St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH

IGNITE • INSPIRE • INNOVATE

(Deemed to be University U/S 3 of the UGC Act, 1956)

M.Sc. MICROBIOLOGY

(Approved by UGC)

(I to IV SEMESTERS)

REGULATIONS AND SYLLABICHOICE BASED CREDIT SYSTEM

REGULATIONS – 2020

(Effective from the Academic Year 2020-21)

St. Peter's Institute of Higher Education and Research

M.Sc. MICROBIOLOGY

REGULATION 2020

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.
- To inculcate entrepreneurship qualities as well as promoting sustainable development of the society.

Programme Educational Objectives (PEOs)

PEO 1: Introduce advanced techniques and ideas required in developing area of Microbiology
PEO 2: Enhance students' ability to develop interdisciplinary knowledge.
PEO 3: Gain the knowledge of Microbiology
through theory and practicals.
PEO4: Understand and apply knowledge of Microbiology
for understanding the scientific phenomenon in enzyme and Microbiology
PEO5: Understand and apply analytical techniques for analyzing the various biochemical systems.
PEO6: Understand good laboratory practices (GLP) and biosafety.
PEO7: Develop research oriented skills.
PEO8: Make aware and handle the sophisticated instruments/equipments.

Programme Outcomes (Pos)

PO1: The students will acquire a solid foundation in mathematical, scientific and fundamentals

PO2: The students will have a sound knowledge on various biomolecules involved in human metabolism and other biochemical reactions.

PO3: Students will develop an ability to identify, formulate and solve research problems related to Microbiology

PO4: Students will demonstrate an ability to resolve and work on laboratory and multi-disciplinary tasks.

PO5: Students will develop an ability to design and conduct experiments, analyze, interpret and document the results.

PO6: Students will demonstrate knowledge of professional and ethical responsibilities.

PO7: Students will be able to communicate effectively in both verbal and written form.

PO8: Students will show the understanding of impact of Microbiology on the society and also will be aware of contemporary issues.

PO9: Students will develop confidence for self education and ability for life-long learning.

Program Specific Outcomes (PSOs)

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

PSO 2: Ability to understand the scientific phenomenon in enzyme, metabolism and clinical microbiology.

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

St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH
M.Sc. (MICROBIOLOGY) PROGRAMME
REGULATIONS AND SYLLABI UNDER CHOICE BASED CREDIT SYSTEM
(Effective from the Academic Year 2020-2021)

M.Sc (MICROBIOLOGY) REGULATIONS

(2020)

Regulations – 2020 is applicable to the students admitted to the Degree of Master of Science (M.Sc.) Microbiology (Four Semesters) programme effective from the academic year 2020- 2021.

1. NOMENCLATURE

- **Programme** : Refers to the Master of Science in Microbiology Stream that a student has chosen for study.
- **Course** : Refers to the course (Subject) that a student would have to undergo during the study in the Institution
- **Batch** : Refers to the Starting and Completion year of a Programme of study. Eg. Batch of 2020–2022 refers to students belonging to a 2 years Degree programme admitted in 2020 and completing in 2022.
- **Department** : Each Programme of the Institution is grouped under a Department. Eg. M.Sc Microbiology is grouped under Departments of Microbiology. This Department offers various Undergraduate and Postgraduate programmes in Sciences like B.Sc (Microbiology), M.Sc (Microbiology).
- **Dean** : Refers to the Head of Arts and Science & Management Studies Programmes.
- **HoD** : Refers to the Head of a Department (HoD) offering various UG and PG programmes.
  He / She will be the Head of all staff members and Students belonging to the Department

2. QUALIFICATION FOR ADMISSION

Qualification for admission will be as per the criterion specified by the appropriate agencies of the Government of India.

- Candidates who passed the B.Sc (Microbiology) 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 two Year M.Sc (Microbiology) Programme.

3. STRUCTURE OF PROGRAMME

Every Programme will have a curriculum with syllabi consisting of theory and practical.

CREDIT DISTRIBUTION

S.No	Category	No. of Courses	Credits
1.	Institute Core Courses	5	13
2.	Institute/Open Elective Courses	1	4
3.	Program Core Courses	15	61
4.	Program Elective Courses	3	14
Total		**24**	**92**

I Semester

Code No.	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMYT1901	Microbial Taxonomy	5	0	0	4	40	60	100
AMYT1902	General Microbiology And Laboratory Animal Science	5	0	0	4	40	60	100
AMYT1903	Immunology	5	0	0	4	40	60	100
AMYT1904	**Institute Core- I** Metabolic pathway	5	0	0	3	40	60	100
AMYT1905	**Program Elective- I** Microbial Diversity	5	0	0	3	40	60	100
AMYL1901	**Practical 1**-General microbiology, Physiology and immunology	0	0	4	2	40	60	100
Total		**25**	**0**	**8**	**20**	**240**	**360**	**600**

* Out of the following **three Institute core**, one paper/course will be chosen for third semester
- Plant Biotechnology; 2) **Metabolic pathways** 3) Animal Biotechnology

Out of the following **three Programs elective**, one paper/course will be chosen for third semester
- **Microbial Diversity**; 2) Bioprocess Technology and 3) Nutirtional Biochemistry

II Semester

Code No.	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMYT1906	Virology	5	0	0	4	40	60	100
AMYT1907	Systematic Medical Bacteriology	5	0	0	4	40	60	100
AMYT1908	Mycology and parasitology	5	0	0	4	40	60	100
AMYT1909	**Open Elective- I** Industrial Pharmaceutical Microbiology	5	0	0	4	40	60	100
AMYT1910	**Program Elective- II** Biostatistics & Bioinformatics	5	0	0	3	40	60	100
AMYL1902	Practical II: Systematic Bacteriology Mycology Parasitology and Virology	0	0	4	2	40	60	100
ASSL1901	Soft skills – I	2	0	0	1	-	100	100
Total		**22**	**0**	**8**	**22**	**200**	**400**	**600**

Out of the following three Institute core, one paper/course will be chosen for third semester

- Biostatistics 2) **Industrial Pharmaceutical Microbiology** 3) Bioinformatics
  Out of the following three Programs elective, one paper/course will be chosen for third semester **Biostatistics & Bioinformatics**; 2) Biophysics and 3) Genomics

Semester III

Code No.	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMYT2901	Microbial Genetics	5	0	0	4	40	60	100
AMYT2902	Genetic Engineering	5	0	0	6	40	60	100
AMYT2903	Molecular Biology	5	0	0	6	40	60	100
AMYT2904	**Institute Core-II** Soil and Agricultural Microbiology	5	0	0	6	40	60	100
AMYT2905	**Program Elective-III** Environmental Bio-technology	5	0	0	6	40	60	100
AMYL2901	**Practical III:** Microbial Genetics, Molecular Biology & Genetic Engineering	0	0	4	2	40	60	100

ASSL2902	Soft skills – II	2	0	0	1	-	100	100
ASSI2901	Internship-I	0	0	4	2	-	100	100
Total		**25**	**0**	**6**	**33**	**240**	**560**	**800**

* Out of the following **three Institute core**, one paper/course will be chosen for third semester

- Biostatistics and Plant Biotechnology; 2) **Soil and Agricultural Microbiology** 3) Bioinformatics and Animal Biotechnology

Out of the following **three Programs elective**, one paper/course will be chosen for third semester

- **Environmental Bio-technology**; 2) Bioinformatics and Bioprocess Technology and 3) Bioinformatics and Pharmaceutical Bio-technology

IV Semester

						Marks		
Code No.	**Course Title**	**L**	**T**	**P**	**Credit**	**CA**	**EA**	**Total**
ARMT2916	Research Methodology	6	1	0	6	40	60	100
AMYP2901	Project Work	0	0	5	10	40	60	100
ASSL2903	Soft skills – III	2	0	0	1	-	100	100
Total		**6**	**1**	**7**	**17**	**80**	**220**	**300**

*Common course for Biochemistry, Biotechnology, Microbiology Departments.

