st Edition, CRC Press
4. Pradeep Kumar, PhD., Jayanta Kumar Patra, Pranjal Chandra (2018) *Advances in Microbial Biotechnology: Current Trends and Future Prospects*, 1st Edition, Apple Academic Press.

REFERENCE BOOKS:

1. Stephen Burchett, Sarah Burchett (2018). *Plant Pathology*, 1st Edition, Garland Science.
2. Ching T. Hou, Jei-Fu Shaw (2019) *Biocatalysis and Agricultural Biotechnology***,** 1st Edition, CRC Press.

3. Parmjit S. Panesar, Satwinder S. Marwaha (2017) *Biotechnology in Agriculture and Food Processing: OpportUNITies and Challenges*, 1st Edition, CRC Press.
4. Noureddine Benkeblia (2019) *Sustainable Agriculture and New Biotechnologies*, 1st Edition CRC Press.
5. Glick BR, Pasternak JJ, and Patten CL (2010) *Molecular Biotechnology*, 4th Edition, ASM Press.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	-	-	-		-	-	-		3	-
CO2	1	-	-	3	-	2	-	3	-	-	2	-	-	-	2	-	3
CO3	1	-	-	3	-	3	-	3	-	-	3	-	-	-	2	-	3
CO4	-	-	-		2	3	-	3	-	-		-	-	-		-	3
CO5	3	-	-	2		3	-	2	-	-	1	-	-	-	1	-	3
Average	**2**	**-**	**-**	**3**	**2**	**3**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25MBU312B **Biosafety, Bioethics and Intellectual Property Rights Practical** **4H–1C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Biosafety and Intellectual Property Rights (25MBU303B)

COURSE OBJECTIVES (CO):

- To understand the various biological containments.
- To emphasize on IPR issues and need for knowledge in patents in biotechnology.
- To gain knowledge on steps of a patenting process and the role of biosafety committee.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Perform basic techniques in standard Microbiological practices	Apply
CO2	Understand and practice biosafety procedures	Apply
CO3	Execute microbial decontamination and risk management practices	Apply
CO4	Get trained in techniques for primary applications of patents	Apply
CO5	Analyze critically the bioethical principles	Analyze

EXPERIMENTS **48 HOURS**

1. Study of components and design of a BSL-III laboratory
2. Perform Standard Microbiological practices
3. Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents.
4. Decontamination in Microbiological Laboratory
5. Risk management methodology.
6. Filing applications for approval from biosafety committee
7. Filing primary applications for patents
8. Study on step sofa patenting process
9. Principles of biomedical ethics.

TEXT BOOKS: **Total**: **48 HOURS**

1. Mittal, D.P. *Indian Patents Law*, Taxmann, Allied Services(p)Ltd. 1999.
2. Singh K K *Biotechnology and Intellectual Property Rights: Legal and Social Implications*, Springer India. 2015.

REFERENCE BOOKS:

1.Bare Act. Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
2.Kankanala C. Genetic Patent Law & Strategy,1st Edition, Manupatra Information Solution Pvt Ltd. New Delhi. 2007.
3. Goel D & Prashar S IPR, Biosafety and Bioethics. Pearson. 2013.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	2	-	-	-	3	-	-	-	-	-	-	-	3	-
CO2	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	2	-	-	3	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	3	-	-	-	-	2	-	-	-	3
CO5	-	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**-**	**2**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25VAC301G **Community Engagement and Social Responsibilty** **2H–2C**

Instruction Hours/week: L:2 T:0 P:0 **Marks:** Internal**:100** External**:-** **T**otal**:100**

End Semester Exam: 3 Hours

PRE-REQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To gain insights into the structures, challenges, and opportUNITies within commUNITies
- To explore ethical frameworks and dilemmas related to commUNITy engagement and social responsibility
- To develop skills in monitoring, evaluating, and reporting on the outcomes of commUNITy engagement efforts to ensure effectiveness and accountability.

COURSE OUTCOMES (COs):

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

COs	Course Outcomes	Blooms Level
CO1	Understand the concept, ethics, and spectrum of commUNITy engagement	Understand
CO2	Recognize the significance in local commUNITy development and rural culture.	Understand
CO3	Know the rural development programs, institutions	Understand
CO4	Comprehend methods for waste management	Understand
CO5	Implement policies for hygiene and sanitation among waste management workers	Apply

UNIT I INTRODUCTION AND PRINCIPLES **5 HOURS**

Concept, Ethics and Spectrum of CommUNITy engagement, Local commUNITy, Rural culture and Practice of commUNITy engagement - Stages, Components and Principles of commUNITy development, Utility of public resources. Contributions of self-help groups

UNIT II RURAL DEVELOPMENT **5 HOURS**

Rural Development Programs and Rural institutions Local Administration and CommUNITy Involvement- Social contribution of commUNITy networking, Various government schemes. Programmes of commUNITy engagement and their evaluation.

UNIT III COMMUNITY AND RESEARCH **5 HOURS**

CommUNITy Engaged Research and Ethics in CommUNITy Engaged Research Rural Distress, Rural Poverty, Impact of COVID-19 on Migrant Laborers, Mitigation of Disaster.

UNIT IV WASTE MANAGEMENT **5 HOURS**

Waste management in rural and sub-urban areas; Government schemes on waste management; Types of waste. Collection, segregation, handling and dispersion of waste. Biomedical waste – Color code. The role of microorganisms in Waste management.

UNIT V PERSONAL CARE **4 HOURS**

Personal care and hygiene for the waste management workers. Psychological wellbeing of the workers. Women folk health care and sanitary practices.

Total: 24 HOURS

TEXT BOOK:

1. *Principles of CommUNITy Engagement,* (2011).2nd Edition, NIH Publication No. 11-7782.
2. Tripathy, S.N., and Panda, S., (2011). *Fundamentals of Environmental Studies*; 3rdEdition, Vrianda Publications Private Ltd., New Delhi.
3. Kumar, A., (2004). *A Textbook of Environmental Science*; APH Publishing Corporation, New Delhi.

REFERENCE BOOKS:

1. Singh, M.P., Singh, B.S., and Dey, S.S., (2004). *Conservation of Biodiversity and Natural Resources.* Daya Publishing House, Delhi.
2. Uberoi, N.K., (2010). *Environmental Studies*, Excel Books Publications, New Delhi, India.
3. Maier RM, Pepper IL, Gerba CP (2019). *Environmental Microbiology*, Elsevier.
4. Bruce E Rittmann and Perry L McCarty. *Environmental Biotechnology. Principles and Applications*. McGraw-Hill International (2020) 2ndedition.

WEBSITES:

1. https://youtu.be/-SQK9RGBt7o
2. https://www.uvm.edu/sites/default/files/commUNITy_engagement_handout.pdf (Comm UNITy Engagement)
3. https://www.atsdr.cdc.gov/commUNITyengagement/pce_concepts.html (Perspectives of CommUNITy).
4. https://egyankosh.ac.in/bitstream/123456789/59002/1/UNIT1.pdf(commUNITy concepts)
5. https://sustainingcommUNITy.wordpress.com/2013/07/09/ethics-and-commUNITy-engagement/ (Ethics of commUNITy engagement)
6. https://www.preservearticles.com/sociology/what-are-the-essential-elements-of-commUNITy/4558 (Elements of CommUNITy)
7. https://www.yourarticlelibrary.com/sociology/rural-sociology/rural-commUNITy-top-10-characteristics-of-the-rural-commUNITy-explained/34968 (features of rural commUNITy)
8. https://www.mapsofindia.com/my-india/government/schemes-for-rural-development-launched-by-government-of-india (Government programmes for rural development)
9. https://www.yourarticlelibrary.com/sociology/rural-sociology/rural-commUNITy-top-10-characteristics-of-the-rural-commUNITy-explained/34968 (rural lifestyle)
10. https://www.insightsonindia.com/social-justice/issues-related-to-rural-development/government-schemes-for-rural-development-in-india/ (schemes for rural development)
11. https://www.mpgkpdf.com/2021/09/commUNITy-development-plan-in-hindi.html?m=1
12. https://images.app.goo.gl/sNF2HMWCuCfkqYz56
13. https://images.app.goo.gl/VaMNNMEs77XyPMrP7

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PO S2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	2	-	-	-	-	-	-	-	-	-	2	2	-
CO5	-	-	-	3	2	-	-	-	-	-	-	-	2	-	-	2	-
Average	-	-	-	**3**	**2**	-	-	-	-	-	-	-	**2**	-	**2**	**2**	-

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25MBU391	**Internship - I**	**0H- 2C**

Instruction Hours/week: L:0 T:0 P:0 **Marks: Internal:100 External: - Total:100**

End Semester Exam: -

25LTU401G	**Language : Tamil - IV**	**SEMESTER IV** **4H - 3C**
Instruction Hours/week : L : 4 T : 0 P : 0		**Marks : Internal : 40 External : 60 Total : 100** **End Semester Exam : 3 Hours**
தமிழக வரலாறும் பண்பாடும்		

பாடத்திட்டப் பொதுநோக்கம்

- கற்றல் வழி சிந்தனைத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும், மேம்படுத்துதல்.
- அரசுத் தேர்வுகளுக்கு மாணவர்களை ஆயத்தமாக்குதல்; திறனாய்வு நோக்கை மேம்படுத்துதல்.
- இலக்கியங்களின் வழி மனித வாழ்வியலை உணர்த்துதல்.
- இன்புறுத்தல் மற்றும் அறிவுறுத்தல் நிலைகளில் இலக்கியங்களின் பங்களிப்பை உணர்த்துதல்.
- இளைய தலைமுறையினருக்கு அற உணர்வு மற்றும் வாழ்வியல் மதிப்புகளை அறிவுறுத்துதல்.

பாடத்திட்டப் பயன்விளைவு

- இந்தியக் குடியுரிமைப்பணி முதலான போட்டித் தேர்வுகளில் இடம்பெறுகின்ற, ' தமிழ் இலக்கிய வரலாறு' குறித்த முழுமையான அறிமுகத்தை அடைதல்.
- தொல்லியல், கல்வெட்டியல் மற்றும் ஓலைச்சுவடியியல் சார்ந்த ஆவணத் தேடலுக்குரிய ஆய்வு மனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
- 'அறிவியல் தமிழ்' ; 'இணையத் தமிழ்' போன்ற தமிழின் வளர்ச்சித் துறைகள் சார்ந்த திறன் மேம்பாடு பெற்றிருத்தல்.
- வேலைவாய்ப்புக்குரிய வகையில் படைப்பாக்கத்திறன் முதலான மொழி ஆளுமை பெற்றிருத்தல்;
- சமூக வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக உள்ள இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி.

தாள்கள் வரிசையும் தேர்வுச் செயல் திட்டமும்

பகுதி-I தமிழ்

இளநிலைப்பட்ட அறிவியல் மற்றும் கலையியல் வகுப்புகள்

பருவம்	தாள்	கற்பிக்கும் நேரம்/வாரம்	தேர்வு மணிகள்	மதிப்பெண் அகமதிப்பீடு/பருவ எழுத்துத் தேர்வு	மொத்தம்	மதிப்புப் புள்ளிகள்
நான்கு	IV	4	3	40 / 60	100	3

25LTU401G	LANGUAGE : TAMIL - IV	SEMESTER IV 4H - 3C
Instruction Hours/week : L : 4 T : 0 P : 0	Marks : Internal : 40 External : 60 Total : 100 End Semester Exam : 3 Hours	

தமிழக வரலாறும் பண்பாடும்

அலகு - 1 தமிழக வரலாறும் நாட்டுப்பிரிவுகளும் 10 மணிநேரம்

பழைய கற்காலம் – புதிய கற்காலம் – இரும்புக்காலம் – சங்க கால மூவேந்தர் நாடுகள் (சேர, சோழ, பாண்டியர்கள்) – பிற்கால நாட்டுப் பிரிவுகள் – பல்லவர் நாடு – நடு நாடு – தொண்டை நாடு – கொங்கு நாடு.

அலகு – 2 தமிழகத்தில் கலை இலக்கிய வளர்ச்சி 10 மணிநேரம்

காலந்தோறும் தமிழகத்தில் கட்டடக்கலை – கோயிற்கலை – கூத்துக்கலை – நாடகக்கலை – ஆடற்கலை - சிற்பக்கலை – ஓவியக்கலை வளர்ச்சி – தமிழ் வளர்ச்சிக்குப் பக்தி இலக்கியங்களின் பங்களிப்பு.

அலகு – 3 தமிழர்களின் வணிகம் 08 மணிநேரம்

சங்க கால வணிகம் – தமிழர்களின் அயல்நாட்டு வணிகத்தொடர்பு – கிரேக்கர்கள் – ரோமர்கள் – மெளரியர்களுடனான வணிகத்தொடர்பு – நாணயங்கள்.

அலகு – 4 தமிழகப் பண்பாட்டில் கொங்கு நாடு 10 மணிநேரம்

கொங்கு நாடும் அதன் வரலாறும் – அரசர்கள் – சிற்றரசர்கள் – கொங்கு நாட்டு எல்லைகள் – கொங்கு நாடும் பிற பகுதிகளும் - புலவர்கள் – இலக்கியங்கள் – பண்பாட்டுச் சிறப்பு.

அலகு – 5 தமிழகத் தொல்லியல் ஆய்வுக்களங்கள் 10 மணிநேரம்

அரிக்கமேடு – ஆதிச்சநல்லூர் – அழகன்குளம் – கீழடி – கொடுமணல் – கொற்கை – மயிலாடும்பாறை – கங்கை கொண்ட சோழபுரம் போன்ற ஆய்வுக்களங்களில் கிடைத்துள்ள தமிழக வரலாற்றுக் குறிப்புகள்.

மொத்த மணிநேரம் - 48

TEXT BOOK T1 - **கற்பகச் சோலை – தமிழ்ப்பாட நூல், இலக்கிய இன்பம்,** தமிழ்த்துறை வெளியீடு, கற்பகம் உயர்கல்விக்கழகம், கோயம்புத்தூர் – 21.

பார்வை நூல்கள்

R1- **தமிழக வரலாறு மக்களும் பண்பாடும் – கே.கே.பிள்ளை –** உலகத் தமிழாராய்ச்சி நிறுவனம், தரமணி,சென்னை.

R2 - **தமிழக வரலாறும் பண்பாடும் – வே.தி.செல்வம் –** மணிவாசகர் பதிப்பகம், பிராட்வே, சென்னை.

இணையதளம்

W1-www.tvu.org.in

W2- www.maduraitamilproject.com

இதழ்கள்

J1- International Research Journal of Indian Literature, irjil.in

J2 - International Tamil Research Journal, iorpress.in

வினாத்தாள் கட்டமைப்பு

இடைத்தேர்வு - மொத்த மதிப்பெண்கள் 60

பகுதி – அ (இரு மதிப்பெண் வினாக்கள்) 6 X 2 = 12 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – ஆ (ஆறு மதிப்பெண் வினாக்கள்) 3 X 6 = 18 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பகுதி – இ (பத்து மதிப்பெண் வினாக்கள்) 3 X 10 =30 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

பருவத்தேர்வு - மொத்த மதிப்பெண்கள் 100

பகுதி – அ (இரு மதிப்பெண் வினாக்கள்) 10 X 2 = 20 (அனைத்து வினாக்களுக்கும் விடையளித்தல்) பகுதி – ஆ (ஆறு மதிப்பெண் வினாக்கள்) 5X 6 = 30 (அனைத்து வினாக்களுக்கும் விடையளித்தல்) பகுதி – இ (பத்து மதிப்பெண் வினாக்கள்) 5X 10=50 (அனைத்து வினாக்களுக்கும் விடையளித்தல்)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Language : Hindi - IV	SEMESTER IV
25LHU401G	**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**
	End Semester Exam: 3 Hours
(MODERN POETRY, ONE ACT, ESSAY, TRANSLATION)	

PREREQUISITE:
Not Required

COURSE OBJECTIVES(CO):

- Develop an interest in the appreciation of short stories
- Comprehend the grammatical structures and sentence making
- Understand the language and developing English to Hindi translation skill

COURSE OUTCOMES(COs):

- Learning the literacy knowledge of Hindi specially reading and writing .
- Learning the literary knowledge specially reading and understanding of Hindi short Stories
- Learning the history of Hindi literature.
- The ability to translate from Hindi to English and from English to Hindi will be improved.
- Develop a skill in spoken Hindi.

UNIT-I a) Poetry – Lakshmanan ke Bare Me **9 HOURS**

b) Bharath ka Bhagya

c) Essay – Dhokha

d) Translation – Lesson – 1 to 3

UNIT-II **a)** Poetry – Soorpanakha Ki Visheshatha **9 HOURS**

b) Bahu Ki Vida

c) Essay – Jabaan

d) Translation– Lesson – 4 to 6

UNIT-III a) Poetry– Kavya Ke AdharPar **10 HOURS**

b) Reed Ki Haddi

c) Essay – Kya Janvar Bhee Sochthi Hai

d) translation– Lesson – 7 to 9

UNIT-IV a) Khanda Kavya Ke Adhar Par Panchavati **10 HOURS** b) Rajputhni Ka Badhala

c) Essay – Shradha-Bhakthi

d) Translation– Lesson – 10 to 12

UNIT-V a) Kavya Ke Adhar Par Prakruthik Varnan **10 HOURS**

b) Bheem Aur Raakshas

c) Essay – Adhunik Nari

d) Translation – Lesson –13 to 15

TOTAL: 48 HOURS

REFERENCE BOOKS:

I. Gupt,M.S, **(**2015**)**. Panchavati**,** Bharathiya Sahithya Sangrah**,** Kanpur - 208002**,** Uttar Pradesh.

II. Hindi Prachar Sabha D.B**, (**2007**).** Adarsh Akanki**,** T.Nagar**,** Chennai - 600017**,** TamilNadu.

III. Ranjan,S.D,Dr.**, (**1987**).** Nibandh Nishchay**,** Hindi Sahithya Sammelan Prayag**,** 12**,** Sammelan Marg**,** Illahabadh.

IV. Hindi Prachar Sabha D.B**, (**2007**).** Anuvadh Abhyas - III**,** T.Nagar**,** Chennai - 600017**,** TamilNadu.

CO, PO, PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**	**PSO1**	**PSO2**
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Language : Malayalam - IV	Semester IV 4H-3C
25LMU401G	
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100** **End Semester Exam:** 3 Hours

COURSE OBJECTIVE:(CO)

- Knowledge of contemporary drama contents of Malayalam literature
- Learn Screen play and its techniques. The ability to read drama and express criticism about it and the ability to express social thoughts will improve
- There will also be litigation messages in Malayalam and news on speech techniques

Able to write articles on their own and improve their creative skills.

COURSE OUTCOME: (COs)

- Get a basic knowledge of drama
- Can read and critique Screenplay
- Create interest in art literature courses
- The hope of writing a Drama or a Screen Play
- The idea of creating new works and critique knowledge will improve.

