FACULTY OF ARTS, SCIENCE, COMMERCE, MANAGEMENT AND HUMANITIES

POST GRADUATE PROGRAMME

M.Sc., MICROBIOLOGY

(I to IV SEMESTERS)

REGULATIONS -2024

CHOICE BASED CREDIT SYSTEM (CBCS)

NATIONAL EDUCATION POLICY-2020

Effective from the Academic Year 2024-2025

ST. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Deemed to be University)
Established under Section 3 of UGC Act, 1956
(Accredited with A+ Grade by NAAC in the Second Cycle
& ISO 9001:2015 Certified)
AVADI, Chennai - 600054

St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH

POST GRADUATE REGULATIONS UNDER CHOICE BASED CREDIT SYSTEM

(with Effective from the Academic Year 2024-25 and onwards)

REGULATIONS (2024)

The following regulations are effective from the academic year 2024-2025 and are applicable to candidates admitted to Post Graduate (PG) degree programmes in the Faculty of Arts, Science, Commerce, Management and Humanities, St. Peter's Institute of Higher Education and Research (SPIHER).

1. PROGRAMMES OFFERED

1.1 The various PG programmes offered in the Faulty of Arts, Science, Commerce and Humanities, SPIHER are listed in the table below.

S. No.	Programme	Discipline
1.	MA	Economics
2.	MA	English
3.	MA	Political Science
4.	MA	Tamil
5.	MBA	Management
6.	MCA	Computer Applications
7.	M.Com.	Commerce
8.	M.Sc.	Biochemistry
9.	M.Sc.	Biotechnology
10.	M.Sc.	Chemistry
11.	M.Sc.	Computer Science
12.	M.Sc.	Information Security and Digital Forensics
13.	M.Sc.	Mathematics
14.	M.Sc.	Microbiology
15.	M.Sc.	Physics
16.	M.Sc.	Visual Communication

1.3 Duration of the Programme

1.3.1 The minimum and maximum period for the completion of the Post graduate degree are given below.

Programme	Minimum number of semesters	Maximum number of semesters
MA. / MBA / MCA / M.Com. / M.Sc.	**4**	**8**

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

2. MODE OF STUDY

All programmes are offered under Full-time regular mode. Candidates admitted under Full-time should be present in the SPIHER during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

3. ELIGIBILITY FOR ADMISSION

A candidate for admission to the first semester PG degree programme shall be required to have passed an appropriate UG degree examination of the St. Peter's Institute of Higher Education and Research or any other university accepted by the SPIHER as equivalent thereto. Institution accepts the scores obtained in the Common University Entrance Test (CUET) conducted by the Ministry of Education, Government of India. Admission shall be offered only to the candidates who possess the qualification prescribed **(Annexure – 1).**

4. CHOICE BASED CREDIT SYSTEM

All the programmes are offered under Choice Based Credit System (CBCS) with a total credit of 80 for PG programmes.

4.1 Credit

Credit means the weightage given to each course by the experts of the Board of Studies concerned.

5. STRUCTURE OF PROGRAMME

Every programme will have a curriculum and syllabus consisting of core, elective courses, open electives, Value added courses, Internship and project work

5.1 CORE COURSES

Core course consists of theory and practical of department domains for which examinations shall be conducted at the end of each semester.

5.2 ELECTIVE COURSES

Elective courses are to be chosen with the approval of the Head of the Department concerned from the list of electives courses prescribed in the curriculum..

5.3 INTERNSHIP

The student shall undergo 15 days internship in the end of second semester. Internship report will be evaluated and marks will be awarded in the third semester. Students have to earn two credits for the internship. Hundred marks is awarded for internship through CIA.

5.4 OPEN ELECTIVE

Student may select one of the open elective courses from the list given below offered by other departments in the third semester. Students have to earn two credits for this course. (The students cannot select the course offered by the parent department)

5.5 PROJECT WORK

The candidates shall undertake the research project or dissertation in the fourth semester either in the department concerned or in industries / research institute or any other

organization (National / International) and the project report has to be submitted at the end of the final semester.

In the case, student undertakes the project work outside the department the faculty concerned within the department shall be the Supervisor and the teacher/ scientist under whom the work is carried out will be the Co-Supervisor. The candidate shall bring the attendance certificate from the place where the project work carried out.

Permission for project work in general will be given to innovative and industry related work. Such projects will be evaluated periodically. If the Project evaluation committee is satisfied with the progress of the project work, continuation for the project work will be given until the final assessment is made in the fourth semester. In case, there is no tangible progress in a session, such project work will be terminated and the students have to do their project in their respective departments.

HOD shall assign a project supervisor who shall monitor the student project works. 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. 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.

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

For project work, assessment is done on a continuous basis by 3 reviews for 40 marks and final *viva voce* carries 100 Marks in each phase at the end of the semester.

There shall be three project reviews (conducted during the pre-final semester and final semester) to be conducted by a review committee. The student shall make presentation on the progress made, before the committee. The head of the department shall constitute the review committee for each branch in consultation with Dean. The members of the review committee will evaluate the progress of the project and award marks as given below.

Project reviews (CIA) Marks			**Final Project Report (ESE) and *Viva Voce* Examination (Marks)**	**Total Marks**
Review 1	**Review 2**	**Review 3**		
5	15	20	60	100

The total marks obtained in the three reviews, rounded to the nearest integer is the continuous internal assessment marks out of 40. There shall be a final *viva-voce* examination at the end of semester conducted by one internal examiner, one external examiner and the supervisor concerned.

A student is expected to attend all the project reviews conducted by the institution on the scheduled dates. It is mandatory for every student to attend the reviews, even if they are working on a project in an industry based outside Chennai city. It is their duty to inform the organization about the project reviews and its importance, and get permission to attend the

same. If a student does not attend any of the project reviews, he / she shall not be allowed for the successive reviews and thereby not allowed to appear for the final *viva voce* Examination.

The candidate is expected to submit the project report as per the guidelines of the institution on or before the last day of submission. If he/she fails to submit the project report, even beyond the extended time, then he/she is deemed to have failed in the project work and shall register for the same in the subsequent semester and re-do the project after obtaining permission from the HoD and Dean.

5.6 ONLINE COURSES

The department shall approve the list of online courses offered by approved external agencies such as SWAYAM / NPTEL / MOOC. While listing the courses, the department shall consider the following points:

a. The course evaluation is carried out by the same external agency

b. Equivalent grading mechanism to be arrived at by the department

A student can register up to a maximum of 18 credits (total) as online courses during the entire programme of study. These shall be treated as Elective courses (programme elective or open elective). Students may be allowed to register for one course per semester. The student shall produce a Pass Certificate from the respective agencies. The credits(s) earned by the students will be transferred to the concerned course in the Grade Sheet.

6. MEDIUM OF INSTRUCTION

The medium of instruction, examinations and project report will be in English Language throughout the programme except MA Tamil.

7. MAXIMUM MARKS

All the theory, practical and project courses shall carry a maximum of 100 marks, out of which 40 marks are awarded for Continuous Internal Assessment (CIA) and 60 marks for End Semester Examination (ESE).

8. REQUIREMENTS FOR COMPLETION OF A SEMESTER

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirement for completion of a semester.

- He / She secures not less than 75% of overall attendance in that semester.
- Candidates who do not have the requisite attendance for the semester will not be permitted to write the semester Examinations.

9. VARIOUS POSITIONS IN A DEPARTMENT

9.1 DEAN

All Arts, Science, Commerce, Management and Humanities Departments are headed by a Dean. The dean is responsible for all activities taking place in coordination with all department heads and all faculty members belonging to them. The Dean makes a review of all the academic activities of faculty members, students and research on a regular time interval and takes steps to improve the morale of all Faculty and Students.

9.2 HEAD OF THE DEPARTMENT

Each department offering various UG and PG programmes is headed by a Head of the Department (HoD). The HoD is responsible for allotting courses to each faculty member uniformly in consultation with other HoD's and Deans. The HoD is responsible for streamlined teaching of courses to students, improvement and assessment of teaching quality within the department on a continuous basis, assessment of faculty members, transparent conduct of continuous internal assessment tests, interacting with parents, ensuring that all academic and non-academic activities of Faculty and students are monitored and steps taken for their improvement.

9.3 FACULTY ADVISOR

To help the students in planning their courses of study and to render general advice regarding either the academic programme or any other activity, the Head of the Department concerned, will assign every year, a certain number of students from the first year to a faculty member who will be called as Faculty Advisor. The set of students thus assigned will continue to be under the guidance of this Faculty Advisor till they complete the programme or replaced by the HoD. The Faculty Advisor gets information about the syllabus coverage by the faculty members, requirements of the students academically and otherwise, attendance and progress of the students from the respective class counselors. The Faculty Advisor also informs the students about the academic schedule including the dates of assessments and syllabus coverage for each assessment, weightage for each assessment, their continuous internal assessment marks and attendance percentage details before the commencement of end semester examinations.

9.4 FACULTY MENTOR

To help students in planning their courses of study and for general advice on the academic programme and personal counselling, the HoD shall allot 20 students to a faculty who will function as a faculty mentor throughout their period of study. Faculty mentor shall advise the students and monitor their behaviour and academic performance. Problems if any shall be counselled 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 four weeks) on the notice board to know their attendance status and satisfies the requirements to appear for the End Semester Examination.

9.5 COURSE COORDINATOR FOR COMMON COURSE

Each common theory course offered to more than one class or branch or group of branches, shall have a "course coordinator". The course coordinator will be nominated by the dean in consultation with respective head of the department. The course coordinator will be normally a senior faculty member who is one among the teachers teaching the course.

The "Course Coordinator" shall meet the teachers handling the course, as often as possible and ensure

- A common teaching methodology is followed for the course.
- The study materials are prepared by the staff members and communicated to the students periodically.
- The involvement of students in course based projects and assignments.
- To prepare common question paper for continuous internal assessment tests.
- For uniform evaluation of continuous internal assessments answer sheets by arriving at a common scheme of evaluation.

The course coordinator is responsible for evaluating the performance of the students in the continuous internal assessments and end semester examinations and analyse them to find suitable methodologies for improvement in the performance. The analysis should be submitted to the HoD and Dean for suitable action.

10. CLASS COMMITTEE

a) Constitution of the Class Committee

For every class, a class committee shall be constituted by the Heads of Department, as given below:

Chairman	A faculty member not teaching that particular class
Members	• Faculty of all the courses of study • Four student members from the class to be nominated by the HoD

b) Functions of the Class Committee

(i) The class committee shall meet thrice during the semester. The first meeting will be held within two weeks from the date of commencement of the semester in which the nature of the broad assessment procedure for the different courses will be discussed. The second and third meetings will be held six weeks and ten weeks respectively from the commencement of a semester to meaningfully interact and express opinions and suggestions to improve the effectiveness of teaching - learning process and analyze the performance of the students in the assessments. The chairperson of the class committee should send the minutes of the class committee meetings to the Dean through the Head of the Department, immediately after the meetings is over.

(ii) During the first meeting of the class committee, all the faculty members shall give their course plan to the class committee chairperson/chairman for approval and uploading into the ERP.

(iii) Any innovation in any course plan not agreed by the class committee or the HoD will be referred to the Chairman/Chairperson for approval.

11. COURSE PLAN AND DELIVERY

a) The course plan will have details of the overview of the course, course objectives, course outcome, course teaching and learning activities and course assessment methods and policy on compensation assessment.

b) Each course will have tailor-made assessment models viz. group tasks, assignments, report on field visit, quizzes, open book tests, laboratory exercises, mini-project and end of session summative assessment etc. The course plan will also have details of information on study materials.

c) The number of assessments for a course shall range from 3 to 5.

d) Every course should have a final assessment (End Semester) on the entire syllabus with 60% weightage.

e) The course plan shall be approved by the Class Committee (CC) chairperson/chairman and the HoD of the Department offering the course.

f) The Course plans for all courses offered by the Institute will be available in the website for reference.

g) ATTENDANCE

All courses should have a common attendance policy:

a) At least 75% attendance in each course is mandatory.

b) A maximum of 10% shall be allowed under On Duty (OD) category.

c) Students with less than 65% of attendance shall be prevented from writing the End Semester Examination..

12. ASSESSMENT PROCEDURE

Each **COURSE** shall have assessments done according to the Course Plan drawn by the faculty who handles the course. The assessments of a course will depend on the needed course learning outcomes.

There will be a Continuous Internal Assessment Tests and End Semester Examination for both theory and practical courses of all programmes.

(i) Theory / practical / projects courses

Continuous Internal Assessment (CIA)	:	40 % Marks
End Semester Examination (ESE)	:	60 % Marks

12.1 CONTINUOUS INTERNAL ASSESSMENT (CIA)

(a) Theory Courses

- There will be a minimum of Three continuous internal assessment tests (Assessment Test 1,2 and a Model test, for each theory course.