TOTAL CREDITS: 92

(i) **Institute Core Courses (IC)** which includes Microbiology

Institute Core Applicable to Department of Microbiology				
Sl.No	**Course Code**	**Course Title**	**Prerequisites courses**	**No. of Credits**
1	AMYT1915	PLANT BIOTECHNOLOGY	None	3
2	AMYT1904	METABOLIC PATHWAY	None	3
3	AMYT1916	ANIMAL BIOTECHNOLOGY	None	3
4	AMYT1917	BIOSTATISTICS	None	4
5	AMYT1909	INDUSTRIAL PHARMACEUTICAL MICROBIOLOGY	None	4
6	AMYT1918	BIOINFORMATICS	None	4
7	AMYT2906	BIOSTATISTICS ANS PLANT BIOTECHNOLOGY	None	6
8	AMYT2904	SOIL AND AGRICULTUTE MICROBIOLOGY	None	6
9	AMYT2907	BIOINFORMATICS & ANIMAL BIOTECHNOLOGY	None	6
10	ASSL1901	SOFT SKILLS - I	None	1
11	ASSL2902	SOFT SKILLS- II	None	1
12	ASSL2903	SOFT SKILLS-III	None	1

(ii) **Programme Core courses (PC)** belonging to the Major Programme of study.

Programme Core Courses				
Sl.No	**Course Code**	**Course Title**	**Prerequisites/ - requisitesCourses**	**No. of Credits**
1	AMYT1905	MICROBIAL DIVERSITY	None	3
2	AMYT1911	BIOPROCESS TECHNOLOGY	None	3
3	AMYT1914	NUTRITIONAL BIOCHEMISTRY	None	3
4	AMYT1910	BIOSTATISTICS & BIOINFORMATICS	None	3
5	AMYT1915	BIOPHYSICS	None	3
6	AMYT1919	GENOMICS	None	3
7	AMYT2905	ENVIRONMENTAL BIOTECHNOLOGY	None	6
8	AMYT2908	BIOINFORMATIS & BIOPROCESS TECHNOLOGY	None	6
9	AMYT2909	BIOINFORMATICS AND PHARMACEUTICAL BIOTECHNOLOGY	None	6

(iii) **Programme Electives (PE)** offered by the Department related to the Major programme ofstudy. A student should choose at least 3 courses during the programme.

Program Elective – I (Semester I)

Course Code	**Course Title**	**L**	**T**	**P**	**Credit**	**Marks**		
						CA	**EA**	**Total**
AMYT1911	BIOPROCESS TECHNOLOGY							
AMYT1905	MICROBIAL DIVERSITY	5	0	0	3	40	60	100
AMYT1914	NUTRITIONAL BIOCHEMISTRY							

Out of the following **three Programs elective**, one paper/course will be chosen for third semester

- **Microbial Diversity**; 2) Bioprocess Technology and 3) Nutritional Biochemistry

Program Elective – II (Semester II)

Course Code	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMYT1910	BIOSTATISTICS & BIOINFORMATICS	5	0	0	3	40	60	100
AMYT1915	BIOPHYSICS							
AMYT1919	GENOMICS							

Out of the following three Programs elective, one paper/course will be chosen for third semester

- **Biostatistics & Bioinformatics; 2) Biophysics and 3) Genomics**

Program Elective – III (Semester III)

Course Code	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMYT2905	ENVIRONMENTAL BIOTECHNOLOGY	5	0	0	6	40	60	100
AMYT2908	BIOINFORMATIS & BIOPROCESS TECHNOLOGY	5	0	0	6	40	60	100
AMYT2909	BIOINFORMATICS AND PHARMACEUTICAL BIOTECHNOLOGY	5	0	0	6	40	60	100

Out of the following **three Programs elective**, one paper/course will be chosen for third semester

- **Environmental Bio-technology**; 2) Bioinformatics and Bioprocess Technology and 3) Bioinformatics and Pharmaceutical Bio-technology

(iv) **Institute Elective/Open Electives (OE)** comprising of Professional elective courses from respective Departments and provides the opportunity to a students to choose any course ofany stream. A student should choose atleast1 course during the programme.

OPEN ELECTIVES				
Sl.No.	**Branch**	**Course Code**	**Course Name**	**Credits**
1	CSE	ACST3112	Soft Computing and its applications	3
2	CSE	ACST3120	Artificial Intelligence For Real World Applications	3
3	CSE	ACST4124	Machine Learning For Real World Applications	3
4	CSE	ACST4139	Applied Cloud Computing	3
5	IT	AITT3111	Cyber Security Fundamentals	3
6	IT	AITT3119	Practical Approach to Data Mining and Analytics	3
7	IT	AITT4129	Big Data Analytics Tools and Applications	3
8	IT	AITT4130	Foundations of Block Chain Technologies	3
9	ECE	AECT3117	Electromagnetic Interference and Compatibility	3
10	ECE	AECT3120	PCB Design	3
11	ECE	AECT3121	Digital Design using EDA tools	3
12	CSE, IT	AITT3120	Internet of Things – Overview & its Application	3
13	EEE	AEET3112	Industrial Automation	3
14	EEE	AEET3119	Electric Vehicle Drive System	3
15	EEE	AEET4140	Robotic Systems	3
16	Mech	AMET4163	Waste Management	3
17	Mech	AMET4164	Computer Workstation Ergonomics	3
18	Mech	AMET4165	Structure and Properties of Materials	3
19	Mech	AMET4166	Total Quality Management	3
20	Mech	AMET4167	Supply chain Management	3
21	Mech	AMET4168	Industrial Automation	3
22	Civil	ACIT4130	Disaster Management	3
23	Civil	ACIT4131	Safety Engineering	3
24	Civil	ACIT4132	Climate Change	3
25	Civil	ACIT4125	Environmental Impact Assessment	3

26	BME	ABMT4128	Trouble shooting of Medical Instruments	3
27	BME	ABMT3117	Biomedical Nanotechnology	3
28	BME	ABMT1101	Biology for Engineers	3
29	BME	ABMT4136	Bioinformatics	3
30	HUM	AHMT4101	Gender, Culture and Development studies	3
31	HUM	AHMT4102	State, Nation Building and Politics	3
32	HUM	AHMT4103	Work Ethics, Corporate Social responsibility and Governance	3
33	HUM	AHMT4104	Indian Constitution, Essence of Indian Knowledge Tradition	3
34	HUM	AMBT3102	Cognitive Science	3
35	MBA	AMBT3103	Stock Trading Fundamentals	3
36	MBA	AMBT3104	Industrial Economics	3
37	MBA	AMBT3105	Finance for Non Finance Professionals	3
38	Maths	AMAT2105	Numerical Methods	3
39	Maths	AMAT2106	Statistics and Numerical Methods	3
40	Maths	AMAT2107	Probability and Random Processes	3
41	Maths	AMAT2108	Probability and Statistics	3
42	Maths	AMAT2109	Probability and Queuing Theory	3

(vi) **ONLINE Courses**: The department Board of Studies (BoS) shall approve the list of online courses offered by approved external agencies. While listing the courses, the BoS 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 6 credits (total) as online courses during the entire programme of study. These shall be treated as Elective courses (program elective or open elective). Students may be allowed to register for one course per semester starting from 2nd semester onwards.

(vii) **Internship Training** during the course of study.

(viii) Project Work

Each semester curriculum shall normally have a blend of lecture courses and practical courses.

MEDIUM OF INSTRUCTION:

The medium of instruction, examinations and project report will be in English Language throughout the Programme.

CREDIT ALLOTMENT TO COURSES

Each course is normally assigned certain number of credits as follows:

- **Lecture Hours (Theory)** 1 credit per lecture hour per week.
- **Laboratory Hours** 1 credit for 2 Practical hours, 2 credits for 3 or 4 hours of practical per week.
- **Project Work** 10 credits for 11 hours of project work per week.
- **Internship Training** 2 credit (In 2nd and 3rd Semesters)

*** All the courses having 4 or 6 credits may have 5 or 7 lecture hours of which one hour will be dedicated for tutorial which will not be accounted as a credit.**

1. DURATION OF THE PROGRAMME

A student is normally expected to complete the M.Sc Programme in 4 semesters but in any case not more than 8 consecutive semesters from the time of commencement of the course.