Unit No.	MALAYALAM -IV	Hours
I	Screen Play - Perumthachan	**10**
II	Screenplay - Perumthachan	**10**
III	Drama - Saketham	**10**
IV	Drama - Saketham	**09**
V	Drama - Saaketham	**09**
	TOTAL	**48**

Text Books:

1. Vasudevan Nair M.T., (2015), *Perumthachan,* DC Books, Kerala
2. Sreekandan Nair C.N., (1974) *Saketham*, DC Books, Kerala

Reference Books:

1. Sankara Pillai G,(1980)Malayala Nataka Sahithya Charithram, Kerala Sahithya Akademi, Trissur
2. Vayala Vasudevan Pillai,(2005),Malayala Nataka Sahithya Charithram,Kerala Sahithya Akademi, Thrissur
3. SmarakaPrasanga Samithi C.J,(1963) Natakam OruPatanam, Koothattukulam Natakaroopacharcha, Kattumadam Narayanan ,NBS, Kottayam
4. Vijayakrishanan,(2024)Chalachithrasameeksha, Kerala Bhasha Institute,Current Book, Kottayam 5. Jose-K.Manual ,(2004)Cinemayude Paadangal,VisakalanavumVeekshanavum ,D C Book,Kerala

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

LANGUAGE : SANSKRIT - IV	**SEMESTER IV**
25LSU401G	**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**
	End Semester Exam: 3 Hours

(LYRICS, GRAMMAR AND TRANSLATION)

COURSE OBJECTIVES(CO):

- The fundamental objective of the curriculum is to impart effective science education at the undergraduate level, exposing them to recent trends and developments in the subject.
- Creating scientific temper is another major objective of this curriculum.
- Another major thrust given here is to develop an environmental concern in all activities of the students. 'Go green', the motto of the syllabus emphasizes the urgent need to conserve nature without destruction of natural resources.

COURSE OUTCOMES(COs) :

- **Critical Thinking** :Take informed actions after identifying the assumptions that frame students' thinking and actions.
- **Problem Solving**: Understand and solve problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired.
- **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development.
- **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

UNIT-I **10 HOURS**

Introduction to Sanskrit Lyrics and erotic literature.

UNIT – II **10 HOURS**

Devotional Literature, Important works

UNIT – III **10 HOURS**

Krishnakarnamrita of Leelasuka (Second Section only)

UNIT – IV **09 HOURS**

Grammar – Past tense, Declension of personal pronouns

UNIT – V

Simple sentences from Sanskrit Self Teacher **09 HOURS**

TOTAL: 48 HOURS

Drama text Book Available at:

- *Krishnakarnamrita of Leelasuka***,** (2013). Sri Ramakrishna Mud, Mylapore**,** Chennai.

CO, PO, PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**	**PSO1**	**PSO2**
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

	Language : French - IV	**SEMESTER IV**
25LFU401G		**4H-3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60 T**otal**:100**	
	End Semester Exam: 3 Hours	

(COMPREHENSION, TRADUSION, REDUCTION, UNE ACT)

PREREQUISITE:
Not Required

COURSE OBJECTIVES (CO):
The objectives of this course are:

- To provide the students with an ability to build and enrich their communication skills.
- To help them think and write imaginatively and critically.
- To strengthen their professional skills.

COURSE OUTCOMES (COS):
At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	make the students proficient communicators in French.	Apply
CO2	develop learners' ability to understand French.	Understand
CO3	understand the nuances of listening, speaking and reading French.	Understand
CO4	prepare the learners to face situations with confidence and to seek employment in the modern globalized world.	Apply
CO5	build the students' ability to listen and to speak French better.	Apply

Unite – I **9 HOURS**

a) Leçon – On fait le ménage !

b) Communication - Protester et réagir

c) Grammaire - Le présent progressif, Les pronoms possessifs
La phrase négative (3)

d) Lexique – Le logement,La maison,Les pièces

e) Culture – Paris et ses symboles

Unite – II **9 HOURS**

a) Leçon – À propos de logement

b) Communication – Exprimer l'intérêt et l'indifférence

c) Grammaire – Quelques adjectifs et pronoms indéfinis

Les verbes lire, rompre et se plaindre

d) Lexique – Meubles et équipement,Les tâches ménagères

e) Culture – Les fêtes et les traditions en France

Unite – III **10 HOURS**

a) Leçon – Tous en forme ! Accidents et catastrophes

b) Communication – Raconter au passé

c) Grammaire – Le passé composé et l'imparfait
Le passé récent, L'expression de la durée,

d) Lexique – Le corps humain : l'extérieur,Le corps humain :

l'intérieur Les maladies et les remèdes

e) Culture – La longue histoire de la Francophonie

Unite – IV **10 HOURS**

a) Leçon – Faire ses études à l'étranger

b) Communication -• Exprimer la peur et rassurer

c) Grammaire - Les adjectifs et les pronoms ,indéfi nis : rien, personne, aucun Les verbes dire, courir et mourir

d) Lexique – Les accidents,Les catastrophes naturelles

e) Culture - Les jeux de la Francophonie .

Unite – V **10 HOURS**

a) Leçon – Bon voyage !La mété

b) Communication - Exprimer son opinion, Parler de la météo

c) Grammaire - Les pronoms démonstratifs neutres
Le futur simple, Situer dans le temps

d) Lexique – Le système scolaire,Les formalités pour partir à

l'étranger La météo

e) Culture- Le français hors de France

TOTAL: 48 HOURS

REFERENCE BOOKS:

1. Marie-Noëlle Cocton, December 2015, ***Saison 1: méthode de français,*** Volume 89, Number 2, Johns Hopkins University Press, Difier Paris.
2. Marion Alcaraz, Dorothée Escoufier, Camille Gomy, Mathilde Landier, Francine Quéméner, Delphine Ripaud, 2014, ***Saison 1- Cahier d'activites,*** Dider, Paris.
3. Anne Akvüz, Bernadette Bazelle-Shahmaei, Joëlle Bonenfant, Marie-Françoise Gliemann, 24 Aug. 2005, ***LES 500 EXERCICES DE GRAMMAIRE AVEC CORRIGÉS,*** Hachette Francais Langue Etrangere, Paris.
4. Anne Akyüz,Bernadette Bazelle- Shahmael,JoëlleBonenfant, Marie- Françoise Gliemenn,Les ***exercices de grammaire,Hachette FLE,*** Paris,2005
5. Christian Beaulieu, 2011, ***Je Pratique Exercice De Grammaire A1,*** French, Goyal Publishers, Paris.
6. Nathalie Bié, Philippe Santinan, April 2014, ***Grammaire pour adolescents 250 exercices,*** French, CLE INTERNATIONAL, Paris.

WEBSITES :

- http:// enseigner.tv5 monde.com/
- bonjourdumonde.com /exercises/contenu/le – francais-du- tourisme.html
- http://www.bonjurdefrance.com/
- https://www.lepointdufle.net/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

25ENU401G	**English - IV**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:
Not required

COURSE OBJECTIVES(CO):

- To provide the students with an ability to build and enrich their communication skills.
- To help them think and write imaginatively and critically.
- To strengthen their professional skills.

Course Outcomes (COs):

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

COs	Course Outcomes	Blooms Level
CO1	Make the students proficient communicators in English.	Apply
CO2	Develop learners' ability to understand English.	Understand
CO3	Understand the nuances of listening, speaking and readingEnglish.	Understand
CO4	Prepare the learners to face situations with confidence and to seek employment in the modern globalized world.	Apply
CO5	Build the students' ability to listen and to speak English better.	Apply

UNIT - I **8 HOURS**

Concept of Communication- Barriers to Communication- Body Language-Personality Development-Etiquette and Manners-Soft Skills

UNIT - II **7 HOURS**

Listening Comprehension-Reading Comprehension-Paragraph Writing-Precis Writing-Collocation

UNIT - III **7 HOURS**

Writing-Writing Resume and Covering Letter- Types of Letter Writing-Letter Formats-E-mail Writing-Writing MoU- DictoComposition--Term Paper-Book Reviews

UNIT - IV **7 HOURS**

Speaking-Interview Skills-Preparing Welcome address and Vote of Thanks-Compering -

UNIT - V **7 HOURS**

Punctuation Marks- Figures of Speech

TOTAL: 36 HOURS

TEXT BOOK:

1. Board of Editors (2024). *Proficiency in Communication II*, Karpagam Academy of Higher Education

REFERENCE BOOKS:

1. *Martin's, St* (2013). *Oxford Handbook of Writing: Handbook of Writing.* Cambridge University Press.
2. Wren & Martin, *(*2008). *High School English Grammar & Composition*, S. Chand & Company Ltd, Board of Editors.
3. Krashen, Stephen D (1982). *Principles and Practice in Second Language Acquisition*. New York: Pergamon Press.

WEB SITES:

1. https://www.skillsbuilder.org/blog/top-5-speaking-skills-for-success-in-interviews
2. https://www.coursera.org/articles/interviewing-skills

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	-	**2**	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

25MBU401 Immunology 5H–4C

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide overview of immune system, antigen antibody structure and interactions.
- To develop understanding of innate and adaptive immUNITy along with major cells and molecules involved.
- To integrate immunology with health and enrich the knowledge for autoimmune disorders, hypersensitivity reaction

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Comprehend types of immune systems and mechanism of immune activation and autoimmUNITy.	Understand
CO2	Develop understanding about antigen - antibody interactions.	Understand
CO3	Analyse disease conditions generated due to interplay of immune system components.	Analyze
CO4	Explain primary and secondary Immune response and immune deficiencies	Understand
CO5	Apply techniques in vaccine production and practice different immunoassays	Apply

UNIT I **10 HOURS**

Concept of Innate and Adaptive immUNITy; Contributions of following scientists to the development of field of immunology – Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter and Susumu Tonegawa. Structure, Functions and Properties of Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, dendritic cell- and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT.

UNIT II **8 HOURS**

Antigens – Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T &amp- B cell epitopes)- T-dependent and T-independent antigens, Adjuvants. Antigenicity, Immunogenicity and Factors influencing Immunogenicity. Antibodies – Structure, Types, Functions and Properties of antibodies- Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic)- Monoclonal and Chimeric antibodies.

UNIT III **10 HOURS**

MHC – Organization of MHC locus- Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways). Complement system – Components of the

Complement system- Activation pathways (Classical, Alternative)- Biological consequences of complement Activation

UNIT IV **10 HOURS**

Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co-stimulatory signals); Killing Mechanisms by CTL and NK cells, Introduction to tolerance. Types of Autoimmunity and Hypersensitivity with examples. Immuno deficiencies – Animal models (Nude and SCID mice), DiGeorge syndrome, Chediak-Higashi syndrome. Transplantation immunology, Graft versus host reaction, Graft rejection.

UNIT V **10 HOURS**

Types of tumors, tumor Antigens, causes and therapy for cancers. Types of vaccine and their vaccination schedule in Practice. Principles of precipitation, agglutination, complement fixation, Immunodiffusion, Immuno electrophoresis, ELISA, ELISPOT, Western blotting, Immuno fluoresence, Flow cytometry, Immunoelectron microscopy. Immunological biosensors.

Total: 48 HOURS

TEXT BOOKS:

1. Goldsby RA, Kindt TJ, Osborne BA. *Kuby's Immunology*. 6thedition. W.H. Freeman and Company, New York. (2007).
2. Delves P, Martin S, Burton D, Roitt IM. Roitt's *Essential Immunology*. 11th edition Wiley-Blackwell Scientific Publication, Oxford. (2006).

REFERENCE BOOKS:

1. Murphy K, Travers P, Walport M. (2008). Janeway's *Immunobiology*. 7th edition Garland Science Publishers, New York.
2. Abbas AK, Lichtman AH, Pillai S. (2007). *Cellular and Molecular Immunology*. 6th edition, Saunders Publication, Philadelphia.
3. Peakman M, and Vergani D. (2009). *Basic and Clinical Immunology*. 2nd edition Churchill Livingstone Publishers, Edinberg.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-		-	-	-	-	-	-	-	-	3
CO2	3	-	-	2	2	-	-	2	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	-	-	**2**	**2**	-	-	**3**	-	-	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

25MBU402 Medical Bacteriology and Mycology 5H–3C

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To introduce basic principles and applications of various clinical diseases and their epidemiology.
- To characterize, isolate and identify different microbes under a wide range of host pathogen interaction.
- To understand etiology, clinical systems and laboratory diagnosis of disease- causing microorganisms.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand microflora in the body and microbe-based infections	Understand
CO2	Gain knowledge on various bacterial infections of different organs of the body	Understand
CO3	Analyse various viral diseases in human beings	Analyze
CO4	Comprehend transmission, symptoms and prevention of fungi causing diseases	Understand
CO5	Evaluate microbial diagnosis and Artificial Intelligence in microbial diagnosis.	Evaluate

UNIT I Introduction to Medical Microbiology 10 HOURS

Normal micro flora of the human body: skin, throat, gastrointestinal tract, gut flora, urogenital tract. Definitions – Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity. Transmission of infection, Carriers and their types, Opportunistic infections, Nosocomial infections. Collection, transport and processing of clinical samples – Blood, Sputum, Stool, Urine and CSF.

UNIT II Medical Bacteriology 10 HOURS

List of diseases of various organ systems and their causative agents. Respiratory pathogens: Streptococcus pyogenes, Haemophilus influenzae, Mycobacterium tuberculosis. Gastrointestinal pathogen Escherichia coli, Salmonella typhi, Vibrio cholerae, Helicobacter pylori. Others: Staphylococcus aureus, Bacillus anthracis, Clostridium tetani, Treponema pallidum Klebsiella pneumonia

UNIT III 8 HOURS

Study of Bacterial transmission, symptoms and prevention of Bacterial food poisoning, diarrhea, respiratory infection. Sexually transmitted diseases, Meningitis, Urinary Tract Infection.

UNIT IV Medical Mycology 10 HOURS

Study of mycoses- transmission, symptoms and prevention. Cutaneous mycoses- Tinea pedis (Athlete's foot). Systemic mycoses: Histoplasmosis. Opportunistic mycoses: Candidiasis. Diagnosis of Tinea pedis (Athlete's foot), Histoplasmosis. Candidiasis.

UNIT V Antimicrobial agents **10 HOURS**

Antibacterial agents: Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis- Antibiotic resistance - MDR, XDR, MRSA, NDM-1 and PDR resistance mechanisms. Antifungal agents- Mechanism of action of Amphotericin B, Griseofulvin. Artificial Intelligence in microbial diagnosis.

Total: 48 HOURS

TEXT BOOKS:

1. Ananthanarayan R. and Paniker C.K.J. (2022). *Textbook of Microbiology*. 12th edition, University Press Publication.
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson International Edition.

REFERENC BOOKS:

1. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. Jawetz, Melnick, (2013). *Adelberg's Medical Microbiology*. 27th edition. McGraw Hill Publication.
2. Greenwood D, Slack R, Barer M, and Irving W. *Medical Microbiology*, 19th Edition. Churchill Living stone. (2018).
3. Goering R., Dockre ll H. Zuckerman M and Wakelin D (2007). Mims' Medical Microbiology. 4th edition. Elsevier.
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott, Harley and Klein's *Microbiology*. 9th edition. McGraw Hill Higher Education.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	-	3	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	-	2	-	-	-	-	-	-	2	-	-	-	-	-	3
CO4	-	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	2	2	-	-	-	3	3	-	-	-	-	-	-	3
Average	**3**	-	**3**	**2**	**2**	-	**2**	-	**3**	**3**	**2**	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

25MBU403A **Molecular Biology** **3H–3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Biochemistry (25MBU101)

COURSE OBJECTIVES (CO):

- To study on structure and organization of chromosome and mutagenesis.
- To expose the students on the basic understanding of various techniques used in molecular studies.
- To gather information to know mechanism of DNA replication and protein synthesis

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand structure and types of DNA	Understand
CO2	Describe the processes of DNA replication	Understand
CO3	Explain transcription and transcriptional control in prokaryotes and eukaryotes	Understand
CO4	Narrate concept of RNA splicing and mRNA and its significance.	Understand
CO5	Illustrate translation and regulation of gene expression in prokaryotes	Understand

UNIT I DNA Structure **8 HOURS**

DNA Structure: Miescher to Watson and Crick - historical perspective, DNA Structure, Salient features of double helix, Chargaff's rule, Types of DNA, Conformations of nucleic acids, Stability of nucleic acid structure, Types of genetic material, Organization of DNA in Prokaryotes, Viruses, Eukaryotes., Organelle DNA—mitochondria and chloroplast DNA. RNA Structure.

UNIT II DNA Replication **8 HOURS**

DNA replication in prokaryotes and Eukaryotes. Types of DNA replication. Mechanism of DNA replication: Enzymes and proteins involved in DNA replication–DNA polymerases, DNA ligase, primase, telomerase– for replication of linear ends. DNA topology –linking number, proof reading mechanism.

UNIT III DNA Transcription **6 HOURS**

Transcription and transcriptional control in prokaryotes and eukaryotes, initiation, elongation, termination, promoter sequences - TATA box, Hogness Box, CAAT box, Enhancers, upstream activating sequences, Posttranscriptional modification, splicing, spliceosomes, nuclear transport of mRNA.

UNIT IV DNA Translation **8 HOURS**

Translational machinery, charging of tRNA, amino acyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptide s in both prokaryotes and eukaryotes, Fidelity of translation, Inhibitors of protein synthesis in prokaryotes and eukaryotes, post translational modifications.

UNIT V Regulation of gene expression **6 HOURS**

Regulation of gene expression in prokaryotes. Operon hypothesis, Positive and Negative regulation. Regulation of gene expression in Eukaryotes. Enhancers and transcription factors. DNA binding domains. Regulation at post- translational level: Translation Initiation, Riboswitches. Epigenetic Level control: Chromatin Structure and DNA Modifications.

Total: 36 HOURS

TEXT BOOKS:

1. Gardner EJ, Simmons MJ, Snustad DP (2008). *Principles of Genetics*. 8th Ed. Wiley-India.
2. De Robertis EDP and De Robertis EMF (2006). *Cell and Molecular Biology*, 8th edition. Lippin Cott Williams and Wilkins, Philadelphia.
3. Sambrook J and Russell DW (2001). *Molecular Cloning: A Laboratory Manual* 4th Edition, Cold Spring Harbour Laboratory press.