Distribution of Continuous Internal Assessment (CIA) marks for a theory course			
Evaluation Component	**Syllabus coverage**	**Duration of the Exam**	**Maximum marks**
CIA-1	First 1.5 Units of the syllabus	2 Hours	**7.5**
CIA-2	Second 1.5 Units of the syllabus	2 Hours	**7.5**
Model Test	All Units	3 Hours	**15**
Assignment / Seminar / Mini Project (or) Group Presentation	Two written assignments for each course / Written quiz (or) Presentation of a written Report (or) Case study / Multiple Choice Objective Type Test Or Technical Project involving not more than 3 students (or) any other Group Presentation related to the course.		**10**
Attendance	75% and above		**5**
Total			**40**

- The continuous assessment marks obtained by the candidate in the first appearance shall be retained, considered and valid for all subsequent attempts, till the candidate secures a pass.

(b) Practical Courses

S. No.	Category	Maximum Marks
01	Attendance (75% and above)	**05**
01	Observation work	**20**
02	Model Test	**15**
Total		**40**

- For practical courses, the student will be evaluated on a continuous basis for 20 Marks (which will include performing all experiments, submitting observation and record note book in scheduled format and time), 15 marks for model test at the end of the semester and 5 marks for attendance in the course.

- For practical courses, if a student has been absent for some practical classes or has performed poorly, then the student will have to get permission from the lab in-charge and year coordinator to do the experiments, so that he/she meets all the requirements for the course and thereby allowed to appear for model and end semester practical exams.

- If a student has not done all the experiments assigned for that lab, before the scheduled date will not be allowed to appear for the model and end semester practical exam. Such students will have to register the course again by doing all the experiments in the next semester when the course is offered.

Pattern of Question Paper (Theory) for CIA 1 and 2

Particulars	Remarks
Maximum Marks	50 Marks
Duration	2 Hours
Part – A (Q.No. 1 to 10)	MCQ (10 x 1 =10)
Part – B (Q.No. 11 to 15)	Short Answers (5 x 4 = 20)
Part – C (Q.No. 16 to 17)	Long Answers (2 x 10 = 20)

12.2 END SEMESTER EXAMINATION (ESE)

- The end semester examinations shall be conducted at the end of the odd and even semester of the Academic year.
- End semester examinations will be conducted for a maximum of 100 marks. The marks secured in end semester exams will be converted to 60 marks.
- The evaluation of training will be made by a three member committee constituted by Head of the Department in consultation with Faculty Advisor and respective Training Coordinator. A presentation should be made by the student before the Committee, based on the Industrial Training or Professional Enrichment undergone.

Pattern of Question Paper (Theory) for Model and ESE

Particulars	Remarks
Maximum Marks	100 Marks
Duration	3 Hours
Part – A (Q.No. 1 to 10)	MCQ (10x1=10)
Part – B (Q.No. 11 to 15)	Short Answers (Either or Type) (5x5=25)
Part – C (Q.No. 15 to 20)	Long Answers (Either or type) (5x10=50)`
Part – D(Q.No. 21)	Essay Answers - Compulsory (1x15=15)

13. PURSUING COURSES IN OTHER INDIAN INSTITUTIONS AND ABROAD

- A student can be selected, to get Professional Exposure in his/her area of Expertise in any Reputed Research Organization or Educational Institution of repute or any Universities in India andabroad.
- This is possible only with the List of Research Organizations, Educational Institutions in India and abroad approved by the Academic Council.
- The student can have the option of spending not more than three to Six months in the Final year or Pre- final year of his/her Degree. During this period, the student can do his/her Project work or register for courses which will be approved by the Class Committee and Dean, under the Guidance of a Project Supervisor who is employed in the Organization and Co-guided by a staff member from our Institution.
- Credit Transfer can be done by the CoE on submission of certificate through the HoD and Dean within 15 days of completion of the training.

- The students who undergo training outside the Institution (either in India or Abroad) is expected to abide by all Rules and Regulations to be followed as per Indian and the respective Country Laws, and also should take care of Financial, Travel and Accommodation expenses.

14. PASSING REQUIREMENTS

- A candidate should secure not less than 50% of total marks (Minimum 50% of the grand total of CIAE arks and ESE marks put together) prescribed for the courses, subject to securing a minimum of 50% marks out of maximum mark in End Semester Exams (ESE). Then he/she shall be declared to have passed in the examination.
- If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that he/she should continue to register and reappear for the examination till he/she secures a pass.

15. REVALUATION OF ANSWER SCRIPTS

A candidate can apply for revaluation of his/her End semester examination answer Scripts in a theory course, immediately after the declaration of results, on payment of a prescribed fee along with application to the Controller of Examinations through the Head of the Department. The Controller of Examination will arrange for the revaluation and the result will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

16. WITHDRAWAL FROM EXAMINATIONS

- A candidate may, for valid reasons, (medically unfit / unexpected family situations) be granted permission to withdraw from appearing for the examination in any course or courses in any one of the semester examination during the entire duration of the degree programme.
- Withdrawal application shall be valid only if the candidate is otherwise normally eligible (if he/she satisfies Attendance requirements and should not be involved in Disciplinary issues or Malpractice in Exams) to write the examination and if it is made within FIVE days before the commencement of the examination in that course or courses and also recommended by the Dean through HoD.
- Notwithstanding the requirement of mandatory FIVE days notice, applications for withdrawal for special cases under extraordinary conditions will be considered based on the merit of the case.
- Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for the purpose of Classification of Degree.
- Withdrawal is NOT permitted for arrears examinations of the previous semesters.

17. AUTHORIZED BREAK OF STUDY

- This shall be granted by the Institution, only once during the full duration of study, for valid reasons for a maximum of one year during the entire period of study of the degree programme.
- A candidate is normally not permitted to temporarily break the period of study. However, if a candidate would like to discontinue the programme temporarily in the middle of duration of study for valid reasons (such as accident or hospitalization due to prolonged ill health), he / she shall apply through the Dean in advance (Not later than the Reopening day of that semester) through the Head of the Department stating the reasons. He /She should also mention clearly, the Joining date and Semester for Continuation of Studies after completion of break of Study. In such cases, he/she will attend classes along with the Junior Batches. A student who availed break of study has to rejoin only in the same semester from where he/she left.

- The total period for completion of the programme shall not exceed more than 8 consecutive semesters from the time of commencement of the course irrespective of the period of break of study in order that he / she may be eligible for the award of the degree.

- If any student is not allowed to appear for End Semester Examinations for not satisfying Academic requirements and Disciplinary reasons, (Except due to Lack of Attendance), the period spent in that semester shall NOT be considered as permitted 'Break of Study' and is NOT applicable for Authorized Break of Study.

- In extraordinary situations, a candidate may apply for additional break of study not exceeding another one Semester by paying prescribed fee for break of study. Such extended break of study shall be counted for the purpose of classification of First Class Degree.
- If the candidate has not reported back to the department, even after the extended Break of Study, the name of the candidate shall be deleted permanently from the institution enrolment. Such candidates are not entitled to seek readmission under any circumstances.

18. AWARD OF DEGREE

All assessments of a course will be done on 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:

RANGE OF MARKS FOR GRADES

Range of Marks	Letter Grade	Grade Point
90 -100	**O**	**10**
80 – 89	**A+**	**9**
70 – 79	**A**	**8**
60 – 69	**B+**	**7**
50 – 59	**B**	**6**
00-49 (Reappear)	**F**	**0**
ABSENT	**AAA**	**0**
Withdrawal	**W**	**0**
Authorised Break of Study	**ABS**	**0**

18.1 CUMULATIVE GRADE POINT AVERAGE CALCULATION

The CGPA calculation on a 10 Point scale is used to describe the overall performance of a student in all courses from first semester to the last semester. RA, AAA and W grades will be excluded for calculating GPA and CGPA.

$$GPA = \frac{\sum_{i=1}^{N} Ci\ GPi}{\sum_{i} Ci} \qquad CGPA = \frac{\sum_{i=1}^{n} Ci\ GPi}{\sum_{i} Ci}$$

Where

Ci – Credits for the course

GPi – Grade Point for the course

i – Sum of all courses successfully cleared during all the semesters

n - Number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA

18.2 GRADE SHEET

After revaluation results are declared in each semester, Grade Sheets will be issued to each student. At the end of programme a consolidated grade sheet also will be issued to each student. The grade sheet and consolidated grade sheet will contain the following details:

- The programme and degree in which the candidate has studied
- The list of courses enrolled during the semester and the grade secured
- The Grade Point Average (GPA) for the semester.

18.3 CLASSIFICATION OF DEGREE AWARDED

Final Degree is awarded based on the following

Range of CGPA	Classification of Degree
≥ 7.50	First Class with Distinction
≥ 6.00 <7.50	First Class
≥ 5.00 < 6.0	Second Class

Minimum requirements for award of Degree: A student should have obtained a minimum of 5.0 CGPA.

1. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 4 semesters in his/her first appearance within a maximum of 10 consecutive securing a overall CGPA of not less than 7.5 (Calculated from 1st semester) shall be declared to have passed the examination in **First Class with Distinction**. Authorized Break of Study vide Clause 17, will be considered as an Appearance for Examinations, for award of First Class with Distinction. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction

2. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 4 semesters within a maximum period of 6 consecutive semesters after his/her commencement of study securing an overall CGPA of not less than 6.0 (Calculated from 1st semester), shall be declared to have passed the examination in **First Class.** Authorized break of study vide Clause 17 (if availed of) or prevention from writing End semester examination due to lack of attendance will not be considered as Appearance in Examinations.
3. All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the 4 semesters within a maximum period of 6 consecutive after his/her commencement of study securing a overall CGPA of not less than 5.0, (Calculated from 1st semester) shall be declared to have passed the examination in **Second Class**.

4. A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification.

18.4 ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of Post graduate degree, provided the student has successfully completed all the requirements of the programme, and has passed all the prescribed examinations within the maximum period specified in clause 1.3.

i) Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.

ii) Successfully completed the programme requirements and has passed all the courses prescribed in all the semesters within a maximum period of 5 years reckoned from the commencement of the first semester to which the candidate was admitted.

iii) Successfully completed any additional courses prescribed by the Institution.
iv) has earned a CGPA of not less than 5
v) has no dues to the Institution, Library, Hostels, etc.,
vi) has no disciplinary action pending against him / her.

19. SUPPLEMENTARY EXAMINATION

Supplementary examination will be conducted only for the final semester students within 10 days from the date of publication of results for students who have failed up to two theory courses. Only such students shall apply with the prescribed fee to the Controller of Examinations within the stipulated time period.

20. RANKING

A candidate who qualifies for the PG 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 IV to the programme shall be eligible for ranking. Such ranking will be confirmed to 10 percent of the total number of candidates qualified in that particular programme of study subject to a maximum of 10 ranks.

21. DISCIPLINE

Every student is required to observe disciplined and decorous behaviour both inside and outside the Institution and not to indulge in any activity which will tend to bring down the prestige of the Institution. If a student indulges in malpractice in any of the end semester theory / practical examination, continuous assessment examinations he/she shall will be liable for disciplinary action as prescribed by the SPIHER from time to time.

22. REVISION OF REGULATION AND CURRICULUM

St. Peter's Institute of Higher Education and Research may from time-to-time revise, amend or change the Regulations, Scheme of Examinations and Syllabi if found necessary.

23. ACADEMIC BANK OF CREDITS (ABC)

All the students who admitted in any one of the above programmes are mandatory to register in the Academic Bank of Credits (ABC) portal provided by the Ministry of Education (MoE), Government of India.

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Annexure – 1

Eligibility requirement for admission to PG Programme in Arts, Science, Commerce and Humanities for the Academic year 2024-2025 and onwards

S. No.	Name of the Programme	Eligibility for admission
01	M.A. Economics	Candidates who passed the Under graduation in any stream of study (B.A/ B.B.A. / B.COM / BCA / B.Sc.) or its equivalent in the relevant subjects as recognized by the Institute or any other equivalent Examination thereto are eligible for admission to M.A. in Economics Programme.
02	M.A. English	Candidates who passed the B.A. English Programme or its equivalent in the relevant subjects as recognized by the Institute or any other equivalent Examination thereto wherever prescribed are eligible for admission to M.A English Programme.
03	M.A. Political Science	B. A. Degree with Political Science / For admissions in M.A Political Science, candidates must have completed a Bachelor's Degree in any discipline under 10+2+3 education pattern with at least 50 % marks in aggregate of Social Sciences subjects and at least 55 per cent marks aggregate of Science and Technology subjects.
04	M.A. Tamil	Candidates need to have a Bachelor's degree in any stream with Tamil as one of the subjects of study with minimum 50% aggregate marks
05	MBA	Candidates who passed the under graduation any stream of study (B.B.A. / B.Com. / BCA / B.Sc.) or its equivalent in the relevant subjects as recognised by the institute or any other equivalent examination thereto are eligible for admission to MBA programme.
06	MCA	a) Recognized Bachelor's Degree of Minimum three year duration in B.Sc. Computer Science / B.Sc. (Information Technology)/ BCA with 50 % in qualifying examination with Mathematics as one of the subjects at graduate level / 10+2 level. b) Other equivalent degrees B.Com. / B.B.M. /B.B.A./ B.L.M. / B.A. Corporate Secretaryship / B.A. Economics / any other degree with Business Mathematics and Statistics or Mathematics / Statistics in Main / Allied level or c) B.Sc. Chemistry with Mathematics and Physics and Physics as allied subject. d) B.E./ B.Tech. / M.B.A. **e)** Bachelor's degree in any discipline with Mathematics as one of the subjects at the Higher Secondary level.
07	M.Com	Candidates who passed the B.Com Programme or its equivalent in the relevant subjects as recognized by the Institute or any other equivalent or Any Bachelor degree with Accounts and Commerce as Major course. (B.Com any stream, BBA and BBM).Examination thereto wherever prescribed are eligible for admission to M.Com Programme.