2. 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 secure 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 towrite the semester Examinations.

3. VARIOUS POSITIONS IN A DEPARTMENT

DEAN

All Arts, Science and Management Studies Departments are headed by a Dean. The dean is responsible for all activities taking place in coordination with all department heads and all staff members belonging to them. The Dean shall act as a bridge between the Management, Vice – Chancellor, Registrar, HoD's, Faculty Members and the Students. The Dean makes a review of all the academic activities of staff, students and research on a regular time interval and takes steps to improve the morale of all Faculty and Students.

HEAD OF THE DEPARTMENT

Each department offering various UG and PG programmes is headed by a Head (HoD). The head of the department (HoD) is responsible for allotting courses to each staff 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 assessment examinations, interacting with Parents, ensuring that all academic and non-academic activities of Faculty and students are monitored and steps taken for their improvement.

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 staff 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 assessment marks and attendance % details before the commencement of end semesterexaminations.

CLASS COUNSELOR

There shall be a class counselor for each class/section. The class counselor will be one among the teachers of the department. He / She will be appointed by the Head of the respective department. The responsibilities for the class counselor shall be:

To act as the channel of communication between the HoD, dean, year coordinator, course coordinator, staff and students of the respective class.

To collect and maintain various statistical details of students.

To help the year coordinator in planning and conduct of the classes.

To monitor the academic performance of the students including attendance and to informthe year coordinator.

To take care of the students' welfare activities like industrial visits, seminars, awards etc.

COURSE COORDINATOR FOR EACH COURSE

Each 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 senior staffs who are 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 thecourse.
- The study materials are prepared by the staff members and communicated to thestudents periodically.
- The involvement of students in course based projects andassignments.
- To prepare common question paper forcontinuous assessment exams.
- For uniform evaluation of continuous assessments answer sheets by arriving at a commonscheme of evaluation.

The course coordinator is responsible for evaluating the performance of the students in the continuous 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.

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 Head of the Department

b) Functions of the Class Committee

(i) The class committee shall meet thrice during the session. The first meeting will be heldwithin two weeks from the date of commencement of the session 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 session to meaningfully interact and express opinions and suggestions to improve the effectiveness of teaching - learning process and analyze the performance of the students inthe 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 class committee meetings.

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

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

4. COURSE PLAN AND DELIVERY

a) The course plan (**IC, PC, PE, OE and PLC**) 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 onfield 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 4 to 6.
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 and the HoD ofthe Department offering the course.
f) The Course plans for all courses offered by the Institute will be available in the website for reference by the faculty and students.

5. 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.

6. 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 assessment examination and end semester examination for both theory and practical courses of all programmes.

(i) Theory courses

Continuous Assessment (CAE)	: 40Marks
End Semester Exams (ESE)	: 60Marks

(ii) Practical courses

Continuous Assessment (CAE)	: 40Marks
End Semester Exams (ESE)	: 60Marks

CONTINUOUS ASSESSMENT EXAMS (CAE)

(a) Theory Courses

There will be a minimum of Three continuous assessment exams (Assessment Test 1, 2 and a Model Exam), for each theory course.

DISTRIBUTION OF CONTINUOUS ASSESSMENT EXAM (CAE) MARKS FOR A THEORY COURSE			
Evaluation Component	**Syllabus coverage**	**Duration of the Exam**	**Max. Weightage**
CAE-1	**First 1.5 Units of the syllabus**	**2 Hours**	**25 Marks (20% weightage for CAE 1 & CAE 2 and 60% for Model Exam)**
CAE-2	**Next 1.5 Units of the syllabus**	**2 Hours**	
Model Exam	**Full syllabus**	**3 Hours**	
Assignment	**2 written assignments for each course / Written quiz (or) Presentation of a written Report (or) Case study / Multiple choice Objective Type Test**		**10 Marks**
Mini Project (or) Group Presentation	**Technical Project involving not more than 3 students (or) any other Group Presentation related to the course.**		**5 Marks**

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

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 notebook in scheduled format and time), 15 marks for model exam 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 Incharge 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 exams.

If a student has not done all the experiments assigned for that lab, before the scheduled date

nor has attendance percentage less than 75%, the student will not be allowed to appear for the model and end semester practical exam. Such students will have to redo the course again by doing all the experiments in the next semester when the course is offered.

END SEMESTER EXAMINATIONS (ESE)

The end semester examinations shall normally be conducted between October and December during the odd semesters and between March and May during the even semesters for both theory and practical courses of all programmes.

End semester examinations will be conducted for a maximum of 100 marks. The marks secured in end semester exams will be converted to 60marks.

Internship / Industrial Training

Every student is required to undergo Industrial Visits during every semester of the Programme. HoDs shall take efforts to send the students to industrial visits in every semester.

Every student will have to undergo Internship / Industrial training for a Minimum period of 2-3 weeks during the 2nd and 3rd semester.

This could be internship in an industry approved by the Dean or Professional Enrichment courses (like attending Summer Schools, Winter Schools, and Workshops) offered on Campus or in Registered Off Campus recognised Training Centre's approved by the Dean for a minimum period of 3weeks.

A report on Training undergone by the student, duly attested by the Coordinator concerned from the industry / Organisation, in which the student has undergone training and the Head ofthe Department concerned, shall be submitted after the completion of training. The evaluationof report and viva voce examination can be computed as per norms for the End Semester examination.

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.

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 and abroad.

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 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.

PROJECT WORK

Project work has to be done by each student in the final year. The project work has to be done during the final semester.

Permission for project work in the second year of the programme in general will be given to innovative and industry related work. Such projects will be evaluated in every session untilthe IV semester. If the 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 IV 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 the final semester in their respective departments.

Project work is an individual project done by the student.

For project work, assessment is done on a continuous basis by 3 reviews for 40 marks and final viva voce carries 60 Marks.

There shall be three project reviews (conducted during the pre-final semester and finalsemester) 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

	PROJECT REVIEWS			FINAL PROJECT
	1	2	3	VIVA VOCE
Max. Marks	5	15	20	60

The total marks obtained in the three reviews, rounded to the nearest integer is the continuous assessment marks out of 40. There shall be a final viva-voce examination at the end of final 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

The final project viva-voce examination shall carry 60 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination. The external examiner shall be appointed by the controller of examinations. The internal and external examiner will evaluate the project for 20 Marks each. The project report shall carry a maximum of 10 marks.

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 a candidate fails to submit the project report on or before the specified deadline, he/she can be granted an extension of time up to a maximum limit of 5 days for the submission of project work, by the head of the department.

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.

REVALUATION OF ANSWER PAPERS:

A candidate can apply for revaluation of his/her End semester examination answer paper 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.

10 PASSING REQUIREMENTS

A candidate should secure not less than 50% of total marks (Minimum 50% of the grand total of CAE Marks 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 toregister and reappear for the examination till he/she secures a pass.

11 . 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 First Class – ……, First Class with Distinction and First Class.

Withdrawal is NOT permitted for arrears examinations of the previous semesters.

12 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 ofthat 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 10 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 exceedinganother 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.

13 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 Points (GP)
90 -100	O	10
80 – 89	A	9
70 – 79	B	8
60 – 69	C	7
50 – 59	D	6
00-49 (Reappear)	RA	0
ABSENT	AAA	0
Withdrawal	W	0
Authorized Break of Study	ABS	0

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.

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

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

14 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:

Name of the candidate with date of birth and photograph.
The programme and degree in which the candidate has studied
T 0he list of courses enrolled during the semester and the grade secured
The Grade Point Average (GPA) for the semester.

15 CLASSIFICATION OF DEGREE AWARDED

Final Degree is awarded based on the following:

Range of CGPA	Classification of Degree
≥ 7.5	First Class with Distinction
≥ 6.00 <7.5	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 8 consecutive semesters 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 12, 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 8 consecutive semesters after his/her commencement of study securing a 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 12 (if availed of) or prevention from writing End semester examination due to lack of attendance will not be considered as Appearance in Examinations. For award of First class, the extra number of semesters than can be provided will be equal to the Number of semesters availed for Authorized Break of Study or Lack of Attendance. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class.