REFERENCE BOOKS:

1. Watson JD, Baker TA, Bell SP, GannA, Levine Mand Losick R (2008). *Molecular Biology of the Gene*, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
2. Becker WM, Kleinsmith L J, Hardin. J and Bertoni GP (2009). *The World of the Cell*,7th edition, Pearson Benjamin Cummings Publishing, San Francisco.
3. Karp G. (2010). *Cell and Molecular Biology: Concepts and Experiments*, 6th edition, John Wiley & Sons. Inc
4. Krebs J, Goldstein E, Kilpatric KS (2013). *Lewin's Essential Genes*, 3rd Ed., Jones and Bartlett Learning.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	3	-	-	-		-	-	-	-	-	-	-	3	-
CO2	2	-	-	3	-	-	-		-	-	-	-	-	-	2	3	-
CO3	-	-	-	2	-	-	-		-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	3	-
CO5	2	-	-	2	-	-	-		-	-	-	-	-	-	-	3	-
Average	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

25MBU403B **Plant and Animal Tissue Culture** **3H–3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To learn the conventional methods of breeding
- To understand the concepts of Tissue culture media, micropropagation, plant hardening transfer to soil, green house technology
- To emphasize tissue culture techniques in secondary metabolites production.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

Cos	Course Outcomes	Blooms Level
CO1	Understand the basics in conventional and non-conventional plant breeding techniques	Understand
CO2	Learn and practice tissue culture media preparation, develop new combinations of media for micropropagation	Apply
CO3	Apply techniques for different culture techniques and hardening	Apply
CO4	Comprehend animal culture techniques	Apply
CO5	Explain transgenic animal production	Apply

UNIT-I **7 HOURS**

Principles of Plant Breeding: Important conventional methods of breeding – self, cross pollinated and vegetatively propagated crops. Non-conventional methods. Polyploidy, Genetic variability. Genome organization in plants – mitochondria and chloroplast. Cytoplasmic male sterility.

UNIT-II **8 HOURS**

Tissue culture media – composition and preparation, Callus and suspension culture, somaclonal variation, micropropagation, , somatic embryogenesis, Embryo culture and embryo rescue.; protoplast fusion and somatic hybridization; cybrids;, and ovary culture for production of haploid plants and homozygous lines. Plant hardening transfer to soil.

UNIT-III **7 HOURS**

Chloroplast, stages of secondary metabolite production, uses of tissue culture techniques in secondary metabolites. Transformation with Ti plasmid of Agrobacterium tumefaciens delay in fruit ripening and Edible vaccines .

UNIT-IV **7 HOURS**

Animal Tissue Culture: Biology of cultured cells; Aseptic techniques, safety and biohazards. Cell lines. Cell culture media – preparation and types. Primary cell culture – isolation of tissues from chick embryo, mouse and human biopsies.

UNIT-V **7 HOURS**

Organ culture: Cell separation techniques, cryopreservation. Transgenic animals – production and applications, Knockout animals. Biopharming. Ethical issues in animal biotechnology.

Total: 36 HOURS

TEXT BOOKS:

1. Slater, A., Scott, N.W., & Fowler, M. R. (2008). *Plant Biotechnology*. Oxford: Oxford University Press.
2. Ignacimuthu, S. (2004). *Plant Biotechnology*. New Delhi: Oxford and IBH Publishing House.
3. Chawla, H.S. (2002). *Introduction to Plant Biotechnology*. New Delhi: Oxford and IBHP Publishing Co. Pvt. Ltd.
4. Freshney, R. I. (2000). *Animal Cell Culture. A practical approach*. John Wiley Publishers. New York.

REFERENCE BOOKS:

1. Kumar, U. (2008). *Plant Biotechnology and biodiversity conservation*. Jodhpur: Agrobios.
2. Stewart, N.C. (2008). *Plant Biotechnology and Genetics*. New Jersey: John Wiley & Sons, Inc.
3. Halford, N., & Halford, N. G. (2006). *Plant Biotechnology: Current and Future Applications of Genetically Modified Crops*. New Jersey: John Wiley &Sons.
4. Davis T. M. (2002). *Basic cell culture – A practical approach*, Oxford University Press, London.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	2	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	3	-	-	-	-	2	-	-	-	3
Average	**3**	-	-	-	-	-	-	**3**	-	-	-	-	**2**	-	-	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

25MBU411 **Immunology Practical** **4H–2C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Immunology (25MBU401)

COURSE OBJECTIVES (CO):

- To strengthen the knowledge of students in immunodiagnostics on skill basis.
- To integrate immunology with health and enrich the knowledge for autoimmune disorders, hypersensitivity reaction.
- To develop the basic skills on handling immunological tests

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

Cos	Course Outcomes	Blooms Level
CO1	Learn and apply skills in identification of human blood groups	Apply
CO2	Practice Leukocyte Count of the given blood sample	Apply
CO3	Perform separation of serum and plasma from the blood sample	Apply
CO4	Execute immunodiffusion by Ouchterlony method	Apply
CO5	Experiment with DOT-ELISA test and immune electrophoresis assay	Apply

EXPERIMENTS **48 HOURS**

1. Identification of human blood groups - ABO Blood grouping, Rh Typing.
2. Perform Total Leukocyte Count of the given blood sample.
3. Perform Differential Leukocyte Count of the given blood sample.
4. Separate serum and plasma from the blood sample.
5. WIDAL test, RPR and CRP.
6. Perform immunodiffusion by Ouchterlony method.
7. Perform DOT-ELISA.
8. Perform immune electrophoresis.

TEXT BOOKS: **Total: 48 HOURS**

1. Ananthanarayan R. and Paniker C.K.J (2009). *Textbook of Microbiology*. 8th edition, University Press Publication.
2. Peakman M and Vergani D (2009). *Basic and Clinical Immunology*. 2nd edition Churchill Livingstone Publishers, Edinberg.

REFERENCE BOOKS:

1. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A and Mietzner, T.A (2013). Jawetz, Melnick and Adelberg's *Medical Microbiology*. 26th edition. McGraw Hill Publication.

2. Greenwood D, Slack R, Barer M and Irving W. (2012). *Medical Microbiology*, 18th Edition. Churchill Livingstone.
3. Ryan KJ and Ray CG. (2014). *Sherris Medical Microbiology*, 6th Edition. McGraw-Hill Professional.
4. Richard C and Geiffrey S. (2009). *Immunology* 6th edition. Wiley Blackwell Publication.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	3	-
CO2	1	-	-		-	-	-	3	-	-	2	-	-	-	-	3	-
CO3	3	-	-	2	-	-	-	3	-	-	-	-	-	-	-	3	-
CO4	3	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	-	-	-	3	-	-	-	3	-	-	-	-	-	-	1	-	3
Average	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**1**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

25MBU412 **Medical Bacteriology and Mycology Practical** **4H–1C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Medical Microbiology (25MBU402)

COURSE OBJECTIVES (CO):

- To introduce the medically important microorganisms, microbial morphology and the characterization,
- To cover all biology of bacteria, viruses and other pathogens related with infectious diseases in humans.
- To develop the basic skills on handling clinical pathogens

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Practice to characterize, isolate and identify medically important microbes.	Apply
CO2	Make use of important differential media for identification of bacteria	Apply
CO3	Execute technique of swab method to study bacterial flora	Apply
CO4	Perform antimicrobial activity using agar or disc diffusion and MIC method	Apply
CO5	Examine various stages of malarial parasite in RBCs using permanent mounts	Evaluate

EXPERIMENTS **48 HOURS**

1. Identify bacteria (any three of *E. coli, Salmonella, Pseudomonas, Staphylococcus, Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests.
2. Study of composition and use of important differential media for identification of bacteria: EMB Agar, MacConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS, *Salmonella Shigella*/ BSA Agar.
3. Study of bacterial flora of skin by swab method.
4. Antibacterial sensitivity assay by Kirby- Bauer method.
5. Determination of minimal inhibitory concentration (MIC) of an antibiotic.
6. Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chickenpox, HPV warts, AIDS (candidiasis), dermatomycoses (ringworms).
7. Isolation of yeast from clinical sample

Total: 48 HOURS

TEXT BOOKS:

1. Ananthanarayan R.and Paniker C.K.J. (2009) *Textbook of Microbiology*. 8th edition, University Press Publication.
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson International Edition.

REFERENCE BOOKS:

1. Green wood D, Slack R, Barer M, and Irving W. (2012). *Medical Microbiology*, 18th Edition. Churchill Livingstone.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013). Jawetz, Melnick and Adelberg's *Medical Microbiology*. 26th edition. McGraw Hill Publication
3. Ryan KJ and Ray CG (2014). *Sherris Medical Microbiology*, 6th edition McGraw-Hill Professional.
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007*). Mims' Medical Microbiology*. 4th edition. Elsevier
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott, Harley and Klein's *Microbiology*. 9th edition. McGraw Hill Higher Education

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	3	-	-	-	3	-	-	2	-	-	-	-	-	3
CO2	3	-	1	2	-	-	-	-	-	-	2	-	-	-	-	3	-
CO3	2	-	-	3	-	-	-	3	2	-	3	-	-	-	-	3	-
CO4	2	-	-	-	-	-	-	3		-	-	-	-	-	-	3	-
CO5	1	-	3	-	-	-	-	3	2	-	-	-	-	-	-	-	3
Average	**2**	-	**2**	**3**	-	-	-	**3**	**2**	-	**2**	-	-	-	-	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

25VAC401BG Cyber Security and Universal Human Values 2H-1C

Instruction Hours/week: L:2 T:0 P:0 **Marks:** Internal**:100** External**: - T**otal**:100**

End Semester Exam: 3 Hours

- **PREREQUISITE:** Not Required

COURSE OBJECTIVES (CO):

- To develop the holistic perspective based on self-exploration about themselves, family, society and nature/existence.
- To understand harmony in themselves, family, society and nature/existence.
- To strengthen the self-reflection.
- To develop the commitment and courage to act.

COURSE OUTCOMES (COs):

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

COs	Course Outcomes	Blooms Level
CO1	Become more aware of themselves and their surroundings (family, society, nature).	Understand
CO2	Be more responsible in life.	Apply
CO3	Deal with problems with sustainable solutions, while keeping human relationship and human nature in mind.	Analyze
CO4	Develop consciousness of themselves through the control of mind.	Evaluate
CO5	Nuture human to live with mutual happiness and prosperity with rest of nature	Analyze

UNIT I: INTRODUCTION TO SECURITY 4 HOURS

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm.

UNIT II: PUBLIC KEY CRYPTOGRAPHY AND HASH ALGORITHMS 5 HOURS

Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange- Hash Functions-Hash Algorithms (MD5, Secure Hash Algorithm)

UNIT III: FUNDAMENTALS OF CYBER SECURITY 5 HOURS

How Hackers Cover Their Tracks- Fraud Techniques- Threat Infrastructure- Techniques to Gain a Foothold (Shellcode, SQL Injection, Malicious PDF Files)- Misdirection, Reconnaissance, and Disruption Methods.

UNIT IV: INTRODUCTION OF UNIVERSAL HUMAN VALUES 5 HOURS

Purpose and motivation for the course, recapitulation from universal human values I. Self-exploration-what is it? – its content and process; 'Natural Acceptance' and Experiential Validation- as a process for self-exploration. Continuous Happiness and prosperity. A look at basic human Aspiration. Right understanding, Relationship and physical Facilities-the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and prosperity correctly- A critical appraisal of the current scenario. Method of fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT V: UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF

5 HOURS

Understanding human being as a co-existence of the sentiment 'I' and the material 'Body'. Understanding the needs of self ('I') and 'Body' – sukh and Suvidha. Understanding the body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and helth; correct appraisal of physical needs, meaning of prosperity in detail. Programs to ensure Sanyam and health**.**

TOTAL 24 HOURS

TEXT BOOKS:

1. Gaur,R.R, Sangal,R and Bagaria,G.P,(2010). A foundation course in Human Values and professional Ethics, Excel books, New Delhi.
2. Schumacher. E.F, Small is Beautiful: Economics as If People Mattered, Perennial Library.
3. Cecile Andrews, (2006). Slow is Beautiful, New Society Publishers.

REFERENCE BOOKS:

1. Joseph Cornelius Kumaruppa,(Digitized 30 Oct 2019). The Economy of Permanence.
2. Mahatma Gandhi, (1983). The Story of My Experiments with Truth.
3. Maulana Abul Kalam Azad, (2017). India Wins Freedom, Create Space Independent Publishing Platform.
4. Romain Rolland, (1952). The Life of Vivekananda and the Universal Gospel, Advaita ashrama.
5. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition, Pearson Education, 2015.
6. William Stallings, "Cryptography and Network Security", Pearson Education, 6th Edition,2013.

WEBSITES:

1. http://www.arvindguptatoys.com/arvindgupta/gandhiexperiments.pdf
2. http://www.sanipanhwar.com/India%20Wins%20Freedom%20%20Maulana%20Abul%20Kalam%20Azad
3. https://estudantedavedanta.net/The-Life-Of-Vivekananda-And-The-Universal-Gospel.pdf
4. Web resources from NDL Library,
5. E-content from open-source libraries

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS 2
CO1	1	-	2	1	-	-	-	-	-	-	-	3	-	-	2	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3	2
CO3	1	-	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	1	-	-	-	-	-	3	-	-	-	-	-	-	-	3	-	1
CO5	1	-	-	3	-	-	-	-	-	-	-	-	-	-	3	2	1
Average	**1**	**-**	**2**	**2**	**2**		**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2.5**	**1.3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

25MBU501 Industrial Microbiology and Microbial Biotechnology 5H-4C

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Microbial Physiology and Metabolism (25MBU201)

COURSE OBJECTIVES (CO):

- To empower for the employability skill by the use of microorganisms in the production of food or industrial products.
- To cover the principles of various processes associated with the production and recovery of different bio-products derived from microorganisms.
- To deliver the large-scale production of microbial products techniques in advanced level.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Comprehend and apply fermentation processes for the production of microbial products	Apply
CO2	To gain information about upstream and downstream process	Understand/Apply
CO3	Perform microbial product extraction, separation and recovery	Apply
CO4	Execute microbial production of industrial products	Apply
CO5	Develop designer microbes for food, energy and health care products	Create

UNIT I Screening of Industrial Important Microbes 12 HOURS

Exploitation of microbes and their products. Sources of industrially important microbes and methods for their isolation, primary and secondary screening methods. Strain improvement method (protoplast fusion, mutation and recombinant DNA technology). Preservation and maintenance of industrial strains. Cell growth kinetics- Kinetics of Substrate utilization.

UNIT II Upstream Process 12 HOURS

Brief history of fermentation- Fermentation, general concepts and application of fermentation. Media formulation. Types of fermentation processes – Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch and continuous fermentations. Design of laboratory bioreactor. Types of bioreactors – Laboratory, pilot- scale and production fermenters, constantly stirred tank and air-lift fermenters.

UNIT III Downstream Process 12 HOURS

Downstream processing-techniques and methods: Stages in downstream processing. Separation of cells– filtration and centrifugation. Cell disruption– physical, chemical and enzymatic methods. Product separation-solvent extraction and precipitation. Lyophilization and spray drying, freeze drying and vacuum drying. Immobilization, Methods of immobilization, advantages and applications of immobilization.

UNIT IV Microorganisms in biofuels, bioremediation, bioproducts 10 HOURS

Bioethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass. Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics, removal of heavy metals from aqueous effluents. Microbial

Valorization of Plastic Wastes. Biotechnological application of microalgae- Food, Feed, colorant, fuel and aquaculture feed. Microbial biotechnology and its applications in agriculture (Biofertilizers, PGPR, Mycorrhizae), biostimulants environmental, and food technology

UNIT V Microbial production of industrial products **14 HOURS**

Bio- analytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute. Biotransformation of antibiotics. Industrial production of organic acids & vitamins, Wine and Beer, probiotics. Recombinant microbial production processes in pharmaceutical industries. Microbial production of bio-pesticides, bioplastics, Microbial biosensors. Microbial based transformation of steroids and sterols. Biotransformation of antibiotics. Importance of microbes in industry-microbial biomass, microbial enzymes and microbial recombinant products.

Total: 60 HOURS

TEXT BOOKS:

1. Crueger W and Crueger A. (2017). *Biotechnology: A textbook of Industrial Microbiology*. 3rd edition. Panima Publishing Co. New Delhi.
2. Stanbury F, Whitaker A and Hall SJ. (2016). *Principles of Fermentation Technology*.3rd edition, Elsevier Science Ltd

REFERENCE BOOKS:

1. Nduka Okafor, Benedict C. Okeke (2017). *Modern Industrial Microbiology and Biotechnology*, 2nd Edition, CRC Press.
2. Geoffrey MGadd, Sima Sariaslani (2015). *Advances in Applied Microbiology*, CRC Press.
3. Mansi El-Mansi (2012). *Fermentation Microbiology and Biotechnology*, CRC Press.
4. E M T El-Mansi, Jens Nielsen, David Mousdale (2019). *Fermentation Microbiology and Biotechnology*, Fourth Edition, CRC Press

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	-	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO4	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	1	-	1	3	-	-	-	3	2	-	-	-	-	-	-	-	3
Average	**2**	-	**1**	**3**	-	-	-	**3**	**2**	-	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

25MBU502 Recombinant DNA Technology 5H-4C

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Molecular Biology (25MBU403A)

COURSE OBJECTIVES (CO):

- To understand the various concepts of cloning vectors and cloning strategies
- To familiarize the students to tools and techniques in genetic engineering and recombinant DNA technology.
- To offer applications of DNA modifying enzymes, cloning strategies, vector types, host genotype specificities for selection and screening of recombinants and/or recombinant transformants

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Explore the role of various enzymes in cloning techniques	Apply
CO2	Learn and practice methods in gene transformation	Apply
CO3	Apply PCR, sequencing techniques and microarray techniques in Genetic engineering	Apply
CO4	Analyze the products of recombinant technology	Analyze
CO5	Perform modern techniques in gene therapy, gene editing, protein engineering and gene silencing	Apply

UNIT I **12 HOURS**

Milestones in genetic engineering and Biotechnology cloning Tools - Restriction modification systems – Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering. DNA modifying enzymes and their applications – DNA polymerases, DNA ligases, Topoisomerase, gyrases, Terminal deoxynucleotidyl transferase, kinases and phosphatases.

UNIT II **12 HOURS**

Cloning Vectors: - Definition and Properties Plasmid vectors – pBR 322 and pUC Vector, Bacterio phage – lambda(λ) and M13 based vectors Cosmids, BACs, YACs. Use of linkers and adaptors. Expression vectors- *E. coli* lac and T7 promoter - based vectors, yeast – YIp, Yep and YCp vectors, Baculovirus based vectors, mammalian – SV- 40- based expression vectors

UNIT III **12 HOURS**

Transformation of DNA – Chemical method, Electroporation. Gene delivery – Micro injection, electroporation, biolistic method (gene gun), liposome and viral – mediated delivery, *Agrobacterium*- mediated delivery. Extraction of DNA, RNA and plasmid DNA. Determination of purity of DNA, RNA and protein. Gel electrophoresis, Blotting techniques, SDS-PAGE. Expression Cloning.

UNIT IV **10 HOURS**

PCR – Basics of PCR, RT - PCR, Real - Time PCR(Quantitative), Multiplex PCR, Sybr Green PCR, Sanger's method of DNA Sequencing, traditional and automated sequencing. Primer walking and shotgun sequencing, Methylation sequencing and RNA sequencing. Microarrays – DNA and Protein microarray.

UNIT V **14 HOURS**

Construction of Genomic and cDNA libraries, screening of libraries: Colony hybridization and colony PCR, Chromosome walking and chromosome jumping. Products of recombinant DNA technology – Products of human therapeutic interest - insulin, hGH. Bt transgenic-cotton, brinjal, recombinant vaccines, protein engineering and site directed mutagenesis. Gene therapy, Replacement and augmentation, gene correction, gene editing, gene silencing, SiRNA, miRNA, Antisense RNA, CRISPR/Cas9.