S. No.	Name of the Programme	Eligibility for admission
08	M.Sc. Biochemistry	A Bachelor's degree with Biochemistry / Molecular Biology / Biotechnology / Botany / Zoology / Chemistry / Microbiology / Nutrition / Animal Science or Medicine / Veterinary Sciences including Indian forms of Medicine (the main subject of this University or from any other University accepted as equivalent, is eligible for admission to M.Sc. (Biochemistry) degree programme.
09	M.Sc. Biotechnology	Candidate must have a Bachelor's degree in Biotechnology / Botany / Plant Biology & Biotechnology / Zoology / Biochemistry / Microbiology / Agriculture Sciences / Life Sciences are eligible for admission to M.Sc. Biotechnology
10	M.Sc. Chemistry	Candidates who have passed with minimum of 50% Marks in their Bachelor degree from a recognized university like B.Sc. (Hons.) in Chemistry / B.Sc.(Pass) / B.Sc.(Life Sciences) with Chemistry as the main subject.
11	M.Sc. Computer Science	**a)** Recognized Bachelor's Degree of Minimum three year duration in Computer Science/ Information Technology/ Mathematics / Physics / Statistics / BCA b) Any other equivalent degree in Information Technology and Computer Science with an 50% of marks (Inclusive of all subjects)
12	M.Sc. Information Security and Digital Forensics	**a)** Recognized Bachelor's Degree of Minimum three year duration in Computer Science/ Information Technology/ Information Science/ Mathematics / Physics / Statistics / BCA / Forensic Sciences / Criminology / Cyber Security / Information Security / Digital Forensics or any other related degrees b) B.Com / B.B.M. /B.B.A./ B.L.M. / B.A. Corporate Secretaryship / B.A. Economics with Computer Science / Computer Applications/Information Technology / Information Science or similar options as one of the subjects c) B.E./B.Tech with an 50% of marks (Inclusive of all subjects). d) Bachelor's degree in any discipline with Mathematics or Computer Science as one of the subjects at the Higher Secondary level.
13	M.Sc. Mathematics	Candidates who have passed with minimum of 40% Marks or equivalent GPA bachelor degree in Mathematics / Applied Mathematics / B.E./ B.Tech from any reputable University or Institution. Honours degree or equivalent in a mathematics, science or engineering degree.
14	M.Sc. Microbiology	B.Sc. Microbiology / Applied Microbiology / Industrial Microbiology / Medical Microbiology / Botany / Zoology / Biology / Biotechnology / Molecular Biology / Genetic Engineering / Biochemistry / Agriculture / Forestry / Medical Lab Technology / Life Sciences with minimum 40% aggregate marks or equivalent GPA.

S. No.	Name of the Programme	Eligibility for admission
15	M.Sc. Physics	Candidates who passed the B.Sc. (Physics) Programme or its equivalent in the relevant subjects as recognized by the Institute or any other equivalent Examination thereto wherever prescribed are eligible for admission to M.Sc. in Physics Programme. Or B.Sc. Physics with Mathematics as an ancillary subject (or) B.Sc. Triple major with Physics, Chemistry, and Mathematics (or) B.Sc. (Applied Science/Applied Physics) with Mathematics as an ancillary subject and Physics as a major.
16	M.Sc. Visual Communication	Candidates who have passed any UG degree are eligible to join the M.Sc. Visual Communication.

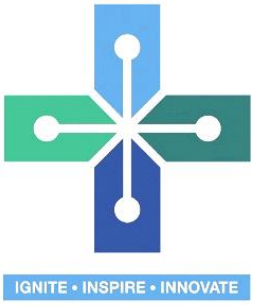
*****

FACULTY OF ARTS, SCIENCE, COMMERCE, MANAGEMENT AND HUMANITIES

POST GRADUATE PROGRAMME
M.Sc., MICROBIOLOGY
(I to IV SEMESTERS)

CURRICULUM AND SYLLABI -2024
CHOICE BASED CREDIT SYSTEM (CBCS)
NATIONAL EDUCATION POLICY-2020

Effective from the Academic Year 2024-2025



ST. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Deemed to be University)
Established under Section 3 of UGC Act, 1956
(Accredited with A+ Grade by NAAC in the Second Cycle
& ISO 9001:2015 Certified)
AVADI, Chennai - 600054

St. Peter's Institute of Higher Education and Research

REGULATION 2024
M.Sc. MICROBIOLOGY

CHOICE BASED CREDIT SYSTEM

VISION & MISSION OF THE INSTITUTION

Vision

To achieve, Academic Excellence in Engineering, Technology and Science through Teaching, Research and Extension to Society

Mission

By generating, preserving and disseminating knowledge through rigorous academic study, inquisitiveness to understand and explore nature, entrepreneurship with creativity and innovation

VISION & MISSION OF THE DEPARTMENT

VISION

- To emerge as a dynamic center of excellence in Microbiology and to flourish in both national and international scene

MISSION

- To conduct high quality research in Microbiology
- To effectively transform our theoretical knowledge and practical skills in Microbiology to the industry and to the common public.
- To impart technical skills with integrity and ethical standards in students.

PROGRAMME OUTCOMES (POs)

PO1 Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2 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.

PO3 Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4 Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5 Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6 Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7 Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PO8 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO-1: Introduce advanced techniques and ideas required in developing area of Microbiology

PEO-2: Enhance the students' ability to develop interdisciplinary knowledge.

PEO-3: Gain the knowledge of Microbiology through theory and practical

PEO-4: Understand and apply the knowledge of Microbiology for understanding the scientific phenomenon in the aspects of Microbiology

PEO-5: Understand and apply analytical techniques for evaluating the various biochemical systems.

PEO-6: Understand good laboratory practices (GLP) and biosafety.

PEO-7: Develop research oriented skills.

PEO-8: Make aware and handle the sophisticated instruments/equipments.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-1: Ability to understand the concepts and applications in the field of advanced techniques and ideas required in developing area of Microbiology

PSO-2: Ability to understand the scientific phenomenon in microbial enzymes, metabolism and proteins

PSO-3: Ability to apply the learning from the courses and develop applications for real world research problems.

PG Curriculum (2024-2025)
Regulation 2024
M.Sc., MICROBIOLOGY

I-SEMESTER

Course Code	Course Title	Hrs/Week			Credit	Marks		
		L	T	P		CIA	ESE	Total
24MBP101	General Microbiology and Laboratory Animal Sciences	5	0	0	4	40	60	100
24MBP102	Immunology	4	0	0	4	40	60	100
24MBP103	Microbial Taxonomy	4	0	0	4	40	60	100
24MBP104	**Program Elective- I**	4	0	0	4	40	60	100
24MBP111	**Practical-I** General Microbiology and Microbial Physiology Lab	0	0	4	2	40	60	100
24MBP112	**Practical-II** Immunology Lab	0	0	4	2	40	60	100
Total		**17**	**0**	**8**	**20**	**240**	**360**	**600**

Program Elective- I

Course Code	Course Title	Hrs/Week			Credit	Marks		
		L	T	P		CIA	ESE	Total
24MBP104-A	Molecular Biology	4	0	0	4	40	60	100
24MBP104-B	Plant Biotechnology	4	0	0	4	40	60	100
24MBP104-C	Animal Biotechnology	4	0	0	4	40	60	100

II-SEMESTER

Course Code	Course Title	Hrs/Week			Credit	Marks		
		L	T	P		CIA	ESE	Total
24MBP201	Systematic Medical Bacteriology	5	0	0	4	40	60	100
24MBP202	Mycology and Parasitology	4	0	0	4	40	60	100
24MBP203	Virology	4	0	0	4	40	60	100
24MBP204	**Program Elective- II**	4	0	0	4	40	60	100
24MBP211	**Practical II:** Systematic Medical Bacteriology Lab	0	0	4	2	40	60	100
24MBP212	**Practical III:** Mycology and Parasitology Lab	0	0	4	2	40	60	100
Total		**17**	**0**	**8**	**20**	**240**	**360**	**600**

Programs Elective-II

Course Code	Course Title	Hrs/Week			Credit	Marks		
		L	T	P		CIA	ESE	Total
24MBP204-A	Industrial Pharmaceutical Microbiology	4	0	0	4	40	60	100
24MBP204-B	Biophysics	4	0	0	4	40	60	100
24MBP204-C	Genomics	4	0	0	4	40	60	100

III-SEMESTER

Course Code	Course Title	Hrs/Week			Credit	Marks		
		L	T	P		CIA	ESE	Total
24MBP301	Microbial Genetics	5	0	0	4	40	60	100
24MBP302	Genetic Engineering	5	0	0	4	40	60	100
24MBP303	**Program Elective-III**	4	0	0	3	40	60	100
24MBP304	**Program Elective-IV**	4	0	0	3	40	60	100
24EOP042	**Open Elective Course** Economics for Agriculture	3	0	0	2	40	60	100
24MBP311	**Practical III:** Microbial Genetics & Genetic Engineering	0	0	4	2	40	60	100
24MBP321	Internship	0	0	0	2	-	100	100
Total		**21**	**0**	**4**	**20**	**240**	**460**	**700**

Programs elective-III

Course Code	Course Title	Hrs/Week			Credit	Marks		
		L	T	P		CIA	ESE	Total
24MBP303-A	Environmental Biotechnology	4	0	0	3	40	60	100
24MBP303-B	Bioinformatics and Bioprocess Technology	4	0	0	3	40	60	100
24MBP303-C	Bioinformatics and Pharmaceutical Biotechnology	4	0	0	3	40	60	100

Program Elective-IV

Course Code	Course Title	Hrs/Week			Credit	Marks		
		L	T	P		CIA	ESE	Total
24MBP304-A	Biostatistics and Plant Biotechnology	4	0	0	3	40	60	100
24MBP304-B	Soil and Agricultural Microbiology	4	0	0	3	40	60	100
24MBP304-C	Bioinformatics and Animal Biotechnology	4	0	0	3	40	60	100

IV-SEMESTER

Code No.	Course Title	Hrs/Week			Credit	Marks		
		L	T	P		CIA	ESE	Total
24MBP401	Research Methodology*	5	0	0	5	40	60	100
24MBP491	Project Work	0	0	20	15	40	60	100
Total		**5**	**0**	**20**	**20**	**80**	**120**	**200**

*Common course for Biochemistry, Biotechnology, Microbiology Departments.

TOTAL CREDITS OF PG CURRICULUM: 80

I-SEMESTER

24MBP101	GENERAL MICROBIOLOGY AND LABORATORY ANIMAL SCIENCE	L	T	P	C	TOTAL MARKS
		5	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Educate students to learn principles, applications and types of microscopes.
2	Equip students to gain knowledge on bacterial growth, structure, biosynthesis and enumeration techniques.
3	Enable students to acquire basic knowledge on microbial diversity, classification and economic significance of extremophiles.
4	Explore students to learn the methods of laboratory animal care.
5	Introduce students to gain knowledge about the techniques for maintaining pathogen-free, gnotobiotic and transgenic animals.

UNIT 1: Microscope and its types **15**

Microscopy – Its principles and application in the field of Microbiology including the following: Dark field, Bright field, Phase contrast, Fluorescence microscopy. Electron microscope- Principle, types, sample preparation- Confocal microscope

UNIT 2: Growth of bacteria and kinetics **15**

Bacterial Structure, properties and biosynthesis cellular components of bacteria – Sporulation – Growth and nutrition – Nutritional requirements – Growth curve – Kinetics of growth – Batch culture – Synchronous growth – Measurement of growth and enumeration of cells – Pure culture techniques.

UNIT 3: Microbial diversity **15**

Biodiversity: Introduction to microbial diversity - distribution, morphology, classification, economic importance of thermophiles, methanogens, halophiles, alkaliphiles, acidophiles, barophiles

UNIT 4: Handling of animal models **15**

Modern methods of care, management, breeding and maintenance of laboratory animals. Detailed account of nutrition, handling, uses of different laboratory animals - rabbits, mice, rats, guinea pigs, monkeys, hamsters, fowl, sheep.

UNIT 5: Maintenance of laboratory animals **15**

Breeding and handling of specific pathogen free Gnotobiotic animals and their maintenance and uses. Transgenic animal models – Methodology and uses. Disposal of animal house wastes and used animals. Laboratory uses of animals with special reference to microbiology, pathogenicity testing, antibody production, toxin/toxoid testing, hypersensitivity testing, maintenance of microbes in animals.