3. All other candidates who qualify for the award of the Degree having passed the examinationin all the courses of all the 4 semesters within a maximum period of 8 consecutive semesters 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.

16 ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of the M.Sc (CS) degree, provided the student has successfully completed all the requirements of the programme, and has passed all the prescribed examinations in all the 4 semesters within the maximum period specified in clause 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 4 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.
vii) No disciplinary action pending against the student.

The award of Degree must have been approved by the Board of Management of the Institution.

17 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 Institution from time to time.

18 POWER TO MODIFY

From time to time, the Institution may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary.

REGISTRAR

Course Code:	Course Title:	L T P C
AMYT1901	MICROBIAL TAXONOMY	5 0 0 4

Prerequisites: None

Course Objectives:

1. To enable the learner to understand the concept of classification of Micro organisms
2. To enable the learner to understand the taxonomical classification of Bacteria, Fungi, Protozoa Algae and virus and its importance

Semester 1

AMYT1901- MICROBIAL TAXONOMY

UNIT I Taxonomy & classification (No. of Hours : 12)

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

UNIT II classification of Bacteria (No.of Hours: 12)

Classification of bacteria according to Bergey's Manual of systematic bacteriology 9th edition (up to level of section); characteristics of major sections; classification of archaea, photosynthetic bacteria, Entrobacteriaceae, Mollicutes.

UNIT III **Classification of Fungi (No.of Hours: 12)**

Classification of Fungi - characteristics of zygomycetes, ascomycetes, basidiomycetes and dueteromycetes.

UNIT IV **Classification of Protozoa (No.of Hours: 12)**

Classification of Protozoa - classical 1980; official system & 1993 Cavalier- Smith. Distinguishing characteristics of ciliates; flagellates; sporozoa; heliozoans; amoeba.

UNIT V **Classification of Algae (No.of Hours: 12)**

Classification of Algae - major characteristics of chlorophycophyta, crisophycophyta, cryptophycophyta, euglinophycophyta & rhodophycophyta. Classification of viruses - animal viruses, plant viruses and phages.

Total hours : 60

course outcome:

On the successful completion of this course

CO1 : Students have the knowledge of classification

CO2 : Understand the classification of Microorganisms based on different characteristics

CO3 : To apply knowledge of the standard rules for classification system of microorganisms

CO4 : Helps to identify and analyze the microorganism and its molecular studies

CO5 : Students can understand and the necessity of modern classification based on various characteristics

Course Code:	Course Title	L T P C
AMYT1902	General Microbiology & Laboratory Animal science	5 0 0 4

Prerequisite required : None

Course Objectives:

1. To enable the learner to understand the basics of Microscopy and Microbiology, specimen preparation,staining techniques
2. To enable the learner to understand the basic concept of nutrition requirement, growth of microorganism, culture techniques
3. To enable the students to understand animal studies how to handle animal models and its maintenance

Semester 2

AMYT1902 - GENERAL MICROBIOLOGY AND LABORATORY ANIMAL SCIENCE

UNIT I Microscope and its types (No. of Hours: 12)

Microscopy – Its principles and application in the field of Microbiology including the following: Dark field, Phase contrast, Fluorescence microscopy. TEM and SEM. Principles, operation and maintenance of: refrigerated and ultracentrifuges, Spectrophotometer. Lyophilizers. Staining methods – Simple, differential and special methods. Sterilization and disinfection methods and their quality control.

UNIT II Growth of Bacteria and kinetics (No. of Hours: 12)

Bacterial Anatomy, 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 III Algae and its lifecycle (No. of Hours: 12)

Distribution of Algae - Thallus structure in algae - Reproduction in alga - Life cycle patterns in algae - Chlamydomonas – Volvox (Green algae) - Nostoc – Spirogyra (BGA) - Ectocarpus – Sargassum (Brown algae) - Poly siphonia – Batrachospermum (Red algae).

UNIT IV Handling animal model (No. of Hours: 12)

Laboratory Animal Science. 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 V Handling and disposal of animal waste (No. of Hours: 12**)**

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.

Total no. of hours : 60

Course outcome

On the completion of this course,

CO1: To equip the students with an basic knowledge on Microbiology, staining techniques and anatomy of Microorganisms

CO2: To Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures, Microbial nutrition based on the requirement and growth curve of Bacteria

CO3: To know basics of bacteriology and microbial techniques for isolating pure cultures of bacteria, fungi and algae

CO4 : To gain knowledge on Distribution of Algea, isolation and advantages of algae

CO5 : To analyze and evaluate the Laboratory management of animals for animal studies, its applications in research studies

Course Code:	Course Title:	L T P C
AMYT1903	Immunology	5 0 0 4

Prerequisites: None

Course Objectives:

1. To enable the students to understand the basics of Immunology and immune system
2. To enable the students to learn about the different types of Immunity and its regulation
3. To understand the principles of vaccine

AMYT1903 - IMMUNOLOGY

UNIT I History of immunology (No. of hours: 12)

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

UNIT II Antigen (No. of hours: 12)

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

UNIT III Antigen- antibody interaction (No. of hours: 12)

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

UNIT IV Immune response (No. of hours: 12)

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

UNIT V Vaccine (No. of hours: 12)

Vaccines: Principles and types. Immunization - its rationale, schedtotal no.hourdules and importance in public health

Total hours : 60

Course outcome :

On the successful completion of this course,

CO1 : Provide knowledge of basic concepts of immunity and immunological response

CO 2: Understand how the immune system works, mechanism in provoking response

CO 3: Antigen antibody interaction and vaccine principle, concepts of innate and adaptive immunity

CO4 : To apply Ag-Ab interaction to study about different types of immunity

CO5 : To gain knowledge on the role of immune system against pathogens and pathogenicity

Course Code:	Course Title	L	T	P	C
AMYT1904	METABOLIC PATHWAY	5	0	0	3

Prerequisite required : None

Course objectives:
Co 1 : To enable the students to learn metabolic pathway of Microorganisms, role of enzymes
CO 2 : enzyme substrate mechanism, various metabolic cycles, lipid meatabolism
CO 3: Biochemical pathways involved various biosynthesis process

AMYT1904 **- ELECTIVE – I METABOLIC PATHWAY**

UNIT I Enzymes **(No. of hours: 12)**

Enzymes – nomenclature, components - Mechanism of enzyme reactions - Factors influencing enzymatic activity - Inhibition of enzyme action - Metabolic channeling – Control of enzyme activity – Regulation of enzyme synthesis.

UNIT II Bioenergetics **(No. of hours: 12)**

Principles of Bio energetics - Oxidation –reduction reactions - Generation of energy – Substrate Level and oxidation phosphorylation - Electron transport chain

UNIT III Carbohydrate **(No. of hours:12)**

Carbohydrate catabolism – Glycolysis – Pentose phosphate pathway – ED pathway – The Kreb`s cycle – Energy yield in glucolysis and aerobic respiration – Anaerobic respiration – Lactic acid fermentation – Alcohol fermentation.

UNIT IV Lipid **(No. of hours:12)**

Lipid Metabolism – Oxidation of lipids; biosynthesis of fatty acids; triglycerides; hospholipids; sterols. Protein and amino acid catabolism – Oxidation of inorganic molecules – Photophosphorylation.

UNIT V Biochemical pathway & Biosynthesis **(No. of hours:12)**

Bio chemical pathways of energy use – Photosynthetic fixation of CO2 – Biosynthesis of peptidoglycan – Biosynthesis of lipids – Biosynthesis of amino acids -proline, arginine, aspartic acid, histidine- Interconversions - therionine, isoleucine and methionine; isoleucine, valine and leucine; serine and lysine; Aspartate and pyruvate. Bio synthesis of purines and pyrimidines.