Total: 60 HOURS

TEXT BOOKS:

1. Brown TA. (2010). *Gene Cloning and DNA Analysis*. 6thedition. Blackwell Publishing, Oxford, U. K.
2. Sambrook J and Russell D. (2001). *Molecular Cloning-A Laboratory Manual*. 3rdedition. Cold Spring Harbor Laboratory Press.

REFERENCE BOOKS:

1. Clark DP and Pazdernik NJ. (2009). *Biotechnology: Applying the Genetic Revolution*. Elsevier Academic Press, USA.
2. Primrose SB and Twyman RM. (2006). *Principles of Gene Manipulation and Genomics*, 7thedition. Blackwell Publishing, Oxford, U.K.
3. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's *Microbiology*. McGraw Hill Higher Education.
4. Primrose SB and Twyman RM. (2008). *Genomics: Applications in human biology*. Blackwell Publishing, Oxford, U.K.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	3	-	-		-	-	-	-	-	-	-	-	3
CO2	-	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	-	-	-	2	-	-	-	3	-	3	2	-	-	-	-	-	3
CO4	-	-	-	-	3	-	-	2	-	-	2	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	3	-	2	1	-	-	-	-	-	3
Average	**3**	**-**	**-**	**2**	**3**	**-**	**-**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

25MBU503 **Microbial Omics and Biotechniques** **5H-4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To detail the importance of Omics and biotechniques in the field of life sciences
- To provide an overview of various bioinformatics tools, databases available and sequence analysis
- To provide knowledge on gene and protein analysis, biotechniques and omics methods

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Provide computational skill and basic concepts of genomics, transcriptomics and proteomics and metagenomics techniques	Understand
CO2	Make use of biological databases for nucleic acid, genome, protein sequence and structure, Understand and analyze the Human genome project	Apply
CO3	Retrieve information from available databases and use them for microbial identifications and drug designing	Apply
CO4	Understand and perform sequence alignment and analysis and Protein structure prediction	Analyze
CO5	Learn and practice instrumentation and biotechniques.	Apply

UNIT I Biological database **10 HOURS**

Biological databases – nucleic acid, genome, protein sequence and structure, gene expression databases, Database of metabolic pathways, Specialized Databases. Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot, PDB, SWISS- Prot,

UNIT II Sequence analysis tools **12 HOURS**

Local and Global Sequence alignment, pairwise and multiple sequence alignment. Scoring an alignment, scoring matrices, PAM & BLOSUM series of matrices. Types of phylogenetic trees, Different approaches of phylogenetic tree construction. Genome annotation, sequence analysis of transcriptome and proteome.

UNIT III Omics **14 HOURS**

Omics- Stream of omics- Proteomics, Genomics, Metabolomics, Lipidomics and Epigenomics. Sequencing Genes and Genome.NGS (Next generation sequencing), Binning, Annotation, Data analysis. Diversity of Genomes: Viral, prokaryotic & eukaryotic genomes Genome projects- The Human genome project. Introduction to Genomics, transcriptomics, proteomics, lipidomics and infectomics, Major features of completed genomes: Bacteriophage φX174, *E.coli, S. cerevisiae,* Arabidopsis.

UNIT IV Structural biology **12 HOURS**

Structural Classes, Motifs, Folds and Domains. Protein structure prediction in presence and absence of structure template Structure evaluation by Ramachandran plot. Protein structure and rational drug design. Use of AI in protein structure prediction. Recent software and tools.

UNIT V Biotechniques **12 HOURS**

Principle, Instrumentation and application of spectrophotometer, colorimeter. 2-D gel electrophoresis, MALTI TOF mass spectroscopy, Microarray technique, FTIR, MS, Nuclear Magnetic Resonance, ESR. Principles and applications of paper chromatography, Thin layer chromatography, Column Chromatography. Upstream and downstream Process techniques.

Total: 60 HOURS

TEXT BOOKS:

1. Saxena Sanjay (2003). *A First Course in Computers*, Vikas Publishing.
2. Lesk M.A. (2008). *Introduction to Bioinformatics*. Oxford Publication, 3rd International Student Edition.
3. Pradeep and Sinha Preeti (2007). *Foundations of Computing*, 4th ed., BPB Publications.

REFERENCE BOOKS:

1. Rastogi S.C., Mendiratta N. and Rastogi P. (2007). *Bioinformatics: methods and applications, genomics, proteomics and drug discovery*, 2nd ed. Prentice Hall India Publication.
2. Primrose and Twyman (2003). *Principles of Genome Analysis & Genomics*. Blackwell.
3. Brown T. A., (2020). *Gene Cloning and DNA Analysis: An Introduction.* 8th Edition. John Wiley & Sons,.
4. Mount, D. (2004). *Bioinformatics: Sequence and Genome Analysis*. Cold Spring Harbor Laboratory Press, New York.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	-	-	-	-	2	2	3	-	-	-	-	-	3	-
CO2	-	-	-	-	-	-	-	2	-	3	-	-	-	-	-	-	3
CO3	2	-	-	2	-	-	-	-	-	2	-	-	-	-	-	-	3
CO4	-	-	-	-	2	-	-	-	-	2	-	-	-	-	-	-	3
CO5	3	-	-	-	2	-	-	-	-	2	-	-	-	-	-	-	3
Average	**3**	-	**2**	**2**	**2**	-	-	**2**	**2**	**2**	-	-	-	-	-	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

25MBU504A **Introduction to Forensic Microbiology** **5H-3C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not Required

COURSE OBJECTIVES (CO):

- To teach the students to basic and high throughput techniques in Genomics and Proteomics and their applications.
- To Teach Sequencing of DNA and its applications in human health.
- To present methods and experimental tools used in modern genomics with emphasis on prokaryotes and eukaryotes.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Comprehend the basic concepts of genomics, transcriptomics and proteomics and metagenomics techniques	Understand/ Apply
CO2	Understand and analyse the Human genome project	Analyze
CO3	Make use of molecular and epidemiological tools for identifying pathogens	Apply
CO4	Experiment with Computational methods for identification of polypeptides	Apply
CO5	Utilize various databases for analysis of protein- protein interactions	Apply

UNIT I **12 HOURS**

History, current, and future use of microorganisms as physical evidence. Methods for identification. Classical microbiology, genomics and strain typing. Types of sampling in crime scene. Sample collection techniques, Sample preservation, storage, and handling techniques in forensics.

UNIT II **12 HOURS**

DNA analysis in the identification of crime suspects, Genetic fingerprinting by hybridization probing, DNA profiling by PCR of short tandem repeats, Studying kinship by DNA profiling, DNA profiling and the remains of the Romanovs, STR, Mitochondrial DNA analysis of the Romanov bone. Sex identification by DNA analysis.

UNIT III **12 HOURS**

Archaeogenetics, using DNA to study human prehistory. Applications of forensic microbiology in food safety, Environmental Forensics, crime investigation, disease outbreak, Bioterrorism. Next-Generation Sequencing (NGS) and Single Nucleotide Polymorphism SNPs in forensics. Paleomicrobiology and Thanatomicrobiome.

UNIT IV **10 HOURS**

Molecular and Epidemiological tools: Nucleic amplification and molecular epidemiological techniques are essential tools in clinical microbiology for identifying pathogens. Typing tools for Phylogenetic study.

UNIT V **14 HOURS**

Nanotechnology in forensic investigations. Evidence Analysis, Fingerprint Detection, forensic toxicology, Nano-sensors in forensics. Multi-omics sequencing: metagenomic, metatranscriptomic, metaproteomic, and metametabolomic approaches in forensics.

Total: 60 HOURS

TEXT BOOKS:

1. Graur, D and W H Li, 2000. *Fundamentals of molecular evolution*. Sinauer Associates.
2. Pevsner, J. (2003). *Bioinformatics and Functional Genomics* by John Wiley and Sons, New Jersey, USA.
3. David O. Carter, Jeffery K. Tomberlin, M. Eric Benbow, Jessica L. Metcalf. (2017). *Forensic Microbiology.* John Wiley & Sons Ltd.

REFERENCE BOOKS:

1. Brown T. A., (2020). *Gene Cloning and DNA Analysis: An Introduction.* 8th Edition. John Wiley & Sons,.
2. Dunham, I., 2003. *Genome Mapping and sequencing*. Horizon Scientific
3. Hartwell, L. H., L. Hood, M. L. Goldberg, A. E. Reynolds, L. M. Silver and R. G. Veres. 2004. *Genetics from Genes to Genomes*. McGraw Hill.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	1	-	2	-	-	-	-	-	-	3
CO2	-	-	2	-	-	-	-		-	1	-	-	-	-	-	-	3
CO3	3	-	-	-	3	-	-	2	-	-	-	-	-	-	-	-	3
CO4	2	-	-	-	-	-	-	2	-	3	-	-	-	-	-	-	3
CO5	-	-	-	2	-	-	-	2	-	2	2	-	-	-	-	-	3
Average	**3**	**-**	**2**	**2**	**3**	**-**	**-**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

25MBU504B **Diagnostic Microbiology** **5H-3C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To introduces basic principles and then applies clinical relevance of manyetiological agents.
- To provide the basic principles of medical microbiologyand infectious disease, and mechanisms of infectious disease transmission, principles of aseptic practice
- To focus on pathogenic mechanisms in order to foster a student's ability to solve problemsin their future clinical career

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Demonstrate an advanced level of microbial virulence mechanisms and host response to infection.	Understand
CO2	Apply molecular techniques to medical microbiology	Apply
CO3	Demonstrate skin and respiratory tract infections to identify a unknown organisms in clinical samples	Understand/ Apply
CO4	Apply diagnostic skills, and interpretation of laboratory tests in the diagnosis of infectious diseases.	Apply
CO5	Understand pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.	Understand

UNIT I Isolation and identification of pathogens **13 HOURS**

Laboratory precaution and guidelines - Collection of clinical specimens - Blood, Urine, Sputum, Pus, CSF, Stool, Throat swab, Semen, Dental plaque - transport Media and its types - handling and examination of pathological specimens - Routine Laboratory diagnosis of bacterial pathogen -Antibiotic susceptibility testing. Quality control in microbiology lab, clean room maintenance and surveillance, face mask porosity testing- Bacterial Filtration Efficiency (BFE).

UNIT II Infections **12 HOURS**

Infections - types of infections - methods of infections - Sources of infections - infectious disease cycle. Biomedical waste management. Definitions of Epidemics, Endemics Pandemics and investigation of epidemics and control. Definition of pathogens, Saprophytes and Commensal.

UNIT III Gram positive organisms **11 HOURS**

Morphology, cultural characteristics, antigenic property, pathogenicity, laboratory diagnosis and treatment. *Staphylococcus* sp., *Streptococcus* sp., *Bacillus* sp., *Corynebacterium* sp., *Clostridium sp. Mycobacterium* sp.

UNIT IV Gram negative organisms **12 HOURS**

Morphology, cultural characteristics, antigenic property, pathogenicity, laboratory diagnosis andtreatment. *E.coli, Klebsiella* sp., *Proteus* sp., *Pseudomonas* sp., *Vibrio* sp., *Salmonella* sp., *Shigella* sp.,*Treponema* sp., *Leptospira* sp; *Neisseria* sp. and *Haemophilus* sp.

UNIT V Infection and Therapy **12 HOURS**

Nosocomial infection - Urinary tract infection, Respiratory tract infection, sexually transmitteddisease - Monoprophylaxis - Antimicrobial chemotherapy and antibiotics. Antibacterial resistance- Inhibitors of nucleic acid synthesis, inhibitors of protein synthesis and inhibitors of cell membrane synthesis. Vaccines - Types - Vaccination schedule.

TOTAL: 60 HOURS

TEXT BOOKS:

1. Ananthanarayanan, R., and Panicker, C.K.J. (2017). *Text Book of Microbiology* (10thed.).The Orient Blackswan.
2. Carl Fraenkel (2012). *Text book of bacteriology*. Printing company publishers, NewYork.

REFERENCE BOOKS:

1. Salle, A.J. (2008). *Fundamentals principles of bacteriology*. T.M.H. Ed.). McGraw Hill.
2. Brook, G.F., J., Butel, S., Stephen, A., and Morse, A., (2003). *Medical Microbiology*,(22nded.). McGraw Hill.
3. Jawetz, E., Melnic, J.L., and Adelberg, E.A., (2019). *Medical Microbiology*. (28thed.).Lange Medical Publishers. NY.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3
CO2	2	-	2	3	-	-	-	2	-	-	-	-	-	-	-	2	3
CO3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO4	-	-	-	3	-	-	-	-	-	2	-	-	-	-	-	3	-
CO5	3	-	3	2	-	-	-	2	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

25MBU511 Industrial Microbiology and RDNA Technology - Practical 5H-3C

Instruction Hours/week: L:0 T:0 P:5 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Industrial Microbiology and Microbial Biotechnology (25MBU501)

COURSE OBJECTIVES (CO):

- To use chromatographic techniques
- To know about electrophoresis techniques for protein separation
- To understand centrifuge techniques for separation of various components

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Demonstrate different fermenter types	Understand
CO2	Use fermentation techniques for enzyme and organic acid production	Apply
CO3	Evaluate the quality of probiotics in tablets and nutritional supplements	Evaluate
CO4	Utilize chromatography techniques for separation of mixtures	Apply
CO5	Make use of electrophoresis and centrifuge techniques for protein separation	Apply

EXPERIMENTS (60 HOURS)

1. Study of different parts of fermenter
2. Microbial fermentation – Production and estimation of enzyme – Amylase and Protease
3. Microbial fermentation – Production and estimation of organic acid- Citric acid
4. Assess quality of probiotics in tablets and nutritional supplements, stability of vials at different time.
5. Perform Cell growth kinetics.
6. Separation of mixtures by paper/thin layer chromatography.
7. Demonstration of column chromatography packing.
8. Separation of protein mixtures by SDS- Poly Acrylamide Gel Electrophoresis (SDS - PAGE).
9. Separation of components of a given mixture using a laboratory scale centrifuge.

TEXT BOOKS: **Total: 60 HOURS**

1. Nigam A and Ayyagari A. (2007). *Lab Manual in Biochemistry, Immunology and Biotechnology*. Tata McGraw Hill

2. Crueger Wand Crueger A. (2017). *Biotechnology: A textbook of Industrial Microbiology*. 3rdedition. Panima Publishing Co. New Delhi.
3. Geoffrey M Gadd, Sima Sariaslani (2015). *Advances in Applied Microbiology*, CRC Press.

REFERENCE BOOKS:

1. Nduka Okafor, Benedict C. Okeke (2017). *Modern Industrial Microbiology and Biotechnology*, 2nd Edition, CRC Press.
2. Stanbury PF, Whitaker A and Hall SJ. (2006). *Principles of Fermentation Technology*.2ndedition, Elsevier Science Ltd.

3. E.M TEl-Mansi, Jens Nielsen, David Mousdale (2009). *Fermentation Microbiology and Biotechnology*, Fourth Edition, CRC Press.
4. Karp G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. 6th edition. John Wiley & Sons. Inc.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	2	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	3
CO4	2	-	-	3	-	-	-	2	-	-	-	-	-	-	-	-	3
CO5	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

25MBU512 **Microbial Omics Practical** **5H-2C**

Instruction Hours/week: L:0 T:0 P:5 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- **Microbial Omics and Biotechniques** (**25MBU503)**

COURSE OBJECTIVES (CO):

- To Impart a skill-based knowledge on bacterial and fungal isolation.
- To appreciate the diversity of microbial commUNITies in water samples and the potability of water
- To learn competent cell preparation and DNA isolation from microbes

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

Cos	Course Outcomes	Blooms Level
CO1	Provide basic concepts of omics and metagenomics techniques	Understand
CO2	Understand and analyze the Microbial omics	Apply/Analyze
CO3	Retrieve information from available databases and use them for microbial identifications	Apply
CO4	Learn and practice Microbial omics technoques.	Analyze
CO5	Understand and perform Protein analysis	Apply/Understand

EXPERIMENTS **(60 HOURS)**

1. Isolation of DNA from soil sample-metagenomic approach.
2. Isolation of DNA from water sample-metagenomic approach.
3. Study Two dimensional gel electrophoresis (Demonstration)
4. Study Basics of DNA Sequencing (Demonstration)
5. Introduction to bioinformatics databases: NCBI/PDB/Uniprot
6. Study Basics of Searching database and BLAST analysis.
7. Sequence alignment & phylogenetic analysis.
8. Protein structure prediction: homology modeling using Swiss model.
9. Study of Maldi Tof spectroscopy and MASCOT search.

TEXTBOOKS: **Total: 60 HOURS**

1. Izard, Jacques., Rivera, Maria. (2014). *Metagenomics for Microbiology*. Elsevier.
2. Saxena Sanjay (2003). *A First Course in Computers*, Vikas Publishing.
3. Lesk M.A. (2008) Introduction to Bioinformatics. Oxford Publication, 3rd International Student Edition.
4. Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication

REFERENCE BOOKS:

1. Rastogi S.C., Mendiratta N. and Rastogi P. (2007). *Bioinformatics: methods and applications, genomics, proteomics and drug discovery*, 2nd ed. Prentice Hall India Publication.
2. Primrose and Twyman (2003). *Principles of Genome Analysis & Genomics*. Blackwell.
3. Brown T. A., (2020). *Gene Cloning and DNA Analysis: An Introduction.* 8th Edition. John Wiley & Sons.
4. Mount, D. (2004). *Bioinformatics: Sequence and Genome Analysis*. Cold Spring Harbor Laboratory Press, New York.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	3	-	-	-	2	-	-	-	-	-	-	-	3	-
CO2	3	-	1	2	2	-	-	2	-	-	-	-	-	-	1	3	-
CO3	2	-	1	2	-	-	-	3	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	3	-	-	-	-	1	-	-	-	3
CO5	3	-	-	-	-	-	-	3	2	-	-	-	-	-	-	-	3
Average	**2**	-	**1**	**3**	**2**	-	-	**3**	**2**	-	-	-	**1**	-	**1**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

25MBU591	**Internship - II**	**0H- 2C**

Instruction Hours/week: L:0 T:0 P:0 **Marks:** Internal**:100** External**:0 T**otal**:100**

End Semester Exam: -

Semester VI

25MBU601 **Food and Dairy Microbiology** **5H-4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To understand food spoilage microorganisms.
- To understand the microbiology of food preservation and food commodities; fermented and microbial foods.
- To study the micro biological quality control, and quality schemes.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Comprehend the existence of microbes in food and food spoilage	Understand
CO2	Make use of methods of food preservation in industries	Apply
CO3	Develop fermented dairy products and probiotics and prebiotics	Create
CO4	Analyse the characteristics of food-borne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.	Analyze
CO5	Experiment with Biosensors in food processing	Apply

UNIT I **12 HOURS**

Food and microorganisms – Important microorganisms in food (bacteria, molds and yeast). Sources of contamination of food. Intrinsic and extrinsic factors that affect growth and survival of microbes in foods. Microbial spoilage of various foods–Spoilage of vegetables, fruits, meat, eggs, milk and sea food.