75 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Explain principles and applications of different microscopy techniques.
CO2:	Describe bacterial growth, nutritional requirements and growth kinetics.
CO3:	Review concept of microbial biodiversity based on their morphology and distribution.
CO4:	Discuss modern methods for care, breeding and handling of laboratory animals.
CO5:	Interpret maintenance, methodologies and proper disposal of laboratory animals.

TEXT BOOKS

1.	Pelczar, M.J., Chan, E.C.S. and Krieg, N.R. (2006). Microbiology: Concepts and Applications. McGraw Hill.

2.	Prescott, L.M., Harley, J.P. and Klein, D.A. (2021). Microbiology. McGraw Hill.
3.	Atlas, R.M. (1997). Principles of Microbiology. McGraw Hill.
4.	Kumar, H.D. (1991). Modern Concepts of Microbiology. Vikas Publishing.
REFERENCES	
1.	Murphy, D.B. (2001). Fundamentals of Light Microscopy and Electronic Imaging. Wiley-Liss.
2.	Moat, A.G., Foster, J.W. and Spector, M.P. (2002). Microbial Physiology. Wiley.
3.	Atlas, R.M. and Bartha, R. (1997). Microbial Ecology: Fundamentals and Applications. Benjamin-Cummings.
4.	Weir, B.J. (1986). Handbook on Experimental Animals. Academic Press.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP102	IMMUNOLOGY	L	T	P	C	TOTAL MARKS
		4	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Introduce students about history, scope and fundamental concepts of immunology
2	Equip students with knowledge of antigens, immunoglobulins and antibody production.
3	Explore students to learn antigen-antibody interactions, immunological techniques and immunohaematology.
4	Enable students to understand immune responses, hypersensitivity, auto-immunity and transplantation immunology.
5	Educate students about vaccine principles, immunization strategies and immunodeficiency diseases in public health.

UNIT 1: History of immunology **12**

History and scope of immunology: types of immunity – Innate, acquired, passive and active, Physiology of immune response – Humoral immunity and cell mediated immunity – Cells and organs of immune system

UNIT 2: Antigens and Antibodies **12**

Antigen: Types – properties and functions: Immunoglobulin: structure, function and techniques of purification, - Antibody production – regulation and diversity – polyclonal and monoclonal antibodies.

UNIT 3: Antigen - antibody interaction **12**

Antigen – antibody reaction including agglutination and precipitation reactions – Enzyme immunoassays –Radio immune assays, Immunofluorescene, Immunoperoxidase. Immunohaematology of blood groups. ABO and RH incompatibility.

UNIT 4: Immune response **12**

Complement and its role in immune responses.Antigen presentation. Hypersensitivity – types and manifestations. Autoimmunity. Transplantation immunology and tumor immunology. HLA tissue typing – Major histocompatibility complex – structure and types.

UNIT 5: Vaccines and Immunization strategies **12**

Vaccines: Principles and types. Immunization - its rationale, schedules and importance in public health. Immunodeficiency diseases.

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Outline history of Immunology and various types of immunity
CO2:	Explain structure and function of immunoglobulins and their role in immune defense.
CO3:	Interpret antigen-antibody interactions, including agglutination and precipitation reactions.
CO4:	Describe role of the complement system in immune responses.
CO5:	Explain principles of Immunization by vaccines and types of vaccines.

TEXT BOOKS

1.	Kuby, J. (2021). Kuby Immunology. W.H. Freeman & Company.
2.	Abbas, A.K., Lichtman, A.H. and Pillai, S. (2022). Cellular and Molecular Immunology. Elsevier.
3.	Janeway, C.A., Travers, P., Walport, M. and Shlomchik, M. (2017). Immunobiology: The

	Immune System in Health and Disease. Garland Science.
4.	Goldsby, R.A., Kindt, T.J., Osborne, B.A. and Kuby, J. (2013). Immunology. W.H. Freeman & Company.
REFERENCES	
1.	Paul, W.E. (2012). Fundamental Immunology. Lippincott Williams & Wilkins.
2.	Sompayrac, L. (2019). How the Immune System Works. Wiley-Blackwell.
3.	Bloom, B.R. and Lambert, P.H. (2003). The Vaccine Book. Academic Press.
4.	Plotkin, S.A., Orenstein, W.A., Offit, P.A. and Edwards, K.M. (2017). Plotkin's Vaccines. Elsevier.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP103	MICROBIAL TAXONOMY	L	T	P	C	TOTAL MARKS
		4	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Enable students to understand microbial taxonomy, identification methods and classification of Microorganisms
2	Equip students with knowledge of bacterial classification based on Bergey's Manual.
3	Educate students about fungal classification and characteristics of major fungal groups.
4	Introduce students to understand about protozoa and viral classification
5	Explore students with algal classification and its characteristics of major algal groups.

UNIT 1:	**Taxonomy & Classification**	**12**

Taxonomy, systematics, identification: Taxonomical hierarchy species- type strains: culture collections; binomial nomenclature; systems of classification- phenetic, numerical taxonomy- similarity matrix, dendrograms; phylogenetics; general characteristics used in classification- five kingdom, six kingdom and eight kingdom systems

UNIT 2:	**Classification of Bacteria**	**12**

Classification of bacteria according to Bergey's Manual of systematic bacteriology; Characteristics of major sections; classification of Archaea, Photosynthetic bacteria, Enterobacteriaceae, Mollicutes.

UNIT 3:	**Classification of Fungi**	**12**

Classification of Fungi - characteristics of Zygomycetes, Ascomycetes, Basidiomycetes and Dueteromycetes.

UNIT 4:	**Classification of Protozoa and Viruses**	**12**

Classification of Protozoa- Distinguishing characteristics of ciliates; flagellates; Sporozoa; Sarcodina; Infusoria. Classification of viruses - animal viruses, plant viruses and phages.

UNIT 5:	**Classification of Algae**	**12**

Classification of Algae - major characteristics of Chlorophycophyta, Crisophycophyta, Cryptophycophyta, Euglinophycophyta & Rhodophycophyta.

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Explain concepts of Microbial taxonomy, systematics and identification.
CO2:	Classify major aspects of bacterial classification and their key characteristics.
CO3:	Differentiate major Fungal groups based on structural and reproductive characteristics
CO4:	Classify major aspects of of Protozoa and viruses its key characteristics.
CO5:	Differentiate major Algal groups based on structural and characteristics

TEXT BOOKS

1.	Buchanan, R.E. and Gibbons, N.E. (1974). Bergey's Manual of Determinative Bacteriology. Williams & Wilkins.
2.	Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). Introductory Mycology. Wiley.
3.	Prescott, L.M., Harley, J.P. and Klein, D.A. (2021). Prescott's Microbiology. McGraw Hill.
4.	Lee, R.E. (2018). Phycology. Cambridge University Press.

REFERENCES

1.	Madigan, M.T., Martinko, J.M. and Stahl, D.A. (2022). Brock Biology of Microorganisms. Pearson.

2.	Webster, J. and Weber, R. (2007). Introduction to Fungi. Cambridge University Press.
3.	Flint, S.J., Enquist, L.W., Racaniello, V.R. and Skalka, A.M. (2020). Principles of Virology. ASM Press.
4.	Hoek, C., Mann, D.G. and Jahns, H.M. (1995). Algae: An Introduction to Phycology. Cambridge University Press.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP104 - A	MOLECULAR BIOLOGY	L	T	P	C	TOTAL MARKS
		4	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Equip students with knowledge of structure, composition and function of biomolecules and their role in molecular diagnostics.
2	Enable students to understand DNA replication, repair mechanisms and recombination processes.
3	Explore students about transcription, RNA processing and post-transcriptional modifications in gene regulation.
4	Educate students to understand translation, protein synthesis and post-translational modifications.
5	Introduce students to gene expression regulation in prokaryotes, eukaryotes, phages and viruses.

UNIT 1: Structure of macromolecules **12**

Composition, structure and function of biomolecules (carbohydrates, lipids, proteins and nucleic acids). Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds). Structure and types of DNA and RNA. Stability of protein and nucleic acid structures. Molecular approaches to diagnosis and strain identification.

UNIT 2: DNA replication repair and recombination **12**

DNA replication - Principle of replication, replication enzymes, replication origin and replication fork, fidelity of replication, extra-chromosomal replications. DNA damage and repair mechanisms. DNA recombination.

UNIT 3: Transcription and post transcriptional modifications **12**

RNA synthesis and processing: Transcription factors and machinery - formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination. RNA processing - RNA editing, splicing, polyadenylation, RNA transport.

UNIT 4: Translation and post translational modifications **12**

Protein synthesis - formation of initiation complex, elongation and termination – machineries and their regulation. Genetic code. Aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, translational proof-reading, translation inhibitors. Posttranslational modification of proteins.

UNIT 5: Gene expression & Regulation **12**

Control of gene expression at transcription and translation level - Regulation of phages, viruses, prokaryotic and eukaryotic gene expression - Role of chromatin in regulating gene expression and gene silencing.

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Describe composition, structure and function of biomolecules such as carbohydrates, lipids, proteins and nucleic acids.
CO2:	Explain mechanisms of DNA replication, repair and recombination.
CO3:	Discuss process of transcription and post-transcriptional modifications.
CO4:	Interpret process of translation and post-translational modifications of proteins
CO5:	Outline regulation of gene expression and its important components

TEXT BOOKS

1.	Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A. and Ploegh, H. (2021). Molecular Cell Biology. W.H. Freeman.
2.	Lehninger, A.L., Nelson, D.L. and Cox, M.M. (2021). Lehninger Principles of Biochemistry. W.H. Freeman.

3.	Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2018). Molecular Biology of the Gene. Pearson.
4.	Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. (2022). Molecular Biology of the Cell. Garland Science.
REFERENCES	
1.	Creighton, T.E. (2017). Proteins: Structures and Molecular Properties. W.H. Freeman.
2.	Friedberg, E.C., Walker, G.C. and Siede, W. (2005). DNA Repair and Mutagenesis. ASM Press.
3.	Brown, T.A. (2017). Gene Cloning and DNA Analysis: An Introduction. Wiley-Blackwell.
4.	Struhl, K. (1998). Fundamentals of Gene Regulation. Cold Spring Harbor Laboratory Press.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP111	GENERAL MICROBIOLOGY AND MICROBIAL PHYSIOLOGY LAB	L	T	P	C	TOTAL MARKS
		0	0	4	2	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Demonstrate students to gain practical knowledge on sterilization methods and media preparation techniques.
2	Equip students to gain practical knowledge on culture media preparation and biochemical characterization.
3	Explore students to get practical knowledge on the staining techniques for microbial identification, including Gram's and acid-fast staining.
4	Enable students to understand laboratory animal care, breeding and handling for research applications.
5	Demonstrate students to gain practical knowledge on pathogen-free animal models, transgenic animals and microbiological applications in laboratory animals.

UNIT 1:	**Sterilization and media preparation**	**12**

Cleaning of glass wares Sterilization principle and methods- moist heat- dry heat and filtration methods. Media preparation: liquid media, solid media, agar slants, agar plates, basal, enriched, selective media preparation- quality control of media, growth supporting properties, sterility check of media.

UNIT 2:	**Culture techniques and biochemical characterization**	**12**

Pure culture techniques: streak plate, pour plate, decimal dilution. Culture characteristics of microorganisms: growth on different media, growth characteristics and description. Demonstration of pigment production. Physiology characteristics: IMViC test, H2S, Oxidase, catalase, urease test. Carbohydrate fermentation test, maintenance of pure culture, paraffin method, stab culture, maintenance of mold culture.

UNIT 3:	**Staining Techniques**	**12**

Staining Techniques: Smear preparation, simple staining, Gram's staining, Acid fast staining, and other staining methods.

UNIT 4:	**Handling of animal models**	**12**

Modern methods of care, management, breeding and maintenance of laboratory animals. Nutrition, handling, uses of different laboratory animals - rabbits, mice, rats, guinea pigs, monkeys, hamsters, fowl, sheep.

UNIT 5:	**Maintenance of laboratory animals**	**12**

Hygiene and sterilization in animal facilities, Breeding techniques, weaning, housing and care of gnotobiotic animals, Introduction of microbes into animal models, Safe disposal methods for animal waste.

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Demonstrate sterilization techniques and media preparation.
CO2:	Apply pure culture techniques and biochemical tests for microbial characterization.
CO3:	Test staining techniques for microbial identification and differentiation.
CO4:	Handle laboratory animals following ethical and scientific guidelines.
CO5:	Utilize laboratory animals in microbiological research, including pathogenicity and immunological studies.