Total hours : 60

Course outcome

On the successful completion of this course,
CO 1 : The Metabolic pathway of microorganisms and enzymes involved in metabolism
CO 2 : To gain knowledge of various biochemical cycles involving in microorganisms
CO3 : To apply knowledge in classifying enzymes, mechanism of enzymes, co-factors in various biochemical pathway
CO4 : Understand the pathway involved in metabolism of carbohydrates, lipids and nucleotides
CO5 : To evaluate the Enzyme-substarte interaction in product formation

Course Code:	Course Title:	L T P C
AMYT1905	MICROBIAL DIVERSITY	5 0 0 3

Prerequisite required : None

Course objectives:

CO 1 : To enable the student to learn about Diversity of Microorganisms, Types of Microorganisms

CO 2: To enable the students to study about classification based on nutrition, temperature and other parameters

AMYT1905 **ELECTIVE – II - MICROBIAL DIVERSITY**

UNIT I Microbial diversity **(No. of hours: 12)**

Biodiversity: Introduction to microbial biodiversity- distribution, abundance, ecological niche. Types – Bacterial, Archael and Eucaryal

UNIT II Classification of thermophilic bacteria **(No. of hours:12)**

Thermophiles: classification, hyperthermophilic habitats and ecological aspects. Extremely Thermophilic Archaebacteria, Thermophily, commercial aspects of thermophilies, Applications of thermozymes. Methanogens: Classification, Habitats, applications.

UNIT III Classification of Bacteria based on its environment **(No. of hours: 12)**

Alkalophiles and Acidophiles - Classification, discovery basin, cell walls and membranes purple membrane, compatible solutes. Osmoadaptation/ halotolerance. Applications of halophiles and their extremozymes. Barophiles: Classification, high pressure habitats, life under pressure, barophily, death under pressure. Halophiles - Classification, discovery basin, cell walls and membranes- purple membrane, compatible solutes.

UNIT IV Microbes in space research **(No. of hours: 12)**

Space Microbiology - Aim and objectives of space research. Life detection methods (a) Evidence of metabolism (Gulliver) (b) Evidence of photosynthesis (autotrophic and heterotrophic) (c) ATP production (d) phosphate uptake e) sulphur uptake.

UNIT V microbes and weather **(No. of hours:12)**

Martian environment (atmosphere, climate and other details). Antartica as a model for Mars. Search for life on Mars, Viking mission, Viking landers, and Biology box experiment. Gas exchange, label release and pyrolytic release experiments. Monitoring of astronauts microbial flora: Alterations in the load of medically important microorganisms, changes in mycological and bacterial autoflora

Total hours : 60

Course outcome :

On the completion of this course,

CO1 : To gain knowledge in understanding the microbial physiology and to identify the microorganisms.

CO2 : Understand the regulation of biochemical pathway and controlling mechanism

CO3 : To understand diversity of microorganisms and its classification based on various parameters

CO4 : Students learnt microorganism's classification based on nutrition and importance of microorganisms industry

CO5 : To identify and evaluate different types of microorganisms in eco system

Course Code:	Course Title	L	T	P	C
	A Core Practical – I				
AMYL1901	General Microbiology, Physiology and Immunology	0	0	4	2

Prerequisite required : None

Course Objectives:

1. To enable the student to understand microscopy, techniques and types of microscopes
2. To understand the concept of sterilization and its different types
3. To understand staining techniques, preparation of Nutrient media and preservation of microorganisms
4. To understand bacterial growth kinetics
5. To understand antigen –antibody interaction and various immune assays
6. To understand how to prepare lymphocytes and its separation

AMYL1901 **Core Practical – I : General Microbiology, Physiology and Immunology**

UNIT I (Microscopy) **(No. of hours : 12)**

Microscopic Techniques: Light microscopy: Hay infusion broth. Wet mount to show different types of microbes, hanging drop. Dark field microscopy: To show motility of spirochetes and others. Phase contrast microscopy: To show Eukaryotic Cell division, morphology etc. Fluorescence microscopy: Fluorescent staining for Mycobacteria, auromine, staining, Fluorescent antibody techniques.

UNIT II Sterilization **(No. of hours : 12)**

Washing and cleaning of glass wares: Sterilization principles methods: moist heat, dry heat, filtration. Quality control check for each method:

UNIT III Staining techniques **(No. of hours : 12)**

Staining Techniques: Smear preparation, simple staining, Gram's staining, Acid fast staining, Metachromatic granule staining, Cell wall, spore, capsule, Flagella, Silver impregnation methods.

UNIT IV culture media and types **(No. of hours : 12)**

Media Preparation: Preparation of liquid, solid and semisolid media. Agar deeps, slants, plates. Preparation of basal, enriched, selective, enrichment media. Quality control and uses. Preparation of Biochemical test media, media to demonstrate enzymatic activities.

UNIT V Microbial kinetics **(No. of hours : 12)**

Microbial Physiology: Purification and maintenance of microbes. Streak plates, pour plate, and slide culture technique. Aseptic transfer, growth and growth requirements: Cell number, and cell proteins. Direct counts, viable counts, pour plate, streak plate. Bacterial growth curve – Turbidimetry, Anaerobic culture methods.

UNIT VI Antigen abtibody reaction **(No. of hours : 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 VII Immune assays (No. of hours : 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 VIII Lymphocyte (No. of hours : 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

Total hours: 45

Course outcome

On the completion of core Practical I,

CO1: To provide the fundamental knowledge in Microscopy, its principle, importance of staining techniques, bacterial anatomy, media preparation , nutrition requirement

CO2 : Students can understand the mechanism of antigen, antibody interaction, immune assays, agglutination reaction in disease diagnosis

CO3: To apply the concepts in Immunoassays and purification of lymphocytes, preparation of antibodies

CO4 : Analyze the Antigen antibody interaction in pathogenicity

CO5 : To prepare and evaluate the antibody for specific antigen and its mechanism in immune response

Course Code:	Course Title:	L T P C
AMYT1905	MICROBIAL DIVERSITY	5 0 0 3

Prerequisite required : None

Course objectives:
CO 1 : To enable the student to learn about Diversity of Microorganisms, Types of Microorganisms
CO 2: To enable the students to study about classification based on nutrition, temperature and other parameters

AMYT1905 **ELECTIVE – II - MICROBIAL DIVERSITY**

UNIT I Microbial diversity **(No. of hours: 12)**

Biodiversity: Introduction to microbial biodiversity- distribution, abundance, ecological niche. Types – Bacterial, Archael and Eucaryal

UNIT II Classification of thermophilic bacteria **(No. of hours:12)**

Thermophiles: classification, hyperthermophilic habitats and ecological aspects. Extremely Thermophilic Archaebacteria, Thermophily, commercial aspects of thermophilies, Applications of thermozymes. Methanogens: Classification, Habitats, applications.

UNIT III Classification of Bacteria based on its environment **(No. of hours: 12)**

Alkalophiles and Acidophiles - Classification, discovery basin, cell walls and membranes purple membrane, compatible solutes. Osmoadaptation/ halotolerance. Applications of halophiles and their extremozymes. Barophiles: Classification, high pressure habitats, life under pressure, barophily, death under pressure. Halophiles - Classification, discovery basin, cell walls and membranes- purple membrane, compatible solutes.

UNIT IV Microbes in space research **(No. of hours: 12)**

Space Microbiology - Aim and objectives of space research. Life detection methods (a) Evidence of metabolism (Gulliver) (b) Evidence of photosynthesis (autotrophic and heterotrophic) (c) ATP production (d) phosphate uptake e) sulphur uptake.