UNIT II **12 HOURS**

General principles of food preservation. Physical methods of food preservation: Asepsis, drying, irradiation, low temperature and high temperature, Chemical methods of food preservation, Canning, food additives.

UNIT III **10 HOURS**

Fermented dairy products: yogurt, acidophilus milk, kumiss, kefir and cheese. Other fermented foods: Idly, sauerkraut, soy sauce and tampeh. Prebiotics and Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market. Beneficial uses of microorganisms in food industry.

UNIT IV **14 HOURS**

Causative agents, foods involved, symptoms and preventive measures of the following diseases, Food intoxications: *Staphylococcus aureus, Clostridium botulinum* and mycotoxins. Food infections: *Bacillus cereus, Vibrio parahaemolyticus, Escherichia coli*, Salmonellosis, Shigellosis and *Campylobacter jejuni*, fungal diseases (Mycotoxins, Aflatoxins, *Alternaria* toxins).

UNIT V **12 HOURS**

Cultural and rapid detection methods of food borne pathogens in foods and introduction to predictive microbiology. HACCP, FSSAI (ISO9001:2008) Indices of food sanitary quality (record maintenance and standards) sanitizers. Quality control of milk – MBRT, Litmus Milk – Alkaline phophatase tests. Biosensors in food processing.

Total: 60 HOURS

TEXT BOOKS:

1. Jay JM, Loessner MJ and Golden DA. (2005). *Modern Food Microbiology*. 7th edition, CBS Publishers and Distributors, Delhi, India.
2. Frazier W.C. and Westhoff D.C. (2008). *Food Microbiology*, 4th Edn. Tata McGraw Hill Publishing Co., New Delhi.
3. Robinson R.K. (2018). *Dairy Microbiology*: *Milk and Milk Products*, 6th Edn. Wiley Publishers.

REFERENCE BOOKS:

1. Lund BM, Baird Parker AC, and Gould GW. (2000). *The Microbiological Safety and Quality of Foods*.Vol.1-2, ASPEN Publication, Gaithersberg, MD.
2. Bamforth C.W. (2005) *Food, Fermentation and Microorganisms*, Blackwell Science.
3. Doyle M.P. and Buchanan R.L. (Ed.) (2013) *Food Microbiology*: Fundamentals and Frontiers, 4th Edn.ASM press.
4. James M Jay (2003). *Modern Food Microbiology*. Fourth edition, CBS Publishers, New Delhi.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	1	-	-	-	-	-	-	-	2	-
CO2	-	-	2	-	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	2	-	-	-	2	-	3	-	-	-	-	-	-	-	-	-	3
CO4	2	-	-	2	-	-	3	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	2	2	-	3	3	-	3	-	-	-	-	-	-	3
Average	**2**	**-**	**2**	**2**	**2**	**-**	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

25MBU602 **Environmental Microbiology** **5H–4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Introduction to Microbiology and Microbial Diversity (25MBU101)

COURSE OBJECTIVES (CO):

- To comprehend the role of microbes in waste water treatment
- To understand the methods in Solid waste management using microorganisms.
- To gain knowledge about the Biogas and biodegradation technology.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Understand different environment levels and environmental monitoring.	Understand
CO2	Apply the role of microbes in waste water treatment	Apply
CO3	Comprehend and practice Artificial Intelligence in Environmental sustainability	Apply
CO4	Perform Solid waste management using microorganisms	Analyze
CO5	Gain knowledge in air pollution and apply techniques to isolate air borne microbes and using microbes in Bioremediation process	Apply

UNIT I Microbes in Environment **12 HOURS**

Terrestrial Environment- soil profile and soil microflora. Biogenesis and Abiogenesis in environment Aquatic Environment- Microflora of fresh water and marine habitat. Atmosphere- Aero microbes and dispersal of microbes. Development of microbial commUNITies.

UNIT II Microbial role and diagnosis **12 HOURS**

Physiological ecology of micro-organisms. C, N, P nutrient cycle. Clean water and Sanitation (SDG 6) Treatment and safety of drinking (potable) water, membrane filter technique, Microbial interaction. Bio-films-surface colonization, Biofilm structure, Biofouling and Biotechnological applications. Xenobiotics.

UNIT III Waste Management **12 HOURS**

Solid waste management- sources and types, methods of disposal (composting sanitary landfill), Liquid Waste Management – Composition and strength of sewage (BOD and COD), Primary, Secondary (Oxidation ponds, trickling filter and activated sludge process) and tertiary sewage treatment.

UNIT IV Air Pollution **12 HOURS**

Introduction, Microbial Contamination of Air, Sources of Contamination, Disease caused by air pollution. Enumeration and Isolation of Bacteria in Air, Air samplers and sampling techniques, Effects and control measures of air pollution.

UNIT V Biogas and biodegradation technology **12 HOURS**

Biogas Technology- Plant design, construction, operation. Biogas from organic wastes. GMO impact and their important - Principles and biodegrading of common pesticides, organic (Hydrocarbons and Oil spills) and inorganic (Heavy Metal), Biosurfactants., bioremediation.

Total: 60 HOURS

TEXT BOOKS:

1. Tripathy, S.N., and Panda, S., (2011). *Fundamentals of Environmental Studies*; 3rdEdition, Vrianda Publications Private Ltd., New Delhi.
2. Kumar, A., (2004). *A Textbook of Environmental Science*; APH Publishing Corporation, New Delhi.
3. Verma, P.S., Agarwal, V.K., (2001). *Environmental Biology (Principles of Ecology*); S. Chand and Company Ltd., New Delhi.
4. Kaushik, A., Kaushik, C.P., (2006). *Perspectives in Environmental Studies*, New Age International Pvt. Ltd. Publications, New Delhi

REFERENCE BOOKS:

1. Singh, M.P., Singh, B.S., and Dey, S.S., (2004). *Conservation of Biodiversity and Natural Resources.* Daya Publishing House, Delhi.
2. Uberoi, N.K., (2010). *Environmental Studies*, Excel Books Publications, New Delhi, India.
3. Maier RM, Pepper IL, Gerba CP (2019). *Environmental Microbiology*, Elsevier.
4. Bruce E Rittmann and Perry L McCarty. *Environmental Biotechnology. Principles and Applications*. McGraw-Hill International (2020) 2ndedition.
5. Ljungdahl LG, Adams MW, Barton LL, Ferry JG, Johnson MK (2003). *Biochemistry and Physiology of Anaerobic Bacteria*, Springer. 8. Madigan MT, Martinko JM, Dunlap PV, Clark DP (2012)

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-		-	-	-	-	-	-	-	-	-	-	-	2	3
CO2		-	-	2	-	-	-	2	-	-	-	-	1	-	-	-	3
CO3	3	-	-		-	-	-	3	-	3	-	-	-	-	-	-	3
CO4		-	-	2	2	-	-	3	-	-	-	-	-	-	-	-	3
CO5		-	-	3	2	-	-	3	-	-	1	-	-	-	-	-	3
Average	**3**	**-**	**-**		**2**	**-**	**-**	**3**	**-**	**3**	**1**	**-**	**1**	**-**	**-**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

25MBU603A **Biopharmacy** **5H-3C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To know about the biological substance which has the medicinal value.
- To improve the biopharmaceutical components and technical knowledge.
- To study isolation and purification techniques of biomolecules

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the biosynthesis and classification of biological substances with medicinal values	Understand
CO2	Utilize chromatography techniques in isolation of phytochemicals and apply chemical fingerprinting	Apply
CO3	Apply techniques for production of secondary metabolites from cultured plant cells	Apply
CO4	Perform bioactivity studies of phytochemicals to in vitro and in vivo	Apply
CO5	Explain the role of plant polyphenolic as antioxidants against free radicals	Understand

UNIT I Phytochemistry **12 HOURS**

Biosynthesis of primary and secondary metabolites - alkaloids, terpenoids. glycosides, Phenolic compounds and coumarins. Classification and sources of alkaloids. Major classes in phenolic compounds – carotenoids, flavonoids, tannins and phenolic acids. Classification of terpenoids.

UNIT II Extraction Techniques **12 HOURS**

General extraction and isolation techniques for compounds from plants. Techniques involved in extraction of phytochemicals – Percolation, Soxhlet extraction, Supercritical Fluid extraction, Pilot scale extraction, reflux and other methods.

UNIT III Isolation and purification techniques **12 HOURS**

Thin layer and Column chromatography, Liquid Chromatography, Gas chromatography, Affinity chromatography and super critical fluid chromatography. Chemical fingerprinting – HPLC and HPTLC, Mass Spectroscopy.

UNIT IV Biotechnology of medicinal plants **12 HOURS**

Production of secondary metabolites from cultured plant cells, elicitation, immobilization and biotransformation. Medicinal plants – Plant DNA isolation.

UNIT V Bioactive studies **12 HOURS**

Anticancer, antidiabetic, anti-inflammatory, hepatoprotectives, antimicrobials from medicinal plants. Antioxidants of plant origin – Reactive Oxygen Species (ROS), antioxidant polyphenols.

Total: 60 HOURS

TEXT BOOKS:

1. Harborne, J.B. (1998). *Phytochemical methods to modern techniques of plant analysis*. Chapman & Hall, London.

REFERENCE BOOKS:

1. Trease G.E. and M.C. Evans, (1979). *Textbook of Pharmacognosy* 12th Edition. Balliere-Tindal, London.
2. Irfan A. Khan and Atitya Khanum, (Eds.) 2004. *Role of Biotechnology in medicinal and Aromatic plants*, Vols. I-X. Ukaaz Publications, Hyderabad.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	3	-	2	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO4	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	2	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3
Average	**3**	-	**2**	**2**	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

25MBU603B **Bionanotechnology** **5H-3C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide knowledge about the Bio nanomaterials and its advancement.
- To learn biosynthesis and characterization of various Nanoparticles.
- To understand in applications of Bio nanomaterials.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the concepts of bionanomaterials and apply techniques Molecular design for nanotechnology	Understand / Apply
CO2	Comprehend Structural principles of Bio nanotechnology	Understand
CO3	Analyse the characterization of nanomaterials	Analyze
CO4	Explore the applications of Bio Nanotechnology	Understand
CO5	Apply knowledge in chemical transformation and biomolecular sensing	Apply

UNIT I Nano particles **11 HOURS**

Biotechnology to Bio nanotechnology: Bio nanomachines – Modern bio nanomaterials – protein, nucleic acid, lipids used for carrying information – polysaccharides use in special structural roles – Present status of bionanotechnology.

UNIT II Bionanomachines **11 HOURS**

Molecular design for nanotechnology: X-ray crystallography, NMR spectroscopy and electron microscopy, use in nanotechnology – Computer modelling to bio nanomachines and computer assisted molecular design.

UNIT III Natural bio nanotechnology designing **14 HOURS**

Structural principles of Bionanotechnology: Natural bio nanotechnology design for specific environment– Biomolecular structure as low materials – Hierarchical strategy in construction of nanomachines – protein folding – self organization – molecular recognition – flexibility.

UNIT IV Principles of Nanotechnology **10 HOURS**

Functional principles of Bionanotechnology: Information driven nano assembly – chemical transformation – bio molecular sensing – self application – machine phase bio nanotechnology.

UNIT V Ethics of Nanotechnology **14 HOURS**

Future of Bionanotechnology: Problems in bio nanotechnology – Abide finger problem – Sticky finger problem – role of enzyme to solve these problems – Core studies – nomotuble synthesis, nano scale assembler, nanosurveillance – ethical consideration – respect for life, potential dangers, fuel.

Total: 60 HOURS

TEXT BOOKS:

1. David, S. (2004). *Bionanotechnology*. Goodsell. Wiley-Blackwell.
2. Rakesh Kumar, and Tiwari, K., (2013). *A Textbook of Nanoscience*. Publisher: S.K. Kataria& Sons.
3. Ausubel, F.M., Breut, R., Kingston, R.E., Moore, D.D., Siedman, J.G., Smith, J.A., and Struhl K., (1999). *Short protocols in Molecular Biology*. (4th ed.). Wiley, New York.
4. Goosell, D.S. (2004). *Bionanotechnology: Lessons from nature*. John Wiley & Sons Inc. publication.

REFERENCE BOOKS:

1. Gonsalves, K., Halberstadt, C., Laurencin, C.T., (2007). *Biomedical Nanostructures*. Wiley-Blackwell.
2. Sabliov, C., Hongda, A., Yada, R., (2015). *Nanotechnology and Functional Foods*. Wiley-Blackwell Publishers
3. Goodsell, D.S. (1996). *Biomolecules and Nanotechnology*. Ancient Scientist, 88, 230 – 237.
4. Blundell, T.L., and Johnson, L.N., (1976). *Protein crystallography*. New York.
5. Eisenberg, D., and Crothers, D., (1979). *Physical Chemistry with Applications to the Life Sciences*. Benjamin Cummings, Menlo Park, California.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO2	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	2	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	2	-	-	2	-	-	-	3	-	3	-	-	-	-	-	-	3
CO5	3	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	3
Average	**3**	-	-	**2**	-	-	-	**3**	-	**3**	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

25MBU603C	Biofertilizer	5H-3C

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide the student knowledge about ecofriendly product.
- To understand the crucial role in environmental management.
- To learn the production and application of biofertilizers to control plant diseases.

COURSE OUTCOMES (COs)

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the importance of biofertilizers	Understand
CO2	Learn and use techniques for sterilization and media preparation	Understand
CO3	Apply techniques for production and quality control of biofertilizers	Apply
CO4	Comprehend applications of biofertilizers	Understand
CO5	Utilize the biofertilizers for crop development	Apply

UNIT – I **12 HOURS**

Introduction to Biofertilizers- Different types – its Application in Agriculture – Advantages of Biofertilizers over chemical fertilizers

UNIT – II **11 HOURS**

Types of carrier material used – its sterilization and processing – Glassware sterilization – Packing materials – Media preparation.

UNIT – III **15 HOURS**

Strain selection – Inoculum development – Mass production – Packaging – Quality control of different Biofertilizers (*Rhizobium*, Phosphate solubilizers, Azotobacter, *Azospirillum*, Mycorrhizae, Azolla, Algae)

UNIT – IV **11 HOURS**

Methods of application of Biofertilizers – Effects of Biofertilizer on crop yield – N_2 Fixation, phosphate solubilization – pot experiment – field trials.

UNIT – V **11 HOURS**

Methods and application of Biofertilizers in different crops – Groundnut, Rice and Vegetables

TEXT BOOKS **TOTAL: 60 HOURS**

1. Subba Rao, N.S., 1999. Biofertilizers in Agriculture and Agroforestry. Oxford and IBH, New Delhi.
2. Rangaswami, G. and D.J. Bhagyaraj, 2001. Agricultural Microbiology. 2nd Edition. Prentice Hall, New Delhi.
3. Rao, N.S., 1995. Soil Microorganisms and plant Growth. Oxford and IBH Publishing Co., New Delhi.

REFERENCE BOOKS:

1. Alexander, M. 1977. Introduction to soil Microbiology, NY, John Wiley & Sons.

2. Atlas.R.M and Bartha.R 1992. Microbial ecology. Fundamentals and applications. 3rd Edition. Red Wood City. C.A. Benjamin
3. Bagyaraj and Rangasamy. 2002. Agricultural Microbiology. 2nd Edition. Prentice Hall, India
4. Paul. E.A. and Clark F.E., 1986. Soil Microbiology and Biochemistry. Academic Press, New York.
6. Robert, L.Tate, 1995. Soil microbiology. 1st Edition, John Wiley & Sons, Inc, New York.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO2	3	-	-	-	-	-	-	1	-	-	-	-	-	-	-	3	-
CO3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	3	-	-	-	3	-	3	-	-	-	-	-	-	3
CO5	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	3	-	2	-	-	-	-	-	-	3
Average	**3**	-	-	**2**	-	-	-	**3**	-	**3**	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

25MBU611 Food and Dairy Microbiology Practical 4H-1C

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Food and Dairy Microbiology (25MBU601)

COURSE OBJECTIVES (CO):

- To obtain understanding of food and dairy products and become qualified as microbiologist in food and dairy industries.
- To recognize the characteristics of important pathogens and spoilage microorganisms in foods.
- To apply methods for their isolation, detection and identification of microorganisms in food and employ in industries.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Analyse milk samples for efficiency of pasteurization and Standard plate count	Analyze
CO2	Perform techniques in isolation of food borne pathogen from food products and count	Apply
CO3	Utilize techniques in isolation of spoilage microorganisms from spoiled food	Apply
CO4	Experiment with isolation of microorganisms from curd and production of yogurt	Apply
CO5	Observe and learn the UNIT operation procedures in food and dairy industries	Understand

EXPERIMENTS **(48 HOURS)**

1. Methylene Blue Dye Reduction Test and Resazurin test for testing the Raw milk quality
2. Standard plate count of milk sample.
3. Alkaline phosphatase test to check the efficiency of pasteurization of milk.
4. Isolation of food borne pathogen from food products.
5. Microbial count from packed food.
6. Isolation of spoilage microorganisms from spoiled vegetables/fruits.
7. Production of yogurt.
8. Isolation of microorganisms from curd (*Lactobacillus* observation).

TEXT BOOKS: **Total: 48 HOURS**

1. Jay JM, Loessner MJ and Golden DA. (2005). *Modern Food Microbiology*. 7thedition, CBS Publishers and Distributors, Delhi, India.
2. Lund BM, Baird Parker AC, and Gould GW. (2000). *The Microbiological Safety and Quality of Foods*. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
3. Tortora GJ, Funke BR, and Case CL. (2008). *Microbiology: An Introduction*. 9thedition. Pearson Education.
4. Diane Roberts (2013). *Practical Food Microbiology*, Third Edition, Blackwell Publishing Ltd.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO2	3	-	1	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	2	-	3	2	-	-	-	3	-	-	1	-	-	-	-	-	3
CO4	1	-	2	2	-	-	-	2	-	-	1	-	-	-	-	-	2
CO5	2	-	1	2	-	-	1	2	-	-	-	-	-	-	-	-	2
CO6	1	-	2	-	-	-	-	2	-	-	-	-	-	-	2	-	3
Average	**2**	-	**2**	**2**	-	-	**1**	**2**	-	-	**1**	-	-	-	**2**	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

25MBU612 **Environmental Microbiology Practical** **4H–1C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Microbial Biotechnology (25MBU303A)

COURSE OBJECTIVES (CO):

- To make students understand the aspects of Enzyme immobilization.
- To acquire technical knowledge in Pigment production
- To familiarize in Production of Microbial Biomass in bioreactor and single cell protein

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Evaluate yeast cell and enzyme immobilization techniques	Evaluate
CO2	Exercise pigment production from Bacteria	Apply
CO3	Experiment with xylanase production by bacteria	Apply
CO4	Perform lipase production using bacteria	Apply
CO5	Practice production of algal single cell proteins	Apply

EXPERIMENTS **48 HOURS**

1. Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action.
2. Isolation of microbes (bacteria &fungi) from rhizosphere and rhizoplane.
3. Analysis of potable water- MPN method.
4. Determination of BOD and COD of wastewater sample.
5. Isolation of phosphate solubilizing bacteria from soil and study.