TEXT BOOKS

1.	Pelczar, M.J., Chan, E.C.S. and Krieg, N.R. (1993). Microbiology: Concepts and Applications. McGraw-Hill.

2.	Cappuccino, J.G. and Sherman, N. (2019). Microbiology: A Laboratory Manual. Pearson.
3.	Prescott, L.M., Harley, J.P. and Klein, D.A. (2021). Microbiology. McGraw-Hill.
4.	Tortora, G.J., Funke, B.R. and Case, C.L. (2022). Microbiology: An Introduction. Pearson.
REFERENCES	
1.	Atlas, R.M. (2010). Handbook of Microbiological Media. CRC Press.
2.	Dubey, R.C. and Maheshwari, D.K. (2013). A Textbook of Microbiology. S. Chand Publishing.
3.	Aneja, K.R. (2017). Experiments in Microbiology, Plant Pathology and Biotechnology. New Age International Publishers.
4.	Madigan, M.T., Bender, K.S., Buckley, D.H., Sattley, W.M. and Stahl, D.A. (2021). Brock Biology of Microorganisms. Pearson.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP112	IMMUNOLOGY LAB	L	T	P	C	TOTAL MARKS
		0	0	4	2	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Equip students to gain practical knowledge on blood group typing, precipitation and agglutination reactions in immunodiagnostics.
2	Demonstrate students to gain practical knowledge on complement fixation tests, immunofluorescence and ELISA techniques.
3	Explore students to get practical understanding on bacterial antigen preparation, polyclonal antisera production and immunization procedures.
4	Enable students to gain practical knowledge on immunological techniques such as hemagglutination, immunodiffusion and immunoelectrophoresis.
5	Demonstrate students to gain practical knowledge on lymphocyte isolation, immunoglobulin purification and hypersensitivity testing methods.

UNIT 1:	**Blood typing and precipitation reactions**	**12**

Blood groups and typing - Coombs's test. Precipitation reaction inA-8 14Gel-Outchelony double diffusion, Single Radial Immunodiffusion. VDRL, RPR. Agglutination reactions: Slide and Tubemethods RBC agglutination IHA, TPHA Bacterial.

UNIT 2:	**Complement fixation and Immunoassays**	**12**

Complement fixation test. Titration of amboceptor and complement (demonstration only). Immunofluorescene, (Demonstration only), ELISA

UNIT 3:	**Antigen preparation and Polyclonal antisera production**	**12**

Preparation of Bacterial Antigens (Crude preparation) by homogenization or sonication. Raising polyclonal antisera in experimental animals - rabbit or mouse with bacterial antigens, RBC (Demonstration).

UNIT 4:	**Agglutination, Hemagglutination and ELISA techniques**	**12**

Agglutination & Haemagglutination reactions: Latex Agglutination - RF, ASLO, CRP. Blood grouping, RH-Typing/IHA/RPHA. Precipitation reactions in gels: SRID - Single radial immunodiffusion. Double immunodiffusion. Immuno electrophoresis and staining of precipitation lines. ELISA technique –HbsAg or other Viral Markers.

UNIT 5:	**Lymphocyte preparation and Hypersensitivity testing**	**12**

Preparation of Lymphocytes from peripheral blood by density gradient centrifugation. Purification of Immunoglobulins: Ammonium sulphate precipitation. Separation of IgG by chromatography using DEAE cellulose or Sephadex. Anaphylactic reactions in Guinea pigs; Arthus reaction in rabbits (Demonstration only). Skin tests

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Perform blood grouping, precipitation, and agglutination reactions for immunodiagnostics.
CO2:	Apply immunoassay techniques such as ELISA and complement fixation in laboratory testing.
CO3:	Prepare antigen and polyclonal antibody from the experimental animals.
CO4:	Perform immunological reactions including hemagglutination, immunodiffusion and electrophoresis.
CO5:	Demonstrate lymphocyte isolation, immunoglobulin purification and hypersensitivity reactions.

TEXT BOOKS

1.	Roitt, I., Brostoff, J. and Male, D. (2017). Immunology. Elsevier.
2.	Abbas, A.K., Lichtman, A.H. and Pillai, S. (2022). Cellular and Molecular Immunology.

	Elsevier.
3.	Goldsby, R.A., Kindt, T.J., Osborne, B.A. and Kuby, J. (2013). Immunology. W.H. Freeman & Company.
4.	Parham, P. (2014). The Immune System. Garland Science.
REFERENCES	
1.	Paul, W.E. (2012). Fundamental Immunology. Lippincott Williams & Wilkins.
2.	Janeway, C.A., Travers, P., Walport, M. and Shlomchik, M.J. (2005). Immunobiology: The Immune System in Health and Disease. Garland Science.
3.	Tizard, I.R. (2017). Veterinary Immunology: An Introduction. Elsevier.
4.	Kindt, T.J., Goldsby, R.A., Osborne, B.A. and Kuby, J. (2007). Kuby Immunology. W.H. Freeman & Company.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

II-SEMESTER

24MBP201	SYSTEMATIC MEDICAL BACTERIOLOGY	L	T	P	C	TOTAL MARKS
		5	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Educate students to learn microbial flora, bacterial virulence and clinical syndromes.
2	Equip students with knowledge of host-parasite interactions and immune defense mechanisms.
3	Explore students to understand bacterial pathogens, their classification, pathogenicity and disease control.
4	Enable students to understand infectious bacteria, their diagnosis and treatment strategies.
5	Introduce students to zoonotic diseases, hospital-acquired infections and infection control measures.

UNIT 1:	**Microbial physiology and syndromes**	**15**

Philosophy and General approach to clinical conditions of various syndromes – general and specific syndromes. Indigenous normal microbial flora of human body. General attributes and virulence factors of bacteria causing infections.

UNIT 2:	**Host –parasite interactions and disease diagnosis**	**15**

Host Parasite relationships – Nonspecific host immune mechanisms. Ground rules for collection and dispatch of clinical specimens for microbiological diagnosis, maintenance of mold culture.

UNIT 3:	**Bacterial pathogens and associated diseases**	**15**

Morphology, classification, cultural characteristics, Pathogenicity, pathology, Laboratory diagnosis and prevention – Control and treatment of diseases caused by the following organisms: Staphylococci, Streptococci, Pneumococci, Neisseriae (Gonococci & Meningococci), *Corynebacterium*, *Mycobacterium*, *Clostridium*, *Bacillus*, *Helocobacter*, *Pseudomonas*, Enterobacteriaceae

UNIT 4:	**Infectious bacteria and diseases**	**15**

Studies on *Salmonella*, *Shigella*, *Vibrios*, *Proteus*, *Klebsiella*, *Brucella*, Gram negative anaerobes, Spirochetes, Rickettsiae, Chlamydiae, Mycoplasmas and Ureoplasmas.

UNIT 5:	**Infection control and Hospital management**	**15**

Zoonotic diseases and their control – Hospital acquired infections – Hospital Infection control committee – functions – Hospital waste disposal – Ethical committee – functions

75 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Review microbial flora, bacterial virulence factors and syndromes related to infections.
CO2:	Interpret host-parasite relationships and immune mechanisms in disease prevention.
CO3:	Analyze bacterial pathogens based on morphology, pathogenicity and laboratory diagnosis.
CO4:	Describe microbiological techniques for the detection and control of infectious bacteria.
CO5:	Explain hospital infections, control measures and ethical guidelines in microbiology.

TEXT BOOKS

1.	Greenwood, D., Slack, R., & Barer, M. (2012). Medical Microbiology. Elsevier.
2.	Jawetz, E., Melnick, J.L. and Adelberg, E.A. (2020). Medical Microbiology. McGraw-Hill.
3.	Ryan, K.J. and Ray, C.G. (2022). Sherris Medical Microbiology. McGraw-Hill.
4.	Murray, P.R., Rosenthal, K.S. and Pfaller, M.A. (2021). Medical Microbiology. Elsevier.

REFERENCES

1.	Tille, P. (2021). Bailey & Scott's Diagnostic Microbiology. Elsevier.
2.	Brooks, G.F., Carroll, K.C., Butel, J.S. and Morse, S.A. (2019). Jawetz, Melnick &

	Adelberg's Medical Microbiology. McGraw-Hill.
3.	Collier, L., Oxford, J. and Kellam, P. (2011). Human Virology. Oxford University Press.
4.	Schaechter, M. (2009). Encyclopedia of Microbiology. Academic Press.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP202	MYCOLOGY AND PARASITOLOGY	L	T	P	C	TOTAL MARKS
		4	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Educate students to learn about fungal structure, taxonomy and classification.
2	Introduce students to understand medically important fungi and associated diseases.
3	Explore students to understand diagnostic techniques, immunity and antifungal treatment methods.
4	Enable students to understand parasitology, host-parasite relationships and protozoan infections.
5	Equip students to gain knowledge on helminthic diseases, diagnosis, treatment and infections in immune compromised hosts.

UNIT 1: History and classification Fungi **12**

Historical introduction to mycology - Structure and cell differentiation. Lichens – Scolichens, Basidiolichens, Deuterolichens. Morphology, Taxonomy, Classification of fungi.

UNIT 2: Pathogenic fungi and fungal diseases **12**

Dermatophytes and agents of superficial mycoses. Yeasts of medical importance. Dimorphic fungi causing systematic mycoses. Dimatiaceous fungi, opportunistic hyaline hyphomycetes, agents of zygomycosis. Fungi causing Eumycotic mycetoma.

UNIT 3: Treatment and controlling measures **12**

Detection and recovery of fungi from clinical specimens. Newer methods in diagnostic mycology. Immunity to fungal infections. Mycotoxins. Antifungal agents - testing methods and quality control

UNIT 4: Introduction to medical parasitology **12**

Introduction to Medical parasitology – classification, host-parasite relationships. Epidemiology, life cycle, pathogenic mechanisms, lab diagnosis, treatment, etc. for the following: Protozoa causing human infections – Entamoeba, Aerobic and Anaerobic amoebae. Toxoplasma, Cryptosporidium, Leishmania, Trypanasoma, Giardia, Trichomonas, Balantidium

UNIT 5: Parasitic infections **12**

Classification, life cycle, pathogenicity, laboratory diagnosis and treatment for the following parasites: Helminths: cestodes – *Taenia solium*, *T. saginata*, *T. echinococcus*. Trematodes – Fasciola hepatica, Fasciolopsis buski, Paragonimus, Schistosomes. Nematodes: *Ascaris*, Ankylostoma, Trichuris, Trichuris, Trichinella, Enterobius, Strongyloides, Wuchereria. Other parasites causing infections in immune compromised hosts and AIDS

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Describe history and classification of fungi.
CO2:	Interpret medically important fungi and their causative disease.
CO3:	Discuss diagnostic methods and treatment strategies for fungal infections.
CO4:	Explain protozoan parasites based on its life cycle, pathogenicity and diagnosis.
CO5:	Review parasitic infections and their effects on immune compromised individuals.

TEXT BOOKS

1.	Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). Introductory Mycology. Wiley.
2.	Garcia, L.S. (2021). Diagnostic Medical Parasitology. ASM Press.
3.	Rippon, J.W. (1988). Medical Mycology: The Pathogenic Fungi and the Pathogenic Actinomycetes. W.B. Saunders.

4.	Chandrasekaran, C. (2022). Textbook of Medical Parasitology. Universities Press.
REFERENCES	
1.	Baron, E.J., Peterson, L.R. and Finegold, S.M. (2020). Bailey & Scott's Diagnostic Microbiology. Elsevier.
2.	Koneman, E.W., Allen, S.D., Janda, W.M., Schreckenberger, P.C. and Winn, W.C. (2021). Color Atlas and Textbook of Diagnostic Microbiology. Lippincott Williams & Wilkins.
3.	Prescott, L.M., Harley, J.P. and Klein, D.A. (2017). Microbiology. McGraw-Hill.
4.	Talaro, K.P., & Chess, B. (2021). Foundations in Microbiology. McGraw-Hill.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP203	VIROLOGY	L	T	P	C	TOTAL MARKS
		4	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Explore students to understand discovery of virus, properties and classification of viruses
2	Equip students to gain the knowledge of bacteriophage structure, life cycles and their role in bacterial genetics.
3	Explore students to understand plant viruses, their replication, transmission and impact on agriculture.
4	Enable students to understand the diversity of animal viruses and their role in human and animal diseases.
5	Provide students with a comprehensive learning of viral epidemiology, diagnostic methods, vaccines and antiviral therapies.

UNIT 1:	**Introduction to Virology and Viral agents**	**12**

Brief outline of virology- discovery of virus- general properties of viruses- general methods of diagnosis and serology- viriods, prions, satellite RNAs and virusoids.

UNIT 2:	**Bacteriophages and viral life cycles**	**12**

Bacterial viruses - ΦX 17E4, M13, MU, T4, lambda, Pi; structural organization, lifecycle and phage production. Lysogenic cycle-typing and application in bacterial genetics.

UNIT 3:	**Plant viruses**	**12**

Plant viruses-TMV- general characters- morphology-replication-RNA as its initiator of infection. Cauliflower mosaic virus; Transmission of plant viruses; common viral diseases of crop plants- paddy, cotton, tomato, and sugarcane. Viruses of cyanobacteria, algae, fungi and insects.

UNIT 4:	**Animal viruses**	**12**

DNA Viruses- Pox viruses, Herpes viruses, Adeno viruses, Papova viruses and Hepadna viruses; RNA Viruses- Picorna, Orthomyxo, Paramyxo, Toga and other arthropod borne viruses, Rhabdo, Rota, HIV and other Hepatitis viruses.