UNIT V microbes and weather **(No. of hours:12)**

Martian environment (atmosphere, climate and other details). Antartica as a model for Mars. Search for life on Mars, Viking mission, Viking landers, and Biology box experiment. Gas exchange, label release and pyrolytic release experiments. Monitoring of astronauts microbial flora: Alterations in the load of medically important microorganisms, changes in mycological and bacterial autoflora

Total hours : 60

Course outcome :
On the completion of this course,
CO1 : To gain knowledge in understanding the microbial physiology and to identify the microorganisms.
CO2 : Understand the regulation of biochemical pathway and controlling mechanism
CO3 : To understand diversity of microorganisms and its classification based on various parameters
CO4 : Students learnt microorganism's classification based on nutrition and importance of microorganisms industry
CO5 : To identify and evaluate different types of microorganisms in eco system

Course Code:	Course Title:	L T P C
AMYT1906	Virology	5 0 0 4

Prerequisite required : None

Course objectives :

CO 1: To enable students to learn virus and its properties

CO 2 : various types of viruses- based on its genetic material, life cycle, Transmission, Diagnosis, treatment and viral vaccine

SEMESTER II
AMYT1906 - VIROLOGY

UNIT I History of virus (No. of hours: 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 II life cycle of virus (No. of hours: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 III Plant viruses (No. of hours: 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 IV Animal viruses (No. of hours: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 V Disease diagnosis (No. of hours: 12)

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

Totalhours:60

Course outcome :

On the successful completion of this course,

CO1 : To understand The nature of viruses, their structure, replication in host and classification

CO2 : To gain knowledge on Viral transmission, diagnosis and treatment

CO3 : To understand the mechanism of Plant and animal viruses and diseases its transmission

CO4: To apply techniques to produce Viral vaccines and antiviral agents in controlling the cause and spread of diseases

CO5 : Learn Principle of basic mechanism of Vaccine and production

Course Code:	Course Title:	L T P C
AMYT1907	SYSTEMATIC MEDICAL BACTERIOLOGY	5 0 0 4

Prerequisite required : None

Course Objectives :
CO 1 : to enable the learner to study various types of syndromes, Diagnosis, transmission
Co 2 : Host parasite relationship, rules and regulation for sample collection and dispatch
CO 3 : Morphology and pathnognicity , laboratory diagnosis, prevention and control od cause of disease
CO 4 : Hospital waste management, Ethical committee regulations

AMYT1907 - **SYSTEMATIC MEDICAL BACTERIOLOGY**

UNIT I Physiology and syndromes **(No. of hours: 12)**

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 II Host –parasite relationship and diseases **(No. of hours: 12)**

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

UNIT III Characteristics andBacterial diseases **(No. of hours: 12)**

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.

UNIT IV Infectious bacteria and diseases **(No. of hours: 12)**

Studies on Salmonella, Shigella, Vibrios, Brucella, Gram negative anaerobes, Spirochetes, Rickettsiae, Chlamydiae, Mycoplasmas and ureoplasmas.

UNIT V Controlling measures **(No:of hours: 12)**

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

Total hours: 60

Course Outcome :
On the successful completion of this course,
CO1 : To gain knowledge in Bacterial infection, transmission , diagnosis and treatment
CO2 : To understand Host parasite interaction, mechanism of Bacterial infection, treatment to various types of Bacteria
CO3 : To analyze the mechanism involved in Pathogenicity, host specificity, hospital waste management and ethical committee

CO4 : To understand the relationship of this infection to symptoms, relapse and the accompanying pathology.

CO5 : To create the diagnostic tool for various diseases for early detection

Course Code :	Course Title:	L T P C
AMYT1908	MYCOLOGY AND PARASITOLOGY	5 0 0 4

Prerequisite required : None

Course Objectives :
CO 1: To help the students to learn Mycology, classification, taxonomy of fungi
CO 2 : various types of Fungi, Fungal infection, diagnosis, treatment, Antifungal agents
CO 3 :Host parasite interaction of fungi, parasitology, diseses, life cycle of fungi and diseases

AMYT1908- MYCOLOGY AND PARASITOLOGY

UNIT I History of Fungi (No. of hours:12)

Historical introduction to mycology - Structure and cell differentiation. Lichens – scolichens, basidiolichens, deuterolichens. Fungi as insect symbiont. Morphology, Taxonomy, Classification of fungi.

UNIT II Fungal diseases (No. of hours: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 III Treatment and controlling measures (No. of hours: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 IV Parasitology (No. of hours: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 V Diseases caused by parasites (No. of hours:12)

Classification, life cycle, lpathogenicity, 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 immunocompromised hosts and AIDS.

Total hours : 60

Course outcome :
On the successful completion of this course,
CO 1: To gain knowledge in classification of fungi, different types of fungi causing diseases
CO2 : To understand Host parasite interaction, life cycle of fungi, Disease, diagnosis, treatment, antifungal agents and its activity against specific fungi

CO3 : To understand the subject that provides opportunities for employability and scopes for higher education.

CO4 :To study and analyse fungus for its disease causing property and treatment

CO5 : To understand the laboratory techniques for identification and processing

Course Code:	Course Title: -	L T P C
AMYL 1902	CORE PARCTICLE II: SYSTEMATIC BACTERIOLOGY	0 0 4 2

Prerequisite required : None

Course Objectives :

CO 1: To enable students to learn preparation of media, staining procedures, antibiotic sensitivity test

CO 2: cultivation of microorganism is specific media, preservation, culture techniques, fermentation techniques

AMYL1902 - CORE PARCTICLE II: SYSTEMATIC BACTERIOLOGY, MYCOLOGY, PARASITOLOGY AND VIROLOGY

UNIT **I** **sample collection and diagnosis** **(No.of hours :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. Simple, differential and special staining methods.

UNIT II **Media preparation** **(No.of hours :12)**

Cultivation methods -Transport media - Isolation methods – Basal, differential enriched, selective media & special media for the pathogenic bacteria. Biochemical identification. Tests for the respective bacteria up to species level.

UNIT III **Antibiotic assay** **(No.of hours :12)**

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

UNIT IV **Clinical specimen testing** **(No.of hours :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. 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 V **Clinical diagnosis and sample preparation** **(No.of hours :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. Blood smear examination for malarial parasites. Thin smear by Leishman's stain - Thick smear by J.B. stain. Wet film for Microfilariae. Identification of common arthropods of medical importance - spotters of Anopheles, Glossina, Phelbotomus, Aedes, etc. Ticks and mites.

UNIT VI

Isolation and characterization of bacteriophage from natural sources – phage titration - T4. Study of virus infected plants. Isolation of viruses - chick embryo - animal tissue culture - fibroblast culture – preparation (demonstration). Spotters of viral inclusions and CPEstained smears. Viral serology- HAI-ELISA, Western Blotting

Total hours : 60

Course outcome :

On the successful completion of this course,

CO 1 : Students can understand the basics of microbiology, isolation and pure culture techniques

CO 2 : To gain knowledge in Staining methods, identification of microorganisms, quality control and check

CO3 : To understand the laboratory techniques for identification and preparation of specimen

CO4 : To design diagnostic tools for collection of specimen, examination of Parasites in various specimen

CO 5 : Analyze the clinical pathogens in disease causing

Course Code:	Course Title: -	L	T	P	C
AMYT1909	INDUSTRIAL & PHARMACEUTICAL MICROBIOLOGY	5	0	0	4

Prerequisite required : None

Course objectives :

CO 1 : To enable the students to learn, isolation of microorganisms, fermentation, importance of industrial microbes

CO 2: To enable the student to understand, design of fermentor, process, recovery, purification, SCP

CO 3: to understand the concept of mushroom cultivation, biosensor, biofuels, vaccine production, primary metabolite production and optimization, production of secondary metabolites

AMYT1909- INDUSTRIAL & PHARMACEUTICAL MICROBIOLOGY

UNIT I Fermentation (No. of hours:12)

Isolation, preservation and improvement of industrially important micro organisms; Raw materials and media design for Fermentation processes; Sterilization; Development of inoculums for industrial fermentations; Types of fermentation: Batch, continuous, dual or multiple, surface, submerged, aerobic and anaerobic

UNIT II Industrial Applications (No. of hours: 12)

Fermenter – Design and types. Instrumentation and control - aeration and agitation. Recovery and purification of fermentation products. Enzyme and cell immobilization, production of recombinant proteins having therapeutic and diagnostic applications: Vaccines, Insulin, Interferon, Somatotropin, Single cell protein.

UNIT **III** **Industrially nimportant micro organisms (No. of hours: 12)**

Biology of industrial micro organisms. Streptomyces, Yeasts (Saccharomyes, Hansenela) Spirulina and Penicillium. Mushroom cultivation. Biosensors and Biochips. Biofuels from microbial sources.