TEXT BOOKS: **Total: 48 HOURS**

1. Okafor, N (2011). *Environmental Microbiology of Aquatic & Waste systems*. 1st edition, Springer, New York.
2. Atlas RM and Bartha R (2000). *Microbial Ecology: Fundamentals & Applications*. 4th edition. Benjamin/Cummings Science Publishing, USA
3. Barton LL & Northup DE (2011). *Microbial Ecology*. 1stedition, Wiley Blackwell, USA Campbell RE. (1983). Microbial Ecology. Black well Scientific Publication, Oxford, England.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	3	-	-	-	3	-	-	-	-	-	-	-	-	3
CO2	-	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
CO4	-	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	-	-	-	2	2	-	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**2**	**2**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

25MBU691	**Project and Viva Voce**	**7H-6C**

Instruction Hours/week: L:0 T:0 P:7 **Marks:** Internal**:80** External**:120 T**otal**:200**

End Semester Exam: -

25ECU601G **National Service Scheme** **0H- 0C**

Instruction Hours/week: L:0 T:0 P:0 **Marks:** Internal**:100** External**:00 T**otal**:100**

I YEAR

Orientation – NSS origin – motto – symbol – NSS administration at different levels – programme planning – Rural Projects – Urban projects – Government schemes – Career guidance – Self help groups – Environment protection – Use of natural energy – Conventional energy resources – Soil and Water conservation – CommUNITy health programmes – Women and child welfare – Education for all.

II YEAR

Popularization of agro techniques – Self employment opportUNITies – Animal health, Dairy and Poultry farming – Road safety – Training on First aid and emergency cell. Popularization of small savings – communal harmony and National integration – Care of Senior citizens – Personality development – meditation, Yoga Art of living – Activities on the preservation of National monuments, cultural heritage and folklore – special camp activities

PRACTICAL SCHEDULE

Semester-I

1. Orientation of NSS volunteers and programme coordinator and Programme officers.
2. Origin of NSS in India and its development
3. NSS motto, symbol and NSS awards
4. Organizational set up of NSS at Central, State University and college levels.
5. Programme planning – Theme of the year – planning implementation at PC, PO and NSS volunteer level.
6. Visit to selected village - gathering basic data on socio economic status.
7. Participatory rural appraisal – studying the needs of the target group.
8. Visit of urban slum and gathering data on socio economic status.
9. Self involvement and methods of creating rapport with the target group.
10. Awareness campaign on welfare schemes of the central and state government.
11. Formation career guidance group with NSS volunteers and students welfare UNIT
12. Cycle rally on environmental protection.
13. Campus development activities – clean environment campaign, formation of plastic free zones.
14. Campus development,
15. Tree planting maintenance and greening
16. Campus cleaning.
17. FINAL EXAMINATION.

Semester - II

1. Motivation of rural and urban youth for formation of SHG (Self Help Groups) in collaboration with Government machineries and NGOs.
2. Campaign on ill effects of plastics in the adjoining campus areas – Villages / urban areas.

3. Campaign on *Parthenium* eradication.
4. Cycle rally on air pollution – Vehicle exhaust and other means.
5. Popularization of biogas and smokeless chulah.
6. Demonstration on the use of wind energy and solar energy.
7. Demonstration of water harvesting techniques.
8. Demonstration on soil conservation techniques wherever possible.
9. Campaign on CommUNITy health programmes of central and state Government – involving Health department officials.
10. AIDS awareness campaign ; campaign on diabetes and healthy food habits and drug abuse
11. Planing formation of blood donors club – involving NGOs.
12. Campaign on gender equality and women empowerment.
13. Campaign on child health care – immunization, food habits and child labour abolition.

III Semester

1. Conducting field days with KVK to popularize improved agro techniques.
2. Conducing seminar / workshop in a nearby village to motivate the youth on agribusiness (involving DEE, KVK, NGO and local agripreneurs).

3–5 Campaign on self employment opportUNITies like Apiculture, mushroom cultivation, Food processing and value addition, production of biocontrol agents and biofertilizers, nursery techniques, seed production, tissue culture, vermicompost, manufacture of small gadgets and agricultural implements as per local needs and feasibility.

6. Animal health care campaign – Dairy and poultry farming - Forage production techniques and silage making.
7. Training the NSS volunteers on road safety measures in involving traffic wardens and RTO.
8. Training NSS volunteers on First AID and emergency call involving NGOs and organizations like St. John's Ambulance, Red Cross, etc.,
9. Organizing Road safety rally.
10. Motivating NSS Volunteers on small savings concept and conveying the message to the public through them.
12. Observation of National integration and communal harmony.

14 – 16 : Campus development and greening activities

4. Examination.

Semester-IV

1 – 3: Visit to orphanages and old age homes to look after their needs.

4. Personality development programmes – Building up self confidence in youth.

5 – 7: Teaching NSS volunteers on mediation Yoga and art of healthy living with trained teachers

8 – 9 : Visit of nearby National Monument / Places of tourist importance and campaign on cleanliness and preservation.

10–11: Exploration of hidden talents of village youth and public on folklore, traditional art, sports, martial arts and cultural heritage.

12–13. Campus improvement activities

14–16: Visit to special camp village and pre camp planning.

5. Examination

- Besides the above NSS volunteers will attend work during important occasions like Convocation, Farmers Day, Sports meet and other University / College functions. NSS Volunteers will attend one special camp in the selected village for a duration of 10 days and undertake various activities based on the need of that village people.
- For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (Cyclable distance)
- Special camp activity may be carried out in a village situated within a radius of 15 – 20 KM.

Semester VII

25MBU701 **Textile Microbiology** **6H-5C**

Instruction Hours/week: L:6 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To understand the manufacturing process of textile fibers and yarns.
- To gain knowledge about the fabric weaving methods.
- To know about the innumerable applications of enzymes and antimicrobial finishes.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Classify fibers and explain fiber properties and manufacturing processes	Understand
CO2	Learn and apply extraction and fabrication of natural fibers and biomaterials	Apply
CO3	Explain Enzymes in textile processing and for treatment of dye effluent and to manufacture eco-friendly detergents	Understand
CO4	Practice synthesis of Microbial Pigments in textile industry	Apply
CO5	Analyse antimicrobial finishing methods on fabrics	Analyze

UNIT I Introduction to fiber Science **15 HOURS**

Classification of textile fibres according to their nature and origin, manufacturing process of end uses of various fibers. Essential and desirable properties of textile fibres. Natural fibres: Vegetable fibers (bast, leaf and seed fibres), animal fibers (wool and silk) and mineral fibers (glass, asbestos and metallic fibres). classification, distinctive properties and end uses. Man-made fibres- Rayon & Bamboo.

UNIT II Extraction and Fabrication of Natural Fibers and Biomaterials **15 HOURS**

Introduction, Need, and Classification of retting – Mechanical, running water, pool retting, and dew retting, stagnant retting and enzymatic retting. Yarn making and fabrication weaving, knitting and non woven. Biomaterials utilized in medical textiles – an overview. Definition and classification of biomaterials, Structure of biomaterials, Mechanical properties - Elastic behaviour, Stress and Strain, Tension and Compression, Shear, Isotropy -Fatigue- Toughness - Effect of Fabrication on Strength.

UNIT III Enzymes in textile industry **12 HOURS**

Enzymes in textile processing- cellulosic fibres- desizing, scouring, bleaching, biopolishing, flax retting, denim fading. Protein fibres degumming, wool deprickling, shrink proofing. Enzymes in treatment of textile dye effluent.

UNIT IV Enzyme based eco-friendly detergents **15 HOURS**

Introduction, disadvantages of conventional detergents, role of enzymes in detergents. Immobilized enzymes- preparation and industrial applications. Enzymes as fermentation products- amylases, proteases, pectinases and cellulases.

UNIT V Microbial applications in textile field **15 HOURS**

Microbial Pigments - Extraction of bacterial pigments. Application of microbes - decolourization of textile dye effluent, Extraction and softening of fibres. Antimicrobial Finish- Impact of microbial growth on textiles and need for antimicrobial finish. Assessment of antimicrobial activity: Antimicrobial finishing methods on fabrics.

Total: 72 HOURS

TEXT BOOKS:

1. Deepali Rastogi and Sheetal Chopra, (2017). *Textile Science*, Orient Black Swan Private Limited, Hyderabad.
2. Satyanarayana.U and Chakrapani.U , (2006). *Biochemistry*, Third Edition, Arunabha Sen Books and Allied P Ltd., Kolkata.
3. Purohit. S,S, (2008). *Microbiology Fundamentals and Applications*, 7 Th Edition, AGROBIOS, India.

REFERENCE BOOKS:

1. Seema Sekhri, (2011). *Textbook of Fabric Science: Fundamentals to Finishing*, PHI Learning Pvt Limited, New Delhi.
2. Trever Palmer, (2004). *Enzymes, Biochemistry, Biotechnology Clinical Chemistry*: Affiliated East-West Press Ltd., New Delhi.
3. V Nierstrasz A Cavaco-Paulo, (2010). *Advances in Textile Biotechnology*, Woodhead Publishing Ltd., U.K.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	2
CO2	2	-	3	2	2	-	-	3	-	-	-	-	-	-	-	-	3
CO3	3	-	3	2	-	-	-	2	-	-	1	-	-	-	-	-	3
CO4	3	-	-	-	2	-	-	2	-	-	-	-	-	-	-	-	3
CO5	-	-	2	3	2	-	-	2	-	-	-	-	-	-	-	-	2
Average	**3**	**-**	**3**	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

25MBU702 Poultry and Veterinary Microbiology 6H-5C

Instruction Hours/week: L:6 T:0 P: **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To understand the role of microorganisms in animal health.
- To Identify a variety of types of pathogenic microorganisms and the diseases they produce in the host.
- To perform basic microbiological techniques used in the laboratory setting of a veterinary hospital.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand pathogenesis, laboratory diagnosis and treatment of infection in cattle	Understand
CO2	Comprehend pathogenicity and diagnosis of bacterial and fungal diseases	Understand
CO3	Explain viral infection in cattle and the host response to infection.	Understand
CO4	Elucidate epidemiology of infections, treatment and control of infections	Understand
CO5	Analyze and generate animal feed	Analyze

UNIT I Introduction to Veterinary Microbiology 12 HOURS

Introduction- etiology, pathogenesis, laboratory diagnosis and treatment of infection in the individual. Epizootiology - prevention and control of infection in the commUNITy.

UNIT II Veterinary Bacteriology & Mycology 15 HOURS

Study of pathogenic bacteria and fungi in relation to their morphology, isolation, growth, colonial, biochemical characteristics, Pathogenicity and diagnosis of bacterial and fungal diseases: Bacteria - Staphylococcus, Streptococcus, Bacillus, Clostridium, Mycobacterium, Enterobacteriaceae, Campylobacter, Brucella, Pasteurella, Listeria, Actinomyces, Mycoplasma, Rickettsia, Chlamydia. Fungi - Dermatophytes, Candida, Aspergillus, Zygomycetes, Mycotic mastitis and Mycotoxicosis.

UNIT III Cell interaction and cell damage 15 HOURS

Virus –cell interactions, types of interactions, Cytocidal changes in virus infected cells, mechanisms of cell damage., Inclusion bodies, ultrastructural changes in virus infected cells, interferons. Viral persistence, viral strategies to evade host defense mechanisms, persistent infection and chronic damage to tissues and organs, infection induced damage to immune system, autoimmune disease, hypersensitivity.

UNIT IV Veterinary Parasitology 15 HOURS

Principles of Taxonomy, Physiology and Parasite Identification. Animal Parasitic diseases - Parasite morphology, parasite life cycles, host pathology, epidemiology of infections, treatment and control of infections- Platyhelminthes, Nemat helminthes and Acanthocephala.

UNIT V Livestock Management **15 HOURS**

Animal nutrition- Energy sources. Dairy production and Management. Taxonomy, anatomy and biology of commercially important fishes. Most common cattle, sheep, goat, poultry and pig diseases. Types of animal vaccines-Live, Inactivated, Recombinant, synthetic peptide, genetically modified vaccines etc.

Total: 72 HOURS

TEXT BOOKS:

1. Fenner.S, (2016). *Veterinary virology* (5th Edition). Academic Press.

2. Tortora GJ, Funke BR & Case CL. (2004). *Microbiology: An Introduction*. Benjamin/Cummins 4. Publications.

REFERENCE BOOKS:

1. Glen Sonder J amp; Karen W Post (2005). *Veterinary Microbiology: Bacterial and Fungal Agents of Animal Diseases*. Cold Spring Harbor Lab. Press.
2. Prescot LM, Harley JP & Klen DA. (2005). *Microbiology*. Wm. C. Brown Publications.
3. C.L. Gyles, J..F Prescott, J.G. Songer, C.O. Thoen. (2004). *Pathogenesis of Bacterial Infections in Animals*. Wiley.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	1	-	-	-	-		-	-	-	-	-	-	-	3	-
CO2	3	-	-	3	2	-	-	2	-	-	-	-	-	-	-	3	-
CO3	2	-	1	2	-	-	-	2	-	-	-	-	-	-	-	3	-
CO4	2	-	2	2	1	-	-	2	-	-	-	-	-	-	-	2	-
CO5	-	-	3	2	-	-	-	3	-	-	-	-	-	-	-	-	3
Average	**2**	**-**	**2**	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

25MBU703A **Drug Design and Development** **5H-4C**

Instruction Hours/week: L:5 T:0 P: **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To learn the course, introduce the basic principles of modern drug design, discovery and development.
- To know the different source of drug with specific focus on microbial source
- To understand the drug manufacturing process and to identify the Lead compound series

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Describe current approaches and philosophies in drug design and Explore microbes as source of drug	Understand
CO2	Analyse the impact of genomics and related technologies upon drug discovery	Analyze
CO3	Generate different traditional vaccine preparations	Create
CO4	Make use of nucleic acid as gene therapy	Apply
CO5	Practice drug manufacturing process using fermentation	Apply

UNIT I Introduction to drug design **12 HOURS**

Introduction- History of drug design, Current approaches and philosophies in drug design, Molecular mechanisms of diseases and drug action with examples. Pharmaceutical products, Pharmaceuticals of microbial origin (macrolides, ansamycins, Peptide and other antibiotics) animal origin (sex hormones androgens), plant origin (Alkaloids Atropine and scopolamine)

UNIT II Microbial drugs **12 HOURS**

Sources of Drugs- Microbial drugs, E. coli as a source of recombinant therapeutic proteins. Expression of recombinant proteins in yeasts, animal cell culture systems. Transgenic animals, Transgenic plants and Insect cell-based systems. Rational drug design and Combinatorial approaches to drug discovery, Antibody Drug Conjugates.

UNIT III Drug production **12 HOURS**

Drug development process- Impact of genomics and related technologies upon drug discovery: Gene chips, Proteomics, Structural genomics and Pharmacogenetics, Model systems in the development of drugs, Nano scaffolds for Drug Delivery. Drug manufacturing process- Guides to good manufacturing practice, Production of final product - Cell banking systems, Upstream processing, Microbial cell fermentation, Mammalian cell culture systems, Downstream processing, Final product formulation, Freeze drying, Labelling and packing

UNIT IV Vaccines and adjuvant **10 HOURS**

Traditional vaccine preparations, attenuated, dead or inactivated bacteria, Attenuated and inactivated viral vaccines, Toxoids, antigen-based and other vaccine preparations. Impact of genetic engineering on vaccine technology. Peptide vaccines Vaccine vectors. Development of an AIDS vaccine, Difficulties associated

with vaccine development, AIDS vaccines in clinical trials, Cancer vaccines, Recombinant veterinary vaccines. Adjuvant technology: Adjuvant mode of action, Mineral-based adjuvants, Oil-based emulsion adjuvants Bacteria/bacterial products as adjuvants, Biosimilars.

UNIT V Applications of drugs **14 HOURS**

Nucleic acid as drugs- Gene therapy: Basic approach to gene therapy, Vectors used in gene therapy - Retroviral vectors, Additional viral-based vectors, Manufacture of viral vectors, Non-viral vectors. Gene therapy and genetic disease, cancer, Gene therapy and AIDS. Gene based vaccines, Repurposing of drugs.

Total: 60 HOURS

TEXT BOOKS:

1. Kristian Stromgaar, Povl Krogsgaard-Larsen and Ulf Madsen (2017). *Textbook of Drug Design and Discovery*, Fifth Edition, CRC press,2017.
2. David B. Weiner and William V. Williams. *Biological Approaches to Rational Drug Design* (Handbooks in Pharmacology and Toxicology) CRC press,1994

REFERENCE BOOKS:

1. Thomas J. Dougherty and Steven J. Projan. (2003). *Microbial Genomics and Drug Discovery*, Taylor andFrancis,
2. Kenneth M. Merz, Dagmar Ringe and Charles H. Reynolds. (2010). *Drug Design: Structure- and Ligand-Based Approaches*, Cambridge University press,
3. Gary Wlash (2004). *Biopharmaceuticals, Biochemistry and Biotechnology*. 2nd edition. Wiley publisher.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO2	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	-	2
CO3	-	-	3	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO4	-	-	-	3	-	-	-	2	-	-	1	-	-	-	-	-	3
CO5	-	-	2	2	-	-	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**

1 **- Low, 2 - Medium, 3 - High, '-' - No Correlation**

25MBU703B **Bioproduct Development and Entrepreneurial Microbiology** **5H-4C**

Instruction Hours/week: L:5 T:0 P: **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To obtain good understanding about the interpretation of biological products.
- To provide knowledge on manufacturing and production of bioproducts.
- To get introduced to Regulatory aspects of Quality Assurance and Quality control

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand and apply several entrepreneurial ideas and business theories in practical framework	Understand
CO2	Practice production of single cell proteins and express the importance of mushroom cultivation and probiotics	Apply
CO3	Exercise the mass production of microbial inoculants used as Biofertilisers and Bioinsecticides	Apply
CO4	Analyze the application and commercial production of Monoclonal antibodies, Cytokines. TPH and teaching kits	Analyze
CO5	Describe Regulatory aspects of Quality Assurance and Quality control, and FDA guidelines for drugs	Understand

UNIT I **12 HOURS**

Entrepreneurship: Notions and theories of Entrepreneurship, Entrepreneurial traits and motivation- Nature and importance of Entrepreneurs, - Financial Analysis Investment process, Break even analysis, Profitability analysis, Budget and planning process. Government schemes for commercialization of technology - Funding and support mechanisms for entrepreneurship. Professional ethics in entrepreneurship.

UNIT II **12 HOURS**

Production of microbial metabolites and Single cell proteins: Metabolic pathways and control mechanisms of primary and secondary metabolites; Commercially important metabolites: Primary – ethanol, citric acid; Secondary –β exotoxin; Single Cell Protein: Algae (*Spirullina maxima*, *Chlorella pyrenoidosa*) and Yeast (*Candida tropicana*) as SCP, Mushroom Cultivation and Probiotics.