UNIT 5:	**Viral disease diagnosis and control**	**12**

Epidemiology, Diagnosis and Treatment of Viral Diseases; Viral Vaccines and Antiviral agents

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Differentiate various types of Virus and their unique characteristics.
CO2:	Explain bacteriophage life cycles and their applications in genetics.
CO3:	Review plant viruses, their replication and transmission in crops.
CO4:	Differentiate animal viruses based on its genome type, structure and pathogenicity.
CO5:	Describe diagnostic techniques and treatment strategies for viral infections.

TEXT BOOKS

1.	Flint, S.J., Enquist, L.W., Racaniello, V.R. and Skalka, A.M. (2020). Principles of Virology. ASM Press.
2.	Wagner, E.K. and Hewlett, M.J. (2014). Basic Virology. Wiley-Blackwell.
3.	Fields, B.N., Knipe, D.M. and Howley, P.M. (2013). Fields Virology. Lippincott Williams & Wilkins.
4.	Dimmock, N.J., Easton, A.J. and Leppard, K.N. (2021). Introduction to Modern Virology. Wiley.

REFERENCES

1.	Mahy, B.W.J. and van Regenmortel, M.H.V. (2010). Desk Encyclopedia of General Virology.

	Academic Press.
2.	Shors, T. (2017). Understanding Viruses. Jones & Bartlett Learning.
3.	Carter, J. and Saunders, V. (2013). Virology: Principles and Applications. Wiley-Blackwell.
4.	Cann, A.J. (2011). Principles of Molecular Virology. Elsevier.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP204-C	GENOMICS	L	T	P	C	TOTAL MARKS
		4	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Explore students to understand the organization and complexity of prokaryotic and eukaryotic genomes.
2	Equip students to gain knowledge on the principles of comparative genomics and their role in understanding genetic diversity.
3	Provide students with a comprehensive learning of functional genomics and protein interactions.
4	Enable students to understand pharmacogenomics and its applications in personalized medicine.
5	Explore students with genomic technologies and their applications in healthcare and research.

UNIT 1:	**Genome organization and structure**	12

Overview of prokaryotic and eukaryotic genomes – Genome size and organization of genes – Mitochondrial genome – Nuclear genome – Gene families – Transposable elements

UNIT 2:	**Comparative Genomics and Gene Mapping**	12

Diversity and conservation of genes – C value – Complexity of genomes – Gene mapping – Human Genome Project

UNIT 3:	**Functional Genomics and Protein Diversity**	12

Concepts of transcriptome and proteome – Sequence homology – Prediction of gene function – Diversity and multiplicity of proteins

UNIT 4:	**Pharmacogenomics and Personalized Medicine**	12

Concepts of pharmacogenomics – Genetic polymorphisms – Drug target – Effects on drug response – Personalized medicine

UNIT 5:	**Applications of genomics**	12

Microarray technology – 2D electrophoresis – Protein sequencing – Drug therapy – Gene Chips – Applications in disease profile

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Interpret genome organization, gene families, and transposable elements.
CO2:	Analyze genomic structures by the various comparative Genomics methods
CO3:	Interpret transcriptome and proteome data for gene function prediction.
CO4:	Apply pharmacogenomics concepts to drug response and personalized medicine.
CO5:	Outline genomic technologies in disease profiling, drug discovery, and biotechnology.

TEXT BOOKS

1.	Primrose, S.B. and Twyman, R.M. (2014). Principles of Gene Manipulation and Genomics. 7th Ed. Blackwell publications, USA.
2.	Campbell, A.M. and Heyer, L.J. (2018). Discovering Genomics, Proteomics, and Bioinformatics. Pearson.
3.	Makolm Carnbell, A. and Lauries J. Heyer (2002). Discovering Genomics, Proteomics and Bioinformatics. Cold Spring Harbour Lab Press
4.	Arthur, L. (2017). Introduction to Genomics. Oxford Publications, UK.

REFERENCES

1.	Brown, T.A. (2007). Genomes 3 - 3rd ed., Garland Science Publishers, London,
2.	Brenner C and Duggan D (2004). Oncogenomics - Molecular approaches to cancer, Wiley Liss, New Jersey.
3.	Rosanna, M. (2017). Human Genetics and Genomics. Callisto publications, USA.
4.	Strachan, T. and Read, A. (2018). Human Molecular Genetics. CRC Press.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	3	3	3	2	3
CO2:	3	3	2	2	2	3	3	3	3	2	3
CO3:	3	3	2	2	2	3	3	3	3	2	3
CO4:	3	3	2	2	2	3	3	3	3	2	3
CO5:	3	3	2	2	2	3	3	3	3	2	3
CO	3	3	2	2	2	3	3	3	3	2	3

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP211	SYSTEMATIC MEDICAL BACTERIOLOGY LAB	L	T	P	C	TOTAL MARKS
		0	0	4	2	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Equip students to gain practical knowledge on methods of clinical specimen collection and diagnosis.
2	Demonstrate students to achieve practical knowledge on staining techniques for microbial identification.
3	Explore students to get practical understanding on various culture media for bacterial isolation.
4	Provide students to gain practical facts on biochemical tests for bacterial identification at the species level.
5	Explore students to achieve practical knowledge to antibiotic susceptibility testing methods and quality control procedures.

UNIT 1:	**Collection and diagnosis of clinical specimens**	**12**

Collection and transport of clinical specimens -Prerequisites - Proforma -Methodologies. Direct examinations - wetfilms/stainings for Faeces (*V. cholerae*, *Shigella*, *Salmonella*) Pus, Sputum, throat/ear/nasal/wound swabs, CSF and other body fluids.

UNIT 2:	**Microbial staining techniques**	**12**

Staining Techniques: Smear preparation, Simple, differential and special staining methods.

UNIT 3:	**Media preparation and bacterial cultivation**	**12**

Cultivation methods -Transport media - Isolation methods – Basal, differential enriched, selective media & special media for the pathogenic bacteria.

UNIT 4:	**Biochemical identification of bacteria**	**12**

Biochemical identification. Tests for the respective bacteria up to species level and their identification.

UNIT 5:	**Antibiotic sensitivity testing and Quality control**	**12**

Antibiotic sensitivity tests -Stokes & Kirby Bauer methods – Disc diffusion -Dilution -Agar dilution & broth dilution - MBC/MIC – Quality Control for antibiotics and standard strains.

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Demonstrate proper collection, transport and preliminary diagnosis of clinical specimens.
CO2:	Identify microbial diversity by various microbial staining techniques.
CO3:	Prepare different types of culture media for pathogenic bacterial isolation.
CO4:	Perform biochemical tests for bacterial identification and classification.
CO5:	Test antibiotic susceptibility and maintain quality control for antimicrobial agents.

TEXT BOOKS

1.	Mackie, T.J. and McCartney, J.E. (2019). Mackie & McCartney Practical Medical Microbiology. Elsevier.
2.	Collee, J.G., Fraser, A.G., Marmion, B.P. and Simmons, A. (2021). Practical Medical Microbiology. Churchill Livingstone.
3.	Koneman, E.W. (2017). Koneman's Color Atlas and Textbook of Diagnostic Microbiology. Lippincott Williams & Wilkins.
4.	Forbes, B.A., Sahm, D.F. and Weissfeld, A.S. (2020). Bailey & Scott's Diagnostic Microbiology. Mosby.

REFERENCES

1.	Cheesbrough, M. (2006). District Laboratory Practice in Tropical Countries. Cambridge University Press.

2.	Baron, E.J. and Finegold, S.M. (2018). Bailey & Scott's Diagnostic Microbiology. Mosby.
3.	Wilson, G. and Miles, A. (2019). Topley and Wilson's Principles of Bacteriology, Virology, and Immunity. Edward Arnold Publishers.
4.	Mahon, C.R., Lehman, D.C. and Manuselis, G. (2019). Textbook of Diagnostic Microbiology. Elsevier.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	3	3	3	2	3
CO2:	3	3	2	2	2	3	3	3	3	2	3
CO3:	3	3	2	2	2	3	3	3	3	2	3
CO4:	3	3	2	2	2	3	3	3	3	2	3
CO5:	3	3	2	2	2	3	3	3	3	2	3
CO	3	3	2	2	2	3	3	3	3	2	3

1 - LOW, 2 - MEDIUM, 3 – HIGH

24MBP212	MYCOLOGY AND PARASITOLOGY LAB	L	T	P	C	TOTAL MARKS
		0	0	4	2	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Demonstrate students to gain practical knowledge on microscopic examination of clinical specimens for fungal and parasitic infections.
2	Explore students to get practical understanding on cultivation and identification of medically important fungi.
3	Equip students to gain practical knowledge on the techniques for detecting parasitic ova and cysts in clinical specimens.
4	Explore students to get practical understanding on blood smear preparation and staining techniques for malaria and microfilariae detection.
5	Provide students to gain practical facts on identification of arthropods of medical importance.

UNIT 1:	**Microscopic examination of clinical specimens**	**12**

KOH preparation of skin / nail scrapings for fungi and scabies mites. Examination of hair infection under UV light. LPCB mount. Special stains for fungi - Gomori, PAS and Methanamine silver stain for sections.

UNIT 2:	**Fungal cultivation and Identification**	**12**

Cultivation of fungi and their identification - *Mucor*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Candida*, *Trichophyton*, *Microsporum*, Epidermophtyon - Slide culture method - Germ tube method, Sugar assimilation / fermentation tests for yeast.

UNIT 3:	**Parasitic examination in clinical specimens**	**12**

Examination of parasites in clinical specimens - Ova/cysts in faeces - Direct and concentration: methods – Formal, Ether and Zinc sulphate methods - Saturated salt solution method

UNIT 4:	**Blood smear examination for malarial parasites**	**12**

Blood smear examination for malarial parasites. Thin smear by Leishman's stain - Thick smear by J.B. stain. Wet film for Microfilariae.

UNIT 5:	**Identification of medically important Arthropods**	**12**

Identification of common arthropods of medical importance - spotters of Anopheles, Glossina, Phelbotomus, Aedes, etc. Ticks and mites.

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Demonstrate microscopic examination of clinical samples for fungal and parasitic infections.
CO2:	Identify fungal species using cultivation and biochemical tests.
CO3:	Test clinical specimens for the presence of parasitic ova and cysts.
CO4:	Prepare blood smears for malaria and other blood-borne parasites.
CO5:	Identify arthropods of medical significance and their role in disease transmission.

TEXT BOOKS

1.	Koneman, E.W. (2017). Koneman's Color Atlas and Textbook of Diagnostic Microbiology. Lippincott Williams & Wilkins.
2.	Garcia, L.S. (2020). Diagnostic Medical Parasitology. ASM Press.
3.	Rippon, J.W. (2018). Medical Mycology: The Pathogenic Fungi and the Pathogenic Actinomycetes. W.B. Saunders.
4.	Ash, L.R. and Orihel, T.C. (2019). Atlas of Human Parasitology. American Society of Clinical Pathologists.

REFERENCES	
1.	Forbes, B.A., Sahm, D.F. and Weissfeld, A.S. (2020). Bailey & Scott's Diagnostic Microbiology. Mosby.
2.	Baron, E.J. and Finegold, S.M. (2018). Bailey & Scott's Diagnostic Microbiology. Mosby.
3.	Cheesbrough, M. (2006). District Laboratory Practice in Tropical Countries. Cambridge University Press.
4.	Mahon, C.R., Lehman, D.C. and Manuselis, G. (2019). Textbook of Diagnostic Microbiology. Elsevier.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	2	3	3	3	2
CO2:	3	3	2	2	2	3	2	3	3	3	2
CO3:	3	3	2	2	2	3	2	3	3	3	2
CO4:	3	3	2	2	2	3	2	3	3	3	2
CO5:	3	3	2	2	2	3	2	3	3	3	2
CO	3	3	2	2	2	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

III-SEMESTER

24MBP301	MICROBIAL GENETICS	L	T	P	C	TOTAL MARKS
		5	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Introduce the molecular structure and properties of DNA and its role as genetic material.
2	Explain the organization and regulation of microbial genes and chromosomes.
3	Discuss plasmids, their replication, and gene transfer mechanisms in microbes.
4	Examine the processes of mutation, mutagenesis, and their molecular mechanisms.
5	Analyze molecular recombination and genetic mapping techniques in microorganisms

UNIT 1:	**Introduction of DNA**	**15**

Historical perspectives of microbial genetics. Nucleic acid as genetic information carriers: experimental evidence. DNA – types, structure and properties topology, super helicity, linking number.

UNIT 2:	**Chromosomes**	**15**

Organization of genes and chromosomes: Definition of gene. Operon – Positive regulation. Structure of chromatin and chromosomes - unique and repetitive DNA, heterochromatin, euchromatin, transposons.

UNIT 3:	**Plasmids**	**15**

Plasmids as extrachromosomal genetic elements; types and properties. Structure and replication of different plasmids: Col E1, F1 and Ti plasmids. Plasmid amplification and curing; Gene transfer mechanisms: Transformation, conjugation and transduction.