UNIT IV **Large scale production of Primary metabolite (No. of hours: 12)**

Production of primary metabolites: Alcohols (Ethanol and Butanol); Beverages (Beer and Wine); Aminoacids (Glutamic acid and Lysine); Organic acids (Citric acid and acetic acid).

UNIT V **Secondary metabolite synthesis (No. of hours: 12)**

Production of secondary metabolites: Antibiotics (Penicillin and Streptomycin); Vitamins (Riboflavin and Cyanocobalamin); Steroids; Production of enzymes (Protease, amylase and lipase); Biopolymers (Xanthan gum and PHB); Biopreservatives (Nisin).

Total hours : 60

Course outcome :

After the completion of this course,

CO 1: To gain knowledge on fermentation process and its application in scale up production

CO 2: To evaluate the role and Factors affecting parameters to control and to optimize product formation

CO 3: To apply technical skills in handling bacteria, fungi and yeast for the production of primary and secondary metabolites in industries

CO4 : Students will gain knowledge of significance and activities of microorganisms in food.

CO5 : To produce vaccine and pharmaceutical products using bacteria

Course Code:	Course Title:	L T P C
AMYT1910	BIOSTATISTICS AND BIOINFORMATICS	5 0 0 3

Prerequisite required : None

Course objectives :
CO 1 : To enable the learner to understand statistical methods, correlation, sampling and sampling methods
CO 2 : To predict errors, Database, Genomics and Human genome project – tools, computational database, medicine systematics

AMYT1910 EXTRA DISCIPLINARY ELECTIVE I – BIOSTATISTICS AND BIOINFORMATICS

UNIT I **Statistical data and analysis** **(No.of hours:12)**

Nature and scope of statistical methods and their limitations compilation, classification, tabulation and applications in life sciences. Graphical representation – measure of average, dispersion – stem and leaf plots; box and whisker plots, coplots. Introduction to probability theory and distributions (concepts without derivation) binomial, poission and normal (only definition and problems).

UNIT II **Sampling and analysis** **(No.of hours:12)**

Correlation and regression – concepts of sampling and sampling distribution – tests of significance based on t-test, chi-square and F-test for means, proportions, variations and correlation efficient, theory of attributes and tests of independence of contingency tables.

UNIT III **Methods of sampling** **(No.of hours:12)**

Sampling methods- simple, random, stratified, systemic and cluster sampling procedures. Sampling and non-sampling errors. Principles of scientific experiments- analysis of varianceone way and two way classification.

UNIT **IV** **Database and computational analysis** **(No.of hours:12)**

Overview of bioinformatics- database types. Genomics and human genome project. Computational tools for sequence analysis and similarity searching.

UNIT V **Structure prediction of macromolecules** **(No.of hours:12)**

Pair wise and multiple sequence alignment. Macromolecular structure function relationships. DNA micro array. Next generation sequencing. Systems medicine.

Total hours : 60

course outcome :

On the successful Completion of this course, which helps the students
CO 1: To gain knowledge in statistics, subject and relation with science
CO2 : Restate the principal concepts about biostatistics.
CO3 : To collect data relating to variable/variables which will be examined and calculate descriptive statistics from these data.
CO4 : To analyze and learn about the statistics and 3D modelling, sequencing, structure of protein and prediction
CO5: To design or create a tool for describing biomolecules and different types of structure

Course Code:	Course Title:	L T P C
AMYT2901	MICROBIAL GENETICS	5 0 0 4

Prerequisite required : None

Course objectives :
1.To enable the students to learn about genetics of microbes which gives them knowledge on DNA, RNA, protein
2. Types of plasmids used in transformation, genetic changes, carcinogens

III SEMESTER AMYT2901 - MICROBIAL GENETICS

UNIT I **Introduction of DNA** **No.of hours : 12**

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

UNIT II **Chromosomes** **No.of hours : 12**

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

UNIT III **Plasmids** **No.of hours : 12**

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 IV **Mutation** **No.of hours : 12**

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 V **Recombination** **No.of hours : 12**

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

Total hours : 60

Course outcome :

CO 1: To gain knowledge interactions among various systems of the cell, including DNA, RNA and proteins and its regulation
CO 2 : To design and implement experimental procedures using relevant techniques.
CO 3 :To understand Structure of chromosome, mapping, structural elucidation for macro molecules for evaluating its efficiency in recent trends
CO4 : To analyze genetic methods used to investigate interesting biological problems.
CO5 : To apply new techniques in creating genetically modified organisms

Course Code:	Course Title:	L T P C
AMYT2902	GENETIC ENGINEERING	5 0 0 6

Prerequisite required : None

Course objectives:

1. To enable the students to learn about restriction enzymes and its importance in genetic engineering
2. To understand the Role of plasmids and its types
3. To learn about Cloning techniques and vector construction
4. To learn about recombinant technology and blotting
5. To enable the students to learn about molecular markers

AMYT2902 - GENETIC ENGINEERING

UNIT I **Restriction enzymes** **(No of hours: 12)**

Principles and methods in genetic engineering: Host cell restriction - restriction modification. Restriction enzymes - types and applications, restriction mapping; Enzymes used in genetic engineering - Nucleases, Ribonucleases, DNA ligases, Tag DNA Polymerases, Methylases, Topoisomerases, Gyrases and Reverse Transcriptases.

UNIT II **Plasmid and its uses** **(No of hours: 12)**

Vectors - Plasmid vectors: pSC101, pBR322, pUC series and Ti plasmids based vectors - Bacteriophage vectors: Lambda phage based vectors, phagemids, cosmids, and M13 based vectors – Viral vectors: Vaccinia, Retroviral, SV40 and Baculoviral system; Bacterial and yeast artificial chromosomes. Expression vectors.

UNIT III **Cloning and cDNA library construction** **(No of hours: 12)**

Cloning techniques - Genomic DNA and cDNA library Construction - Screening methods. Cloning in E. coli, Bacillus, Pseudomonas, Streptomyces and yeast. Expression systems. Gene fusion and Reporter genes. Gene targeting. Methods of gene transfer - transformation, transfection; electroporation, microinjection and biolistics.

UNIT IV **rDNA technology and Blotting techniques** **(No of hours: 12)**

Analysis of Recombinant DNA. Polymerase chain reaction. Principles and techniques of nucleic acid hybridization and cot curves - Southern, Northern, Western and South-Western blotting techniques. Dot and Slot blotting.

UNIT V **Sequencing** **(No of hours: 12)**

DNA and protein sequencing. Protein engineering. Protoplast fusion. Hybridoma Technology. DNA finger printing - RFLP, RPAD and AFLP techniques. Applications of genetic engineering in agriculture, health and industry including gene therapy

Total hours : 60

Course outcome

On the successful completion of this course,

CO 1: Students able to gain knowledge in mechanism of restriction enzyme, types and application, various enzymes

CO 2: To understand the uses of plasmid in transformation for genetically modified organisms CO 3: To understand the importance of Sequencing of DNA, protein and gene therapy in various diseases

CO4 : To design diagnostic tools for analyzing genetically modified organism

CO5 : To apply new techniques in detecting and treat genetic disorders through molecular changes

Course code	Course title	L T P C
AMYT2903	MOLECULAR BIOLOGY	5 0 0 6

Prerequisite required : None

Course objectives:

1. To enable the students to learn the structure and function of macromolecules, DNA,Molecular identification
2. To understand the replication mechanism of DNA and its repairing mechanism
3. To learn about translation and transcription mechanism
4. To learn gene expression and factors involving in gene regulation

AMYT2903 - MOLECULAR BIOLOGY

UNIT I Strructure of Macromolecules (No. of hours :12)

Composition, structure and function of biomolecules (carbonhydrates, lipids, proteins and nucleic acids). Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds). Conformation of nucleic acids (A-, B-, Z-, DNA), t-RNA, micro-RNA. Stability of protein and nucleic acid structures. Molecular approaches to diagnosis and strain identification.

UNIT II **DNA replication and repairing mechanism (No. of hours :12)**

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

UNIT III **Transcription and Translation mechanism (No. of hours :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 IV Protein synthesis and post translational modifications (No. of hours :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 V Gene expression & Regulation (No. of hours :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.

Total hours : 60

Course outcome :

On the successful completion of this course

CO1 : To understand the mechanism of protein synthesis and structure prediction , conformational changes

CO 2 : To understand the DNA replication and repairing mechanism, RNA synthesis in cells

CO 3 : To understand mechanism enzymes and biochemical pathway

CO4 : To gain knowledge in cell to cell interaction and analyzing its mechanism

CO5 : To design various types of molecular markers

Course Code :	Course Title:	L	T	P	C
AMYL 2901	MICROBIAL GENETICS, MOLECULAR BIOLOGY AND GENETIC ENGINEERING	0	0	4	2

Prerequisite required : None

Course objectives :
Enable the students to learn the techniques of
1.Isolating genetic material, estimation and confirmation of isoted DNA by AGE techniques
2. Isolation of other macro molecules and its purification strategy and estimation
3. 2D gel electrophoresis, SDS-PAGE and blotting techniques
4. restriction digestion, competent cells and its selection mechanism

AMYL 2901 - PRACTICAL - III - MICROBIAL GENETICS, MOLECULAR BIOLOGY AND GENETIC ENGINEERING

UNIT **I Isolation and Quantification of genetic material** **No. of hours : 12 hours**

Isolation of genomic DNA from bacteria and demonstration in agarose gel electrophoresis. Isolation of plasmid DNA by alkali lysis A-9 method. Estimation of DNA by diphenyl amine method. Determination of Tm value of DNA. Quantitation of nucleic acids by UV Spectrophotometer.

UNIT II Isolation of RNA No. of hours : 12 hours

Isolation of RNA from yeast. Estimation of RNA by orcinol method. Induced mutagenesis - Isolation of antibiotic resistant auxotrophic mutants.

UNIT III Separation of proteins and its estimation **No. of hours : 12 hours**

Estimation of proteins by Lowery et al method. SDS-PAGE. 2D-Gel electrophoresis. Isoelectric focussing. Separation of amino acids by TLC and paper chromatography.

UNIT IV Separation and blotting techniques **No. of hours : 12 hours**

Separation of proteins using Gel filtration and Ion exchange chromatography. Immobilization of enzymes and whole cells. Western blotting. Protoplast and spheroplast isolation. Induction of beta-galactosidase activity in E. coli using IPTG.

UNIT V Transformation and selection **No. of hours : 12 hours**

Preparation of competent cells. Transformation and Blue-White selection for transformants. DNA amplification by PCR. Separation of PCR amplified product on PAGE and determination of product size. Restriction mapping / Restriction analysis

Total hours : 60

Course outcome :
On the successful completion of this course,
CO 1: To gain knowledge of isolation of biomolecules and analyzing for various parameters
CO 2: To apply techniques in problem solving and Evaluting the results of changes taken place in molecular level
CO 3: To understand the mechanism of how to prepare competent cells and selection mechanism for genetic transformation
CO4 : To understand the mechanism of protein synthesis , RNA synthesis in cells , mechanism enzymes and biochemical pathway
CO5 : To gain knowledge in cell to cell interaction and analyzing its mechanism

Course Code:	Course Title: -	L	T	P	C
AMYT 2904	SOIL AND AGRICULTURAL MICROBIOLOGY	5	0	0	6

Prerequisite required : None

Course objectives:
To enable the Students able to learn about

1. Importance and role of microorganisms in Environment, mutalism, synergism
2. Nitrogen fixation , symbiosis, industrially important enzymes
3. Biofertilizer , biopesticide production and its importance and disease management

AMYT 2904ELECTIVE - IV: SOIL AND AGRICULTURAL MICROBIOLOGY

UNIT I classification of organisms **(No. of hours :12)**

Characteristics and classification of soils; Soil Microorganisms; Interactions between microorganisms – Mutalism, commensalism, ammensalism, synergism, parasitism, predation, competition. Interaction of microbes with plants – rhizosphere, phyllosphere and mycorrhizae.

UNIT II Bacteria in Agriculture **(No. of hours :12)**

Symbiotic and Asymbiotic Nitrogen fixation – mechanism and genetics of Nitrogen Fixation. Biogeochemical cycles – carbon, nitrogen, phosphorus, sulfur. Biofertilizers – Rhizobium, Azotobacter, Azospirillum, VAM, Phosphobacteria, Azolla Cyanobacteria. Biopesticides. Interrelationships between microorganisms, plants and soil – Enzymes of microbial origin and their role in release of available plant nutrients.

UNIT III Plant pathogen interaction **(No. of hours :12)**

Plant pathogens and classification of plant diseases. Host-pathogen recognition and specificity. Principles of plant infection and defense mechanisms – entry of pathogen in to host, colonization of host; role of enzymes, toxins and growth regulatory substances. Defense mechanisms in plants – Structural and biochemical – Molecular aspects of host defense reactions – Lipoxygenase and other enzymes in the expression of disease resistance

UNIT IV Diseases in plants **(No. of hours :12)**

Symptoms, Etiology, Epidemiology and management of the following plant diseases: Mosaic disease of tobacco; Bunchy top of banana; Leaf roll of potato; Bacterial blight of paddy; Angular leaf spot of cotton, 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, Grassy shoot of sugar cane; Root knot of mulberry.

UNIT V Disease management **(No. of hours :12)**

Plant disease management – exclusion, evasion, eradication, crop rotation. Sanitation – physical, chemical and biological control

Total hours : 60

Course outcome :
On the successful completion of this course
CO 1: Students gain knowledge on technicall aspects of controlling pest and diseases
CO 2: To apply Integrated pest management, biological factors and its controlling mechanism, enzymes and its application
CO3 : To evaluate and analyze the results of IPM and its advantages in controlling pest
CO4 : To improvise skills in pest management for better crop yield
CO5: To create awareness among students on organic pesticides and its application in environment

Course Code:	Course Title: -	L T P C
AMYT2905	ENVIRONMENTAL BIOTECHNOLOGY	5 0 0 6

Prerequisite required : None

Course On bjectives :

1. To enable the students to learn about various types of microorganisms and its industrial application
2. To learn the mechanism and importance of different types of bioreactor
3. To learm metaobolic mechanisms, detoxification in system and bioremediation

AMYT2905 - EXTRA DISCIPLINARY ELECTIVE-II - ENVIRONMENTAL BIOTECHNOLOGY

UNIT I Biofilm formation and controlling measures (no. of hours : 12)

Biofilm – occurrence causes and effects - control measures. Biofilm reactor-soluble microbial products and inert biomass – principle and applications.

UNIT II Principle of fermentor (no. of hours : 12)

Bioreactors - principles and designing. Reactor types – batch, continuous-flow, stirred-tank reactor, plug-flow reactors. Effluent recycle - reactors with recycle of settled cells - alternate rate models - Reactors in series.

UNIT III Metabolicprocess (no. of hours : 12)

Denitrification – physiology, types and microbes involved – sludge denitrification. Waste water treatment systems - anaerobic and aerobic- Special factors for the design of anaerobic sludge digesters. Drinking-water treatment: principles - anaerobic treatment by methanogenesis.

UNIT IV Detoxification (no. of hours : 12)

Detoxification of Hazardous chemicals - factors causing molecular recalcitrance. Synthetic organic chemicals - Energy metabolism versus co-metabolism - Electron donor versus electron acceptor - Biodegradation of environmental contaminants.

UNIT V Bioremediation (no. of hours : 12)

Bioremediation: Strategies for bioremediation - Pollution monitoring, control and remediation (petroleum industry, paper industry, chemical industry etc.). Biomass from the wastes.

Total hours : 60

Course outcome :

CO1: To gain knowledge on Industrially important biofilm forming microorganisms in various fields and its controlling measures

CO2: To understand the mechanism of Metabolism and fermentation process

CO3: To apply various techniques in Fermentation process and its impact in human welfare

CO4 : To create awareness on Bioremediation and safest techniques to protect biodiversity

CO5 : To analyze the results of recent techniques applied in fermentation and bioremediation

Course Code:	Course Title: -	L T P C
ARMT 2916	RESEARCH METHODOLOGY	6 1 0 6

Prerequisite required : None

Course objectives:
To enable the