UNIT III **12 HOURS**

Biofertilizers and Biopesticides: Production of Rhizobium, Azotobacter, *Azospirillum*, Phospho bacterium, BGA (*Anabena*, *Nostoc*); Packing, Quality assurance, Field Application and Crop Response. Bioinsecticide: Mass Production, field Application, and Crop Response of Bacteria (*Bacillus thuringiensis, Bacillus papillae, Pseudomonas fluorescens*), Fungi (*Verticillium lecanii, Coelomyces*) and Viruses (Bacuulo viruses, NPV, Granulosis virus).

UNIT IV **10 HOURS**

Commercial Products: Production and Application of TPA, HGH, Cytokines and Monoclonal Antibodies;

Production of enzymes – Cellulase, Protease, Amylase and lipase Production of teaching kits-DNA isolation, Industrial Production and Application of biogas, bio-diesel, hydrogen fuel, gasoline; Bioplastics - PHB, PHA; Biopigments – Lycopene, Betacarotene, and its applications.

UNIT V **14 HOURS**

Government regulatory practices and policies: Regulatory aspects of Quality Assurance and Quality control. Sterilization control and sterility testing- Chemical and biological indicators. Regulatory authorities for introduction of medicines in market – Role of Food and Drug Administration, FDA guidelines for drugs / biologicals, Validation (GMP, GLP, GCP, etc.). Finished product shelf-life analysis, formulation and packing of finished product.

TOTAL: 60 HOURS

TEXT BOOKS:

1. Stockholm, K.T.H., Sven-Olo f Enfors, and Lena Haggstrom. (2000), *Bioprocess Technology: Fundamentals and Applications*, Royal Institute of Technology: Sweden.
2. Crueger, W, and Crueger. A. (2000), *Biotechnology: A Text Book of Industrial microbiology*, 2nd Edition, Sinauer Associates: Sunderland. Mass.

REFERENCE BOOKS:

1. Stanbury, P.F, and Whitekar. A. (1999), *Principles of Fermentation Technology*, 2nd Edition. Butterworth-Heinemann: Oxford.
2. Ashton Acton, Q., (2012). *Biological Pigments– Advances in Research and Application*. Scholarly Editions: Atlanta, Georgia.
3. Hugo, W.B. and Russel, A.D. (2003), *Pharmaceutical Microbiology*, 6th Edition. Blackwell Scientific Publications: U K.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	2	-	-	1	-	-	-	-	-	-	-	-	3
CO2	3	-	-	2	2	-	-	2	-	-	-	-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	2	-	-	1	-	-	-	-	-	3
CO4	-	-	3	2	2	-	-	1	-	-	-	-	-	-	-	-	3
CO5	-	-	-	3	2	-	-	2	-	-	-	-	-	-	-	-	3
Average	**3**	-	**3**	**2**	**2**	-	-	**2**	-	-	**1**	-	-	-	-	-	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

25MBU704A **Advanced Cell Biology** **4H–3C**

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Introduction to Microbiology and Microbial Diversity (25MBU101)

COURSE OBJECTIVES (CO):

- To discuss the basic organization of cell
- To understand the fundamentals of cellular organization.
- To impart knowledge about the various processes that occur in cell their importance.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the cell Biology with unique reference to prokaryotic and eukaryotic cell.	Understand
CO2	Describe the nature of cellular world and its application in modern Microbiological sectors.	Understand
CO3	Comprehend the process of cell division.	Understand
CO4	Acquire knowledge about the organization of cell.	Understand
CO5	Explain the concepts of cellular functioning.	Apply

UNIT I Cell organization **12 HOURS**

Cell Organization – Eukaryotic (Plant and animal cells) and prokaryotic. Plasma membrane: Structure and transport of small molecules. Biological membranes. Cytoskeleton and Intermediate Filaments. Microtubules and Actin Filaments.

UNIT II Membrane bound Organelles **12 HOURS**

Structure and Functions of Mitochondria, Peroxisomes, chloroplasts, Nucleolus, Ribosomes, Endoplasmic Reticulum, Golgi Apparatus Lysosomes. Chromatin organization. The Endomembrane System. Function of Mitochondria and Chloroplasts.

UNIT III Cell cycle **12 HOURS**

Mitosis, Meiosis, Cytokinesis. Regulation of the cell cycle. Checkpoints: The DNA damage and DNA replication checkpoints.

UNIT IV Apoptosis **12 HOURS**

Cell death, Aging and Senescence. Apoptosis. Stem cells. The Ubiquitin Proteasome system.

UNIT V Cell communication and signalling **12 HOURS**

General principle of cell communication, signalling pathways, second messengers, signal transduction pathways, G-protein couple receptors mediated signalling, cell surface receptors, hormones & their receptors.

TOTAL HOURS: 60 HOURS

TEXT BOOKS:

1. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th Edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
2. Essential CELL BIOLOGY AND EVOLUTION4th edition 2015 by Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander D.Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter

REFERENCE BOOKS:

1. Hardin J, Bertoni G and Kleinsmith LJ. (2010). Becker's World of the Cell. 8th edition. Pearson.
2. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
3. De Robertis, EDP and De Robertis EMF. (2006). Cell and Molecular Biology. 8th edition. Lipincott Williams and Wilkins, Philadelphia.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	3	2	-	-	-	2	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-	3	3
Average	**3**	**-**	**-**	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	-	**-**	**3**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

25MBU704B **Biostatistics and Research Methodology** **4H-3C**

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To study introduction to Biostatistics, Basic Measures, the analytics of data, Correlation and Regression
- To understand research problem identification and hypothesis setting, t-test and ANOVA
- To know research designs, features of good research designs and sampling.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand and apply basic statistical concepts such as regression and correlation	Understand/Apply
CO2	Analyse data using multivariate statistics such as Chi Square test and ANOVA	Understand
CO3	Analyse Problems in Research and set hypothesis	Analyze
CO4	Learn and make use techniques in research design and sampling	Apply
CO5	Write proposals, research papers and dissertations	Apply

UNIT I Introduction of Biostatistics and Correlation **12 HOURS**

Introduction to Biostatistics, Basic Measures - Central Tendency and Dispersion, Variables in Bioscience, Correlation – Meaning and definition - Scatter diagram –Karl Pearson's Correlation Coefficient. Rank Correlation. Regression: Regression in two variables – Properties of Regression, uses of Regression

UNIT II Test of Significance **12 HOURS**

Sampling parameters- Difference between sample and Population, Censoring, difference between parametric and non-parametric statistics. Sampling Distributions, Standard Error, Testing of Hypothesis, Level of Significance and Degree of Freedom, Confidence Interval, Small sample test based on t - test, Large Sample Test based on Normal Distribution – Z – test and F test.

UNIT III Analysis of Variance **12 HOURS**

Distribution - free test - Chi-square test; Basic Introduction to Multivariate statistics, etc. Test of significance: Tests based on Means only-Both Large sample and Small sample tests –Chi-square test –the goodness of fit. Analysis of Variance – one-way and two-way classification, CRD, RBD Designs.

UNIT IV Research **10 HOURS**

Research: Scope and significance – Types of Research – Research Process – Characteristics of good research – Problems in Research – Identifying research problems.

UNIT V Sampling Design **14 HOURS**

Research Designs – Features of good research designs. Sampling Design: Meaning – Concepts – Steps in sampling – Criteria for good sample design. Scaling measurements - Types of scale, Types of sampling – random sampling and non-random sampling. Sampling Errors.

TOTAL: 60 HOURS

TEXT BOOK

1. Jerrold H. Zar. (2003). *Biostatistical Analysis*. (4th ed.). Pearson Education(P) Ltd, New Delhi. 2. Kothari. C.R. (2004). *Research Methodology – Methods and Techniques*. (2nded.). New Age International Pvt. Ltd, New Delhi.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	3	2	-	-	2	-	-	2	-	-	-	-	3	-
CO2	-	-	-	-	3	-	-	2	-	-	-	-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	2	-	-	3	-	-	-	-	2	-	-	-	-	3	-
CO5	-	-	--	-	-	3	-	-	-	-	2	-	-	-	-	-	3
Average	**3**	-	**2**	**3**	**3**	**3**	-	**2**	-	-	**2**	-	-	-	-	**3**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

25MBU711 **Textile Microbiology Practical** **3H-1C**

Instruction Hours/week: L:0 T:0 P: 3 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Textile Microbiology (25MBU701)

COURSE OBJECTIVES (CO):

- To understand the manufacturing process of textile fibres.
- To gain knowledge about the fabric dyeing methods.
- To understand microbial enzyme technology in textile field.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Practice Antibacterial activity assessment of textile materials	Apply
CO2	Analyze the microbial based textile dyeing.	Analyze
CO3	Apply a technique in antimicrobial activity assessment of Textiles against Fungi	Apply
CO4	Learn and practice Microbial Enumeration test in fabrics	Apply
CO5	Apply technique in Textile dye degradation using micro-organisms	Apply

EXPERIMENTS **36 HOURS**

1. Antibacterial activity assessment of textile materials: Parallel Streak Method (AATCC 147).
2. Antibacterial Activity of Fabrics: Agar Plate Method (AATCC 90)
3. Antimicrobial activity assessment of Textiles against Fungi (AATCC 30)
4. Demonstration of fabric dyeing by pad dry cure method
5. Microbial Enumeration test in fabrics
6. Textile dye degradation using micro-organisms

TEXT BOOKS: **Total: 36 HOURS**

1. Deepali Rastogi and Sheetal Chopra, (2017). *Textile Science*, Orient Black Swan Private Limited, Hyderabad.

2. Satyanarayana. U and Chakrapani. U, (2006). *Biochemistry*, Third Edition, Arunabha Sen Books and Allied P Ltd., Kolkata.

3. Seema Sekhri, (2011). *Textbook of Fabric Science: Fundamentals to Finishing*, PHI Learning Pvt Limited, New Delhi.

REFERENCE BOOKS:

1. Trever Palmer, (2004). *Enzymes, Biochemistry, Biotechnology Clinical Chemistry*: Affiliated East-WestPress Ltd., New Delhi.

2. V Nierstrasz A Cavaco-Paulo, (2010). *Advances in Textile Biotechnology*, Woodhead Publishing Ltd.,U.K.

3. Purohit. S S, (2008). *Microbiology Fundamentals and Applications*, 7th Edition, AGROBIOS, India.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	-	-	-	2	1	-	3	-	-	2	-	-	-	-	3	-
CO2	-	-	2	2	2	-	-	-	-	-	2	-	-	-	-	-	3
CO3	-	-	-	-	-	-	-	3	-	-	2	-	-	-	-	-	3
CO4	-	-	-	-	2	-	-	3	-	-	2	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	3	-	-	2	-	-	-	-	-	3
Average	-	-	**2**	**2**	**2**	**1**	-	**3**	-	-	**2**	-	-	-	-	**3**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

25MBU712A **Drug Design and Development- Practical** **3H-1C**

Instruction Hours/week: L:0 T:0 P: 3 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Drug Design and Development (25MBU703A)

COURSE OBJECTIVES (CO):

- To know the different routes of drug delivery to lab animals
- To understand the drug design and Computer Aided Design.
- To study the structure-based drug design and protein structure analysis and molecular basis of drugs

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Learn the routes of drug administration to laboratory animals	Understand/Apply
CO2	Practice Drug design and development and computer aided drug design	Apply
CO3	Apply freely available molecular modelling tools for structure-based drug design	Apply
CO4	Analyse Molecular basis of drugs	Analyze
CO5	Exercise Pharmacophore design and search	Apply

EXPERIMENTS **(36 HOURS)**

1. Routes of drug administration to laboratory animals
2. To evaluate the analgesic potency of drug by tail flick method
3. Screening of anti-inflammatory drugs using hind paw method
4. Drug design and development and computer aided drug design
5. Study the effect of drugs on spontaneous motor activity (SMA) and evaluate their nature as CNS stimulants using drugs
6. Structure based drug design using freely available molecular modelling tools
7. Protein structure analysis
8. Ligand selectivity analysis
9. Molecular basis of drugs
10. Homology modeling
11. Pharmacophore design and search

TEXT BOOKS: **Total: 36 HOURS**

1. Kristian Stromgaar, Povl Krogsgaard-Larsen and Ulf Madsen (2017). *Textbook of Drug Design and Discovery*, Fifth Edition, CRC press,2017.
2. David B. Weiner and William V. Williams. (1994). *Biological Approaches to Rational Drug Design (Handbooks in Pharmacology and Toxicology*), CRC press.

REFERENCE BOOKS:

1. Thomas J. Dougherty and Steven J. Projan. (2003). *Microbial Genomics and Drug Discovery*, Taylor and Francis,
2. Kenneth M. Merz, Dagmar Ringe and Charles H. Reynolds. (2010). *Drug Design: Structure- and Ligand- Based Approaches*, Cambridge University press,
3. Gary Wlash (2004). *Biopharmaceuticals, Biochemistry and Biotechnology*. 2nd edition. Wiley publisher.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	2	2	-	-	2	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	1	-	3	-	-	-	-	-	-	3
CO3	-	-	-	-	2	-	-	1	-	3	-	-	-	-	-	-	3
CO4	-	-	2	-	-	-	-	2	-	2	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Average	**3**	-	**2**	**2**	**2**	-	-	**2**	-	**3**	-	-	-	-	-	-	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

25MBU712B Bioproduct Development and Entrepreneurial Microbiology-Practical 3H-1C

Instruction Hours/week: L:0 T:0 P: 3 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Bioproduct Development and Entrepreneurial Microbiology (25MBU703B)

COURSE OBJECTIVES (CO):

- To obtain on the biological products of microbial origin.
- To provide knowledge on manufacturing and production of antibiotics and biofertilizers.
- To get introduced to models of IFS for rainfed and irrigated farming system and conditions.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Practice production of bioproducts- Biofertilizers, antibiotics and probiotics	Apply
CO2	Perform Organic Farming- Vermicompost	Apply
CO3	Learn and apply Quality control in biofertilizers	Apply
CO4	Analyse and apply integrated farming system	Analy
CO5	Analyse and apply models of IFS for rainfed and irrigated farming system and conditions	Apply

EXPERIMENTS **36 HOURS**

1. Production of bioproducts- Biofertilizers.
2. Production of bioproducts- Probiotics.
3. Production of Antibiotics – (Any antibiotic Eg: Penicillin)
4. Organic Farming- Vermicompost.
5. Quality control in biofertilizers
6. Study on integrated farming system
7. Study of models of IFS for rainfed and irrigated farming system and conditions.
8. Government schemes - NPOF, NPOF, NHM, HMNEH, NPMSH&F and RKVY

REFERENCE BOOKS: **Total: 36 HOURS**

1. Masanobu Fukuoka, Frances Moore Lappé Wendell Berry, (2009). *The One-Straw Revolution: An Introduction to Natural Farming*, YRB Classics; Main edition,
2. Subba Rao, N. S. (2002). Soil Microbiology. 4th ed. *Soil Microorganisms and Plant Growth*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Dubey, R. C. (2008). *A Textbook of Biotechnology*. S. Chand & Co., New Delhi

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO2	2	-	-	2	-	-	-	2	-	-	3	-	-	-	2	-	3
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	2	2	-	-	-	1	-	-	-	-	-	-	-	-	3
CO5	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
Average	**2**	-	**3**	**2**	-	-	-	**2**	-	-	**1**	-	-	-	**2**	-	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

25MBU801A	**Bioprocess Engineering**	**5H-4C**

Instruction Hours/week: L:5 T:0 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Microbial Physiology and Metabolism (25MBU201)

COURSE OBJECTIVES (CO):

- To elucidate the significance of transgenic plants as bioreactors for the production of enzymes.
- To address downstream processes of fermented products
- To learn product formation and inhibition pathways and their regulations

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Learn and design basic fermenter, bioreactor configuration, design features	Understand/Create
CO2	Understand and analyse Growth of cultures in the fermenter	Analyze
CO3	Practice Transport phenomena in fermentation	Apply
CO4	Learn and analyse Enzymes and Enzyme Kinetics	Analyze
CO5	Perform down streaming process of microbial products	Apply

UNIT I Fermenter **10 HOURS**

Design of a basic fermenter, bioreactor configuration, design features, computer control of fermentation process, measurement and control of process. Types of Bioreactors and its functions.

UNIT II Cultures in the fermenter **12 HOURS**

Growth of cultures in the fermenter. Importance of media in fermentation, media formulation and modification. Isolation, selection and improvement of important strains and pathways –Mutation, Protoplast fusion, parasexual cycle and genetic engineering for strain improvements. Kinetics of growth in batch culture, continuous culture with respect to substrate utilization, specific growth rate, steady state in a chemostat, fed-batch fermentation, yield of biomass, product, calculation for productivity.

UNIT III Physical factors and scale-up **12 HOURS**

Transport phenomena in fermentation: Gas- liquid exchange and mass transfer, oxygen transfer, critical oxygen concentration, heat transfer, aeration/agitation, its importance. Sterilization of Bioreactors, nutrients, air supply, products and effluents, process variables and control, scale-up of bioreactors.

UNIT IV Microbial Products and Downstream process **14 HOURS**

Enzymes- Introduction, Enzyme Kinetics, Immobilized Enzyme system, large scale production, Vitamins (Vitamin C), Amino acids, Enzymes, Antibiotics, Organic acids, Vaccines, Cheese, and Exopolysaccharides.

Biotransformation product (steroid). Down streaming process of microbial products (Peptides, Biopolymers, surfactants, Enzymes) - separation, centrifugation, filtration, extraction, purification, crystallization, crystal washing, drying of crystals, freeze-drying, spray drying.

UNIT V Preservation **12 HOURS**

Product formation and inhibition pathways and their regulations; applications in medicine, agriculture and industry. Role of plant and animal cells in bioprocess. Industrially important microorganisms, preservation, national and international culture collection centers.

Total: 60 HOURS

TEXT BOOKS:

1. Shuler, M.L., Kargi F., and DeLisa, M. (2017). *Bioprocess Engineering: Basic concepts*, 3rd Edition, Prentice Hall, Engelwood Cliffs.
2. Casida, L.E.J.R. *Industrial Microbiology*, 2nd Edition, (2019), New Age International Private Limited
3. El-Mansi, E. M. T., Bryce, C. F. A., Arnold L. Demain., Allman, A.R. (2011). *Fermentation Microbiology and Biotechnology*, 3rd Edition, CRC Press.

REFERENCE BOOKS:

1. Peter Stanbury, Allan Whitaker., S, Stephen Hall. (2016). *Principles of Fermentation Technology*, 3rd Edition, Elsevier Science and technology.
2. Richard H. Baltz., Arnold L. Demain., Julian E. Davies. (2010). *Manual of Industrial Microbiology and Biotechnology*, 3rd edition, American Society for Microbiology.
3. Michael J. Waites., Neil L. Morgan. (2001). *Industrial Microbiology: An Introduction*, Wiley-Blackwell

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	1	-	-	2	-	-	1	-	-	-	-	-	3
CO2	2	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**3**	**2**	**2**	**-**	**-**	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

25MBU802A **Microbial Enzymology** **5H-3C**

Instruction Hours/week: L:5 T:0 P: 0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Biochemistry (25MBU101)

COURSE OBJECTIVES

- The course presents methods and experimental tools used in enzymology with anemphasis on prokaryotes and eukaryotes.
- The theoretical grounds of methods and their applications in research will be discussed.
- The course also deals with enzyme structure, stability, organization, and expression.
- The courses include among others model systems, the enzymes behind complexdiseases
- To know the production and purification of microbial enzymes.
- To understand the role of enzymes in microbial metabolism.