UNIT 4:	**Mutation**	**15**

Mutation and Mutagenesis – mechanisms, biochemical basis, mutagens. Molecular basis of spontaneous and induced mutations. Reversion and suppression. Environmental Mutagenesis and toxicity testing; Carcinogenecity - chemical carcinogenesis and their testing. Isolation of Mutants

UNIT 5:	**Recombination**	**15**

Molecular recombination - Mechanism, control and models. Transposition; regulatory sequences and transacting factors. Genetic mapping in E. coli and Yeast. Genetics of Lambda, M13, Mu, T4 and OX174Genetic systems of yeast and Neurospora

75 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Explain the structural features and topological properties of DNA as a genetic material.
CO2:	Analyze gene organization, chromosome structure, and regulation in microbial systems.
CO3:	Differentiate plasmid types and explain microbial gene transfer mechanisms.
CO4:	Interpret the molecular mechanisms of mutation and assess the effects of mutagens..
CO5:	Apply recombination principles and genetic mapping techniques in microbial genetics

TEXT BOOKS

1.	Maloy S.R., Cronan J.E., Freifelder D. (2004). *Microbial Genetics*, 2nd Edition, Jones & Bartlett Learning.
2.	Snyder L., Champness W. (2013). *Molecular Genetics of Bacteria*, 4th Edition, ASM Press.
3.	Brown T.A. (2016). *Gene Cloning and DNA Analysis: An Introduction*, 7th Edition, Wiley-Blackwell.
4.	Willey J., Sherwood L., Woolverton C. (2017). *Prescott's Microbiology*, 10th Edition, McGraw-Hill.

REFERENCES

1.	Watson J.D., Baker T.A., Bell S.P., Gann A., Levine M., Losick R. (2013). *Molecular Biology of the Gene*, 7th Edition, Pearson.
2.	Madigan M., Bender K., Buckley D., Sattley W., Stahl D. (2018). *Brock Biology of*

	Microorganisms, 15th Edition, Pearson.
3.	Russell P.J. (2010). *iGenetics: A Molecular Approach*, 3rd Edition, Pearson.
	Sambrook J., Russell D.W. (2001). *Molecular Cloning: A Laboratory Manual*, 3rd Edition, Cold Spring Harbor Laboratory Press.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	3	3	3	2	3
CO2:	3	3	2	2	2	3	3	3	3	2	3
CO3:	3	3	2	2	2	3	3	3	3	2	3
CO4:	3	3	2	2	2	3	3	3	3	2	3
CO5:	3	3	2	2	2	3	3	3	3	2	3
CO	3	3	2	2	2	3	3	3	3	2	3

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP302	GENETIC ENGINEERING	L	T	P	C	TOTAL MARKS
		5	0	0	4	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Educate students on restriction enzymes and their significance in genetic engineering.
2	Understand the structure and role of plasmids and other genetic vectors.
3	Learn various cloning techniques and strategies for vector construction.
4	Explore recombinant DNA technology and molecular hybridization techniques.
5	Gain knowledge about molecular markers and applications of genetic engineering in various sectors.

UNIT 1:	**Restriction Enzymes and Tools of Genetic Engineering**	**15**

Principles and methods in genetic engineering. Host cell restriction and modification systems. Restriction enzymes: types, recognition sites, cleavage patterns, and their applications. Restriction mapping. Enzymes used in genetic engineering: Nucleases, Ribonucleases, DNA ligases, Tag DNA Polymerases, Methylases, Topoisomerases, Gyrases, and Reverse Transcriptases.

UNIT 2:	**Plasmids and Vectors in Genetic Engineering**	**15**

Structure and significance of plasmids. Plasmid vectors: pSC101, pBR322, pUC series, Ti plasmids. Bacteriophage vectors: Lambda phage, phagemids, cosmids, M13-based vectors. Viral vectors: Vaccinia, Retroviral, SV40, Baculoviral systems. Artificial chromosomes: Bacterial Artificial Chromosomes (BACs) and Yeast Artificial Chromosomes (YACs). Expression vectors and their applications in gene expression studies.

UNIT 3:	**Cloning Techniques and cDNA Library Construction**	**15**

Cloning strategies: Genomic DNA and cDNA library construction and screening methods.
Host systems for cloning: E. coli, Bacillus, Pseudomonas, Streptomyces, and Yeast. Expression systems, gene fusion, and reporter genes. Gene targeting techniques. Methods of gene transfer: transformation, transfection, electroporation, microinjection, and biolistics.

UNIT 4:	**Recombinant DNA Analysis and Blotting Techniques**	**15**

Analysis of recombinant DNA.Polymerase Chain Reaction (PCR).Nucleic acid hybridization: principles, cot curves.Blotting techniques: Southern, Northern, Western, and South-Western blotting.Dot and Slot blotting techniques for nucleic acid and protein analysis.

UNIT 5:	**Sequencing, Molecular Markers, and Applications**	**15**

DNA and protein sequencing techniques. Protein engineering. Protoplast fusion and Hybridoma technology.DNA fingerprinting: RFLP, RAPD, AFLP techniques. Applications of genetic engineering in agriculture, healthcare, and industry, including gene therapy.

75 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Apply the principles and methods of genetic engineering, including the use of restriction enzymes and mapping.
CO2:	Analyze plasmid structures and evaluate various vectors used in genetic engineering applications.
CO3:	Construct gene libraries and develop cloning strategies using appropriate hosts and gene transfer methods.
CO4:	Evaluate and interpret recombinant DNA and perform blotting techniques for nucleic acid analysis.
CO5:	Design applications of sequencing and molecular markers in agriculture, healthcare, and industry.

TEXT BOOKS

1.	Brown T.A. (2016). **Gene Cloning and DNA Analysis: An Introduction.** 7th Edition. Wiley-Blackwell.

2.	Dubey R.C. (2014). **Textbook of Biotechnology.** 5th Edition. S. Chand & Company.
3.	Glick B.R., Pasternak J.J., and Patten C.L. (2010). **Molecular Biotechnology: Principles and Applications of Recombinant DNA.** 4th Edition, ASM Press.
4.	Primrose S.B. and Twyman R.M. (2013). **Principles of Gene Manipulation and Genomics.** 7th Edition. Wiley-Blackwell.
REFERENCES	
1.	Watson J.D., Caudy A.A., Myers R.M., Witkowski J. (2007). **Recombinant DNA: Genes and Genomes - A Short Course.** 3rd Edition, W.H. Freeman.
2.	Sambrook J. and Russell D.W. (2001). **Molecular Cloning: A Laboratory Manual.** 3rd Edition, Cold Spring Harbor Laboratory Press.
3.	Old R.W. and Primrose S.B. (2001). **Principles of Gene Manipulation.** 6th Edition, Blackwell Science.
	Ralph Rapley (2021). **Molecular Biology and Biotechnology.** 7th Edition, Royal Society of Chemistry, UK.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	3	3	3	3	3
CO2:	3	3	2	2	2	3	3	3	3	3	3
CO3:	3	3	2	2	2	3	3	3	3	3	3
CO4:	3	3	2	2	2	3	3	3	3	3	3
CO5:	3	3	2	2	2	3	3	3	3	3	3
CO	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP303-A	ENVIRONMENTAL BIOTECHNOLOGY	L	T	P	C	TOTAL MARKS
		4	0	0	3	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Understand the formation and control of biofilms in environmental systems.
2	Learn the principles and designs of various bioreactors used in environmental biotechnology.
3	Comprehend metabolic processes involved in wastewater and sludge treatment.
4	Study detoxification mechanisms for hazardous environmental contaminants.
5	Explore bioremediation strategies and pollution control in various industries.

UNIT 1:	**Biofilm Formation and Control Measures**	**12**

Biofilm: occurrence, causes, and effects. Control measures for biofilm formation. Biofilm reactors: soluble microbial products and inert biomass. Principles and applications of biofilm reactors.

UNIT 2:	**Principles of Bioreactors**	**12**

Principles and design of bioreactors. Types of reactors: batch, continuous-flow, stirred-tank reactors, and plug-flow reactors. Effluent recycle systems. Reactors with recycling of settled cells. Alternate rate models and reactors in series.

UNIT 3:	**Metabolic Processes in Environmental Treatment**	**12**

Denitrification: physiology, types, and microorganisms involved. Sludge denitrification processes. Wastewater treatment systems: anaerobic and aerobic processes. Design considerations for anaerobic sludge digesters. Drinking water treatment principles. Anaerobic treatment through methanogenesis.

UNIT 4:	**Detoxification of Hazardous Chemicals**	**12**

Detoxification of hazardous chemicals. Factors causing molecular recalcitrance. Biodegradation of synthetic organic chemicals. Energy metabolism vs. co-metabolism. Role of electron donors and acceptors. Biodegradation of environmental contaminants.

UNIT 5:	**Bioremediation and Environmental Remediation Strategies**	**12**

Bioremediation strategies. Pollution monitoring, control, and remediation in various industries (petroleum, paper, chemical industries). Production of biomass from industrial and agricultural wastes.

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Explain the occurrence, formation, and control measures of biofilms in natural and engineered systems.
CO2:	Illustrate the working principles and design considerations of various bioreactors for environmental applications.
CO3:	Analyze microbial metabolic processes involved in wastewater treatment and sludge digestion.
CO4:	Interpret detoxification processes and biodegradation pathways of hazardous chemicals.
CO5:	Design bioremediation strategies and pollution control measures for industrial waste management.

TEXT BOOKS

1.	Evans, G.M., & Furlong, J.C. (2011). Environmental Biotechnology: Theory and Application. 2nd Edition. Wiley-Blackwell.
2.	Rittmann, B.E., & McCarty, P.L. (2001). Environmental Biotechnology: Principles and Applications. 1st Edition. McGraw-Hill.
3.	Mohapatra, P.K. (2008). Textbook of Environmental Biotechnology. 1st Edition. I.K. International Publishing House.

REFERENCES

1.	Thakur, I.S. (2017). Environmental Biotechnology: Basic Concepts and Applications. 2nd Edition. I.K. International Publishing House.
2.	Atlas, R.M., & Bartha, R. (1998). Microbial Ecology: Fundamentals and Applications. 4th Edition. Benjamin/Cummings Science Publishing.

3.	Pepper, I.L., Gerba, C.P., & Gentry, T.J. (2014). Environmental Microbiology. 3rd Edition. Academic Press.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	2	3	3	2	3	3	3
CO2:	3	3	2	2	2	3	3	2	3	3	3
CO3:	3	3	2	2	2	3	3	2	3	3	3
CO4:	3	3	2	2	2	3	3	2	3	3	3
CO5:	3	3	2	2	2	3	3	2	3	3	3
CO	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP304-B	SOIL AND AGRICULTURAL MICROBIOLOGY	L	T	P	C	TOTAL MARKS
		4	0	0	3	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Understand the classification of soils and microorganisms and their ecological interactions.
2	Study the role of beneficial bacteria in agriculture, biogeochemical cycles, and biofertilizers.
3	Comprehend plant-pathogen interactions and plant defense mechanisms.
4	Identify major plant diseases and understand their epidemiology and management.
5	Explore integrated plant disease management practices.

UNIT 1:	**Classification of Soil Microorganisms**	**12**

Characteristics and classification of soils. Soil microorganisms and their ecological roles. Microbial interactions: mutualism, commensalism, amensalism, synergism, parasitism, predation, and competition. Plant-microbe interactions: rhizosphere, phyllosphere, and mycorrhizae.

UNIT 2:	**Bacteria in Agriculture**	**12**

Symbiotic and asymbiotic nitrogen fixation: mechanisms and genetics. Biogeochemical cycles: carbon, nitrogen, phosphorus, and sulfur. Biofertilizers: Rhizobium, Azotobacter, Azospirillum, VAM, Phosphobacteria, Azolla, Cyanobacteria. Biopesticides and microbial enzymes in nutrient release. Microbial-plant-soil interrelationships enhancing soil fertility

UNIT 3:	**Plant-Pathogen Interactions**	**12**

Plant pathogens: types and classification of plant diseases. Host-pathogen recognition and specificity. Principles of plant infection and colonization. Role of microbial enzymes, toxins, and growth regulators in pathogenesis. Plant defense mechanisms: structural, biochemical, and molecular; role of lipoxygenase and other enzymes in disease resistance.

UNIT 4:	**Major Plant Diseases**	**12**

Symptoms, etiology, epidemiology, and management of important plant diseases: Viral: Mosaic disease of tobacco, Bunchy top of banana, Leaf roll of potato. Bacterial: Bacterial blight of paddy, Angular leaf spot of cotton. Fungal: Late blight of potato, Damping-off of tobacco, Downy mildew of bajra, Powdery mildew of cucurbits, Head smut of sorghum, Leaf rust of coffee, Blight of maize/sorghum, Leaf spot of paddy. Other diseaases: Grassy shoot of sugarcane, Root knot of mulberry.

UNIT 5:	**Disease Management in Agriculture**	**12**

Principles of plant disease management: exclusion, evasion, eradication, and crop rotation.Sanitation measures in disease control.Physical, chemical, and biological control methods.

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Classify soil types and microbial populations, and explain their ecological interactions.
CO2:	Analyze the role of soil bacteria and microbial processes in nutrient cycling and agriculture.
CO3:	Examine the interactions between plant pathogens and hosts and evaluate plant defense responses.
CO4:	Identify symptoms, classify diseases, and explain the epidemiology of major plant diseases.
CO5:	Formulate plant disease management strategies using biological, physical, and chemical control measures.

TEXT BOOKS

1.	Subba Rao, N.S. (2018). Soil Microbiology. 4th Edition. Oxford & IBH Publishing Co. Pvt. Ltd.
2.	Rangaswami, G., & Bagyaraj, D.J. (2017). Agricultural Microbiology. 3rd Edition. PHI Learning Pvt. Ltd.
3.	Sylvia, D.M., Fuhrmann, J.J., Hartel, P.G., & Zuberer, D.A. (2005). Principles and Applications of Soil Microbiology. 2nd Edition. Pearson Education.

REFERENCES

1.	Sharma, P.D. (2014). Plant Pathology. 2nd Edition. Rastogi Publications.
2.	Agrios, G.N. (2005). Plant Pathology. 5th Edition. Elsevier Academic Press.
3.	Mehrotra, R.S., & Aggarwal, A. (2017). Plant Pathology. 3rd Edition. Tata McGraw Hill Education.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	2	1	1	2	2	3	2	3	3	2
CO2:	3	2	1	1	2	3	3	3	3	3	3
CO3:	3	3	2	1	2	2	3	3	3	3	3
CO4:	3	3	2	1	2	2	3	3	3	3	3
CO5:	3	3	2	2	3	3	3	3	3	3	3
CO	**3**	**2.6**	**1.6**	**1.2**	**2.2**	**2.4**	**3**	**2.8**	**3**	**3**	**2.8**

1 - LOW, 2 - MEDIUM, 3 - HIGH

24EOP042	ECONOMICS FOR AGRICULTURE	L	T	P	C	TOTAL MARKS
		3	0	0	2	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To introduce fundamental concepts of economics and apply them to agriculture.
2	To describe the role of agriculture in economic development.
3	To analyze agricultural production, marketing, and pricing systems.
4	To study government policies related to agriculture.
5	To develop analytical skills to solve agricultural economic problems.

UNIT 1:	**Introduction to Agricultural Economics**	9

Nature and scope of agricultural economics - Characteristics of Indian agriculture - Role of agriculture in economic development - Differences between agricultural and industrial economics - Problems of agricultural development in India..

UNIT 2:	**Agricultural Production Economics**	9

Production function in agriculture - Laws of returns and returns to scale - Cost concepts: fixed, variable, average, marginal - Farm planning and budgeting - Resource use efficiency and productivity in agriculture.

UNIT 3:	**Agricultural Marketing and Prices**	9

Types of agricultural markets and marketing functions - Market structure and imperfections - Price determination under different market conditions - Agricultural price policy and MSP (Minimum Support Price) - Role of regulated markets and e-NAM.

UNIT 4:	**Agricultural Finance and Credit**	9

Importance of agricultural finance - Sources of agricultural credit: institutional and non-institutional - Credit requirements of farmers - NABARD and cooperative credit institutions - Problems and reforms in agricultural credit.

UNIT 5:	**Agricultural Policy and Development**	9

Agricultural subsidies and their impact - WTO and Indian agriculture - Food security and PDS - Rural development programmes (MGNREGA, PM-KISAN) - Sustainable agriculture and climate change

45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Classify soil types and microbial populations, and explain their ecological interactions.
CO2:	Analyze the role of soil bacteria and microbial processes in nutrient cycling and agriculture.
CO3:	Examine the interactions between plant pathogens and hosts and evaluate plant defense responses.
CO4:	Identify symptoms, classify diseases, and explain the epidemiology of major plant diseases.
CO5:	Formulate plant disease management strategies using biological, physical, and chemical control measures.

TEXT BOOKS

1.	Subba Rao, N.S. (2018). Soil Microbiology. 4th Edition. Oxford & IBH Publishing Co. Pvt. Ltd.
2.	Rangaswami, G., & Bagyaraj, D.J. (2017). Agricultural Microbiology. 3rd Edition. PHI Learning Pvt. Ltd.
3.	Sylvia, D.M., Fuhrmann, J.J., Hartel, P.G., & Zuberer, D.A. (2005). Principles and Applications of Soil Microbiology. 2nd Edition. Pearson Education.

REFERENCES	
1.	Reddy, S., Ram, P., Sastry, T. V. N., & Devi, B. (2020). *Agricultural Economics*. Oxford & IBH Publishing.
2.	Acharya, S. S., & Agarwal, N. L. (2011). *Agricultural Marketing in India*. Oxford & IBH Publishing.
3.	Bhatia, M. S. (2021). *Agricultural Finance in India*. S. Chand Publishing.
4.	Mishra, S. K., & Puri, V. K. (2022). *Indian Economy*. Himalaya Publishing House
5	Govt. of India. (Latest). *Economic Survey of India*. Ministry of Finance.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	2	1	1	2	2	3	2	3	3	2
CO2:	3	2	1	1	2	3	3	3	3	3	3
CO3:	3	3	2	1	2	2	3	3	3	3	3
CO4:	3	3	2	1	2	2	3	3	3	3	3
CO5:	3	3	2	2	3	3	3	3	3	3	3
CO	**3**	**2.6**	**1.6**	**1.2**	**2.2**	**2.4**	**3**	**2.8**	**3**	**3**	**2.8**

1 - LOW, 2 - MEDIUM, 3 - HIGH

24MBP311	MICROBIAL GENETICS & GENETIC ENGINEERING LAB	L	T	P	C	TOTAL MARKS
		0	0	4	2	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Apply basic principles of microbial genetics in laboratory experiments.
2	Perform classical and molecular genetic experiments using microbial systems
3	Understand and carry out gene transfer techniques including transformation and conjugation
4	Use molecular tools for DNA isolation, manipulation, and analysis
5	Gain hands-on experience in recombinant DNA techniques and genetic engineering applications

UNIT 1:	**Bacterial Growth Analysis, Mutagenesis, and Antibiotic Resistance**	**12**

Bacterial growth curve determination; Isolation of auxotrophic mutants (e.g., replica plating technique); Antibiotic resistance screening; UV mutagenesis and mutant selection; Ames test for mutagenicity.

UNIT 2:	**Gene Transfer in Bacteria**	**12**

Conjugation experiment: Demonstration using E. coli Hfr and F- strains; Transformation: Plasmid transformation in E. coli (e.g., pUC19 or pGLO); Transduction: Bacteriophage-mediated gene transfer (optional/advanced).

UNIT 3:	**DNA Isolation and Purification Techniques**	**12**

Isolation of genomic DNA from bacteria; Isolation of plasmid DNA; DNA quantification and purity check (UV spectrophotometry); Agarose gel electrophoresis of DNA samples.

UNIT 4:	**Restriction Mapping and Molecular Cloning Techniques**	**12**

Restriction enzyme digestion of DNA; Preparation of competent cells; Ligation of DNA insert into vector; Transformation and blue-white screening; PCR amplification of target genes (basic primer design and application).

UNIT 5:	**Analysis and Application of Genetic Engineering**	**12**

SDS-PAGE analysis of protein expression (e.g., GFP from pGLO); Screening of recombinant colonies (colony PCR or restriction digest); Bioinformatics tools for gene sequence analysis (e.g., NCBI BLAST, ORF Finder); Introduction to CRISPR-Cas9 concept and virtual demonstration; Safety and ethical issues in genetic engineering.

60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Demonstrate understanding of microbial genetic concepts through laboratory experiments
CO2:	Perform microbial gene transfer techniques such as conjugation, transformation, and transduction.
CO3:	Isolate and analyze microbial DNA using electrophoresis and restriction digestion.
CO4:	Execute recombinant DNA procedures such as cloning and vector construction.
CO5:	Analyze genetically modified organisms using screening and selection techniques.

TEXT BOOKS

1.	Sambrook, J., & Russell, D.W. (2001). Molecular Cloning: A Laboratory Manual (3rd ed.) – Cold Spring Harbor Laboratory Press
2.	Brown, T.A. (2016). Gene Cloning and DNA Analysis: An Introduction (7th ed.) – Wiley.
3.	Maloy, S.R., Cronan, J.E., & Freifelder, D. (1994). Microbial Genetics (2nd ed.) – Jones and Bartlett

REFERENCES

1.	Primrose, S.B., & Twyman, R.M. (2013). Principles of Gene Manipulation and

	Genomics (7th ed.) – Wiley
2.	Lewin, B. (2008). Genes IX – Jones & Bartlett Publishers

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	3	2	3	3	2	3	3	3	2
CO2:	3	3	3	2	3	3	2	3	3	3	2
CO3:	3	3	3	2	3	3	2	3	3	3	2
CO4:	3	3	3	2	3	3	2	3	3	3	2
CO5:	3	3	3	2	3	3	2	3	3	3	2
CO	3	3	3	2	3	3	2	3	3	3	2

1 - LOW, 2 - MEDIUM, 3 - HIGH

IV-SEMSTER

24MBP401	RESEARCH METHODOLOGY	L	T	P	C	TOTAL MARKS
		5	0	0	5	100

PREREQUISITES:

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Introduce the fundamental concepts and processes of research methodology and hypothesis testing.
2	Develop skills in writing research reports, theses, and scientific publications.
3	Familiarize students with molecular biology techniques used in modern biological research.
4	Understand advanced immune techniques and biophysical methods for biomolecule analysis.
5	Explore microscopic and radiolabeling techniques for studying biological systems.

UNIT 1:	**Research Approaches and Hypothesis Testing**	**15**

Meaning, objectives, and types of research. Research approaches and processes. Defining research problems and designing research. Sampling methods: types and design. Data collection, processing, and analysis. Hypothesis testing. Introduction to bioethics and its fundamental principles.

UNIT 2:	**Thesis Writing and Scientific Reporting**	**15**

Writing research reports, theses, and scientific publications. Components of a research report: Title, authors, addresses, and abstract. Keywords, introduction, materials and methods. Results, discussion, summary, acknowledgments, and bibliography.

UNIT 3:	**Molecular Biology Techniques**	**15**

In vitro mutagenesis and detection methods.Gene knockout techniques in bacteria and eukaryotes.Gene expression analysis at RNA and protein levels. Microarray-based techniques. Isolation, separation, and analysis of proteins, carbohydrates, and lipids.

UNIT 4:	**Immunotechniques and Biophysical Methods**	**15**

Histochemical and immunological techniques. Flow cytometry and immune fluorescence microscopy. Molecular detection in living cells: FISH and GISH techniques. Biophysical analysis of biomolecules: UV/visible spectroscopy, fluorescence spectroscopy. Circular dichroism, NMR, and ESR spectroscopy. Structural determination by X-ray diffraction, mass spectrometry, and surface plasmon resonance.

UNIT 5:	**Microscopy and Radiolabeling Techniques**	**15**

Radio labeling techniques: Properties of radioisotopes used in biology, Detection and measurement of radioactivity, Molecular imaging and safety guidelines. Microscopic techniques: Microscopy of living cells, Scanning and transmission electron microscopy (SEM & TEM), Fixation and staining for electron microscopy, Freeze-etch and freeze-fracture methods, Image processing in microscopy.

75 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1:	Apply appropriate research approaches, sampling designs, and data analysis techniques to formulate and test hypotheses.
CO2:	Develop structured research reports, theses, and publications using scientific writing conventions.
CO3:	Utilize molecular biology techniques for gene manipulation and biomolecule analysis.
CO4:	Employ immune techniques and biophysical methods for advanced molecular detection and analysis.
CO5:	Integrate microscopic and radio labeling techniques for cellular and molecular imaging in biological research.

TEXT BOOKS

1.	Kothari, C.R. (2004). *Research Methodology: Methods and Techniques*. 2nd Edition. New Age International Publishers.
2.	Wilson, K., & Walker, J. (2010). *Principles and Techniques of Biochemistry and Molecular Biology*. 7th Edition. Cambridge University Press.
3.	Sambrook, J., & Russell, D.W. (2001). *Molecular Cloning: A Laboratory Manual*. 3rd Edition. Cold Spring Harbor Laboratory Press.

REFERENCES	
1.	Flick, U. (2015). *Introducing Research Methodology: A Beginner's Guide to Doing a Research Project*. 2nd Edition. Sage Publications.
2.	Cooper, H., & Camic, P.M. (2012). *Research Methods in Psychology*. 3rd Edition. American Psychological Association.
3.	Brown, T.A. (2016). *Gene Cloning and DNA Analysis: An Introduction*. 7th Edition. Wiley-Blackwell.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	3	3	2	2	3	3	3	2	3	3	3
CO2:	3	3	3	2	3	2	3	2	3	2	3
CO3:	3	3	3	2	3	3	3	3	3	3	3
CO4:	3	3	3	2	3	3	3	3	3	3	3
CO5:	3	3	3	2	3	3	3	3	3	3	3
CO	**3**	**3**	**2.8**	**2**	**3**	**2.8**	**3**	**2.6**	**3**	**2.8**	**3**

1 - LOW, 2 - MEDIUM, 3 - HIGH