COURSE OUTCOME (CO'S)

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

COs	Course Outcomes	Blooms Level
CO1	This course allows the candidate to recollect the basics of enzymes and apply cognitive thinking to the application-oriented sectors of enzymes.	Understand
CO2	Students would be able to practically apply this knowledge in different sectors withpossibilities ranging from the treatment of human diseases.	Apply
CO3	The development of novel medicines for treatment.	Apply
CO4	A thorough understanding of the process of translation and operons along with therecombination of DNA.	Analyze
CO5	An in-depth study of enzyme analysis with enzyme techniques.	Analyze

UNIT I - Bio energetics: 12 HOURS

Enzyme nomenclature, classification, general properties of enzymes, factors affecting enzymeactivity, activation energy, transition state, turnover number, enzyme co-factors. Enzyme kinetics; General kinetic principles; steady-state enzyme kinetics, Michelis-Menton equation, importance of Km and Vmax.

UNIT II-Enzyme inhibition and Enzyme regulation: 12 HOURS

Enzyme inhibition and types- competitive, noncompetitive and uncompetitive inhibitors. Inhibition kinetics. Allosteric and cooperative effects, conquered model of Monod et al, and sequential model ofKoshland et al, Principles of metabolic regulations; feedback regulations of multifunctional pathway.

UNIT III Isolation and purification of enzymes: 12 HOURS

Enzyme extraction –soluble enzymes, membrane bound enzymes, purification-precipitationmethods, concentration

of biomolecules: salting with ammonium sulphate precipitation, dialysis, lyophilization, chromatographic methods, total activity and specific activity.

UNIT IV- Immobilization technique, Structural aspects of enzyme 12 HOURS

Basic principles of cell and enzyme immobilization. Microencapsulation and Nanoencapsulation techniques. Protein Interaction. Primary, Secondary and Tertiary Structure of Enzyme. Structure prediction of enzyme using *in silico* methods.

UNIT V Uses of enzymes in analysis 12 HOURS

Enzyme electrodes. Enzyme as biosensor, potentiometric biosensor, immunosensor. Applications of enzymes in Industry, pharmaceuticals, agriculture and health care, . Recent advances and future prospects of enzyme engineering; artificial enzymes and applications.

Total: 60 HOURS

TEXT BOOKS:

1. Voet,D,.and Voet,J.G. (2011) Biochemistry 4 rd edition, John Wiley and Sons.
2. Berg, J.M., Tymoczko, J.L. ,and Stryer, L.(2011) Biochemistry,W.H.Freeman and Company.
3. B.D. Hames & N.M. Hooper, Instant Notes in Biochemistry, 2nd Edition.
4. Enzymes by P.Asokan, Chinna publications, 2 nd edition,(2005).

REFERENCE BOOKS:

1.Lehningers Principles of Biochemistry (2000) by Nelson, David l. and Cox, M.M. Macmillan /Worth, NY.

2. Harper & Harper, Biochemistry Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 24 th edition, Prentice Hall International. Inc.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	2	-	-	2	-	-	-	-	-	-	-	3	-
CO3	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	1	3
CO4	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	1	3
CO5	-	-	2	-	3	-	-	1	-	-	-	-	-	-	-	-	3
Average	3	-	2	-	2	-	-	3	-	-	-	-	-	-	-	2	3

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

25MBU803A **Marine Microbiology** **5H-4C**

Instruction Hours/week: L:5 T:0 P: 0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide students with basic knowledge on the biology and ecology of marine microorganisms, and their ecological role.
- To impart modern techniques for the characterization and study of marine microorganisms and microbial commUNITies.
- To understand the ecological role of marine microorganisms and marine microbial commUNITies.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Explore important and their significance of Marine bio-diversity	Understand
CO2	Analyse and explore Marine food pathogenic microorganisms	Analyze
CO3	Learn and apply Microbiology of degradation of xenobiotic environment	Apply
CO4	Exploit Marine Microbes bioproducts as Food and Biomedical products	Apply
CO5	Discuss industrial application of Marine Microbes like bioethanol production and biopigment products	Analyze

UNIT I Marine microorganisms **12 HOURS**

Introduction of coastal, shallow and deep sea. Marine microorganisms- important and their significance. Marine micro and macro-organisms-Collection, enumeration, identification based on morphological, physiological and biochemical characteristics and preservation. International and national collection centres.

UNIT II Extremophiles and Marine bio-diversity **12 HOURS**

Thermopiles, basophiles, halophiles, psychrophiles, alkalinophiles, oligotroph, toxi tolerant, xero tolerant, endolith – Extremophiles and their environment. Coral reefs, Sea grass, Mangroves, Hydrothermal vents and water currents.

UNIT III Marine food pathogens and microbial toxin **12 HOURS**

Marine food pathogenic microorganisms, distribution, indicator organism's prevention and control. Microbiology of processed -finfish and shellfish products. Microbial diseases- diagnosis and control. Introduction, microbial toxin, algal blooms, types. Harmful effect- Human health, Economic impact and Environmental impact, Potential remedies.

UNIT IV Xenobiotics and Marine nutrient cycles **12 HOURS**

Microbiology of degradation of xenobiotic environment: Ecological considerations, decay behavior, degradative plasmids, hydrocarbons, oil pollution, surfactants, plastics and heavy metals. Factors affecting bioremediation – role of microbes in the marine nutrient cycles.

UNIT V Marine Microbes bioproducts **12 HOURS**

Microalgae and seaweeds – Food products- Human food and animal feed, Biomedical Products- Antimicrobial, antioxidant, antiviral and anticancer activity. Aquaculture feed inoculants -Industrial Application-bioethanol production. Biopigment products - Phytoplanktons, Bioluminescence.

Total: 60 HOURS

TEXT BOOKS:

1. Colin Munn. (2011). *Marine Microbiology: Ecology & Applications*. (2nded.). Black Well Publishers.
2. Dube, H.C. (1994). *A text book of fungi, bacteria and viruses*. Vikas Publishing House, New Delhi.
3. David Sigee. (2005). *Freshwater Microbiology: Biodiversity and Dynamic Interactions of Microorganisms in the Aquatic Environment*. (1sted.). Black well Publishers.
4. Dale, J.W. (1994). *Molecular genetics of Bacteria*. John Wiley and Stones.
5. Joanne, M.W., Linda, S., and Christopher, J.W., (2008). Prescott, Harley, and Klein's *Microbiology*. (7thEd). McGraw-Hill Higher Education, UNITed States.

REFERENCE BOOKS:

1. Se-Kwon Kim. (2013). *Bioactive compounds and biotechnological applications*. CLS Publishers.
2. Pelczar, M., JR., Chan, E.C.S., and Noel, R. K., (2006). *Microbiology*. Tata McGraw, Hill. Co. (5^{th} ed.). New Delhi.
3. Presscott, L.N., Harley, J.P. and Klein, D.A., (1999). *Microbiology*. W.C. Brown Publishers.
4. Stanier, R.Y., Ingharam, J.L., Wheelis, M.L., and Painter, P.R., (1986). *General Waste water engineering Treatment, Disposal and Reuse*. Metcaff and Eddy. Inc., Tata Mc Grew Hill, New Delhi.
5. Rheinheimer, G., (1980). *Aquatic Microbiology-an Ecological Approach*. Blackwell Scientific Publications.
6. Kirchman, L (2000). *Microbial Ecology of the Oceans*, John Wiley and Sons.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	-	-	-	3	-	-	-	-	-	2	-	-	-	-	3	-
CO3	2	-	-	3		-	-	2	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	2	-	-	3	-	-	2	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	2	-	-	1	-	-	-	-	3	-
Average	**3**	-	-	**3**	**2**	-	-	**2**	-	-	**2**	-	-	-	-	**3**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

25MBU804A **Laboratory Animal Management** **5H-4C**

Instruction Hours/week: L:5 T:0 P: 0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide training on various methods of animal handling.
- To discuss with the amended act on the Animal Welfare.
- To describe the concept, availability and use of research or testing methods that limit the use of animals or minimize animal distress.
- To study the role of microbes in lab animals and animal houses

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Learn and practice the proper handling and care for animals used in research, testing, and in education.	Understand/ Apply
CO2	Perform handling and care for guinea pigs used in research, testing, and in education	Apply
CO3	Analyse various routes of inoculation in mice	Analyze
CO4	Practice disposal of animal house wastes, safety measures in animal house	Apply
CO5	Understand ethical knowledge for use of animals in research.	Understand

UNIT I Responsibilities of institution and chief investigators **14 HOURS**

General introduction - responsibilities of institution and chief investigators, Aspects of rabbit behaviour relevant to housing, Rabbit Group housing in pens, advantages and disadvantages, Pens, design of pens environment, Rabbit care management – Regrouping, catching and identification in pens and cages, Rabbit care management – food, water, health and breeding in pens and cages, Cage design and environment, Environment enrichment for rabbits in pens and cages, Ethical guidelines for use of animals in research.

UNIT II Mice **12 HOURS**

Introduction-behaviour, anatomic and physiological features of mice in lab, Husbandry- Housing, nutrition and breeding requirements and management of lab mice, occupational health and zoonotic diseases, treatment of disease in mice, regulatory agencies and complain associates with management of lab mice, Restraining and sample collection methods from lab mice, Physical, examination of mice for disease conditions, anesthesia and analgesia -mice, Euthanasia in veterinary care.

UNIT III Rat **10 HOURS**

Introduction to anatomical and physiological features of laboratory rat, major colour groups and varieties of rats, regulatory management housing of laboratory rats-equipment, feed formulation, ailments & disease management of laboratory rats, disease management and ailments of laboratory rats, restraining and sample collection in lab rats, anesthesia and analgesia of lab rats, breeding of laboratory rats.

UNIT IV Guinea pig **12 HOURS**

Introduction – history and classification of guinea pigs, varieties and characteristics of guinea pigs used in labs, characteristics and behaviours of the guinea pig used in labs, housing, nutrition and feeding of guinea pigs, care and handling of guinea pigs in lab, zoonoses of guinea pigs, reproduction and breeding managements in guinea pigs –gnotobiotic animals.

UNIT V Role in microbiology **12 HOURS**

Various routes of inoculation in mice & rats, various routes of inoculation in mice & rats, handling and routes of inoculation in rabbits, guinea pigs, laboratory use of animals –role in microbiology, antibody production in animals, disposal of animal house wastes, safety measures in animal house. National animal house Facilities in India.

Total: 60 HOURS

TEXT BOOKS:

1. The IACUC Handbook (2006)., 2nd ed., eds. Silverman, Murthy, Suckow. CRC Press,
2. Bar Harbor, Maine, (2009). Ed. Joanne Currer, *Handbook on Genetically Standardized Mice*. (6th ed.). The Jackson Laboratory,
3. Pelczar, Jr. M.J., Chan, E.C.S., and Kreig, N.R., (1993). *Microbiology* McGraw-Hill Inc. New York.
4. Suckow, Weisbroth and Franklin. Elsevier, (2006). *The Laboratory Rat*, (2nd ed.). American College of Laboratory Animal Medicine. eds.
5. Yadav, M. (2004). *Applied Entomology*. (1st ed.). Discovery Publishing House, New Delhi.

REFERENCE BOOKS:

1. Richard Fish, Peggy Danneman, Marilyn Brown, and Alicia Karas. (2008). Academic Press, *Anesthesia and Analgesia in Laboratory Animals*. American College of Laboratory Animal Medicine, second ed.).
2. James G. Fox, Muriel T. Davisson, Fred W. Quimby, Stephen W. Barthold, Christian E. Newcomer and Abigail L. Smith. Elsevier, (2007). *The Mouse in Biomedical Research*, second ed.).
3. Fox, Anderson, Lowe, Quimby, (2002). *Laboratory Animal Medicine*, (2nd ed.). American College of Laboratory Animal Medicine, eds. Academic Press,
4. Percy, D.H., and Barthold, S.W., (2007). *Pathology of Laboratory Rodents and Rabbits*, (3rd ed.). Blackwell Publishing Company.
5. Nalinasundari, M.S., and Santhi, R., (2006). *Entomology*. MJP Publishers, Chennai.
6. Warren, D. M. (2002). *Small Animal Care and Management*. (2nd ed.). Delmar – Thomson Learning, Columbia, NY.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	1	2	-	2	-	-	2	-	-	-	-	2	3
CO2	3	-	-	-	1	2	-	2	-	-	2	-	-	-	-	2	3
CO3	-	-	-	-	-	-	-	3	-	-	2	-	-	-	-	-	3
CO4	-	-	-	-	-	-	-	3	-	-	2	-	-	-	-	-	3
CO5	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	3
Average	**3**	-	-	-	**1**	**2**	-	**3**	-	-	**2**	**-**	**3**	-	-	**2**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

25MBU805A **Medical Coding and Pharmacovigilance** **5H-4C**

Instruction Hours/week: L:5 T:0 P: 0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To train students to properly locate, document, and validate appropriate diagnostic and procedure codes.
- To teach conventions, General Coding Guidelines for various diseases and infections
- To impart knowledge in Pharmacovigilance, Management of adverse drug reactions and Pharmacovigilance methods

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand and analyse importance and significance of coding	Analyzig
CO2	Apply coding guidelines for Infections and Parasitic Diseases	Applying
CO3	Evaluate adverse drug reactions	Evaluating
CO4	Learn and apply Pharmacovigilance methods	Applying
CO5	Gain knowledge of medical legal and ethical responsibilities, as well as anatomy and medical terminology	Understanding

UNIT I Introduction to US Healthcare **10 HOURS**

Healthcare in India and US, Patient, Provider and Payers Relationship, Importance and significance of coding in today's world

UNIT II ICD-10-CM **12 HOURS**

History, Volumes, Conventions, General Coding Guidelines, Chapter Specific Guidelines, Infections and Parasitic Diseases, Neoplasms, Endocrine, Nutritional and metabolic diseases and immUNITy disorders. Diseases of blood and blood forming organs. Mental disorders

UNIT III Introduction to Pharmacovigilance **10 HOURS**

History and development of Pharmacovigilance, Importance of safety monitoring of Medicine. WHO international drug monitoring programme, Pharmacovigilance Program of India (PvPI).

UNIT IV Introduction to adverse drug reactions **14 HOURS**

Definitions and classification of ADRs, Detection and reporting, Methods in Causality assessment, Severity and seriousness assessment, Predictability and preventability assessment Management of adverse drug reactions. Drug and disease classification Anatomical, therapeutic and chemical classification of drugs, International classification of diseases, daily defined doses International Non-proprietary Names for drugs.

UNIT V Pharmacovigilance methods **12 HOURS**

Passive surveillance – Spontaneous reports and case series Stimulated reporting. Active surveillance – Sentinel sites, drug event monitoring and registries Comparative observational studies – Cross sectional study, case control study and cohort study. Targeted clinical investigations.

Total: 60 HOURS

TEXT BOOKS

1. SK Gupta, (2018). *Textbook of Pharmacovigilance: Ensuring the Safe Use of Medicines*. Sushma Srivastava Jaypee Brothers Medical Publishers,

REFERENCE BOOKS

1. Varun and Deepak Pragi. (2020). *Current trends in pharmacovigilance*.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2	3
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO3	2	-	2	1	3	-	-	-	-	-	-	-	-	-	-	-	3
CO4	2	-	-	-	-	-	-	3	-	2	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	3
Average	**3**	-	**2**	**1**	**2**	-	-	**3**	-	**2**	-	-	**3**	-	-	**2**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

25MBU811A **Bioprocess Engineering Practical** **5H-2C**

Instruction Hours/week: L:0 T:0 P: 5 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Bioprocess Engineering (25MBU801)

COURSE OBJECTIVES (CO):

- To teach the use of microorganisms in the manufacture of food or industrial products.
- To impart knowledge on microbial fermentation of enzymes and antibiotics
- To acquire knowledge and practice Microbial fermentation of amino acids and organic acids

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Practice production and estimation of various enzymes	Apply
CO2	Apply techniques in production of amino acids	Apply
CO3	Exercise microbial fermentation for the production of organic acids	Apply
CO4	Apply fermentation techniques in the production of antibiotics	Apply
CO5	Utilize techniques for the production of Alcoholic beverages	Apply

EXPERIMENTS **60 HOURS**

1. Microbial fermentation – Production and estimation (qualitative and quantitative) of enzyme- Amylase, Protease, lipase and asparaginase.
2. Microbial fermentation –Production and estimation (qualitative and quantitative) of Amino acid – Glutamic acid.
3. Microbial fermentation – Production and estimation (qualitative and quantitative) of Organic acid- Citric acid and DHA.
4. Microbial fermentation – Production and estimation (qualitative and quantitative) of Antibiotics - Penicillin, Bacitracin.
5. Microbial fermentation – Production and estimation (qualitative and quantitative) of Alcohol - Ethanol

TEXT BOOKS **Total** : **60 HOURS**

1. Crueger W and Crueger A. (2017). *Biotechnology: A textbook of Industrial Microbiology*. 3rdedition. P anima Publishing Co. New Delhi.
2. Geoffrey M Gadd, Sima Sariaslani (2015). *Advances in Applied Microbiology*, CRC Press.
3. Nduka Okafor, Benedict C. Okeke (2017). *Modern Industrial Microbiology and Biotechnology*, 2nd Edition, CRC Press.

REFERENCE BOOKS

1. Stanbury PF, Whitaker A and Hall SJ. (2006). *Principles of Fermentation Technology*. 2nd edition, Elsevier Science Ltd.
2. E. MTEl-Mansi, Jens Nielsen, David Mousdale (2009) *Fermentation Microbiology and Biotechnology*, Fourth Edition, CRC Press.

3. Karp G. (2010) *Cell and Molecular Biology: Concepts and Experiments*.6th edition. John Wiley & Sons. Inc
4. Nigam A and Ayyagari A. (2007). *Lab Manual in Biochemistry, Immunology and Biotechnology*. Tata McGraw Hill.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	2	-	-	2	-	-	-	-	-	3
CO2	-	-	-	2	-	-	-	3	-	-	2	-	-	-	-	-	3
CO3	-	-	-	2	-	-	-	3	-	-	2	-	-	-	-	-	3
CO4	-	-	-	2	-	-	-	3	-	-	2	-	-	-	-	-	3
CO5	-	-	-	2	-	-	-	3	-	-	2	-	-	-	-	-	3
Average	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

25MBU891	**Research Project**	**16H-12C**

Instruction Hours/week: L:0 T:0 P:16 **Marks:** Internal**:80** External**:120 T**otal**:200**

End Semester Exam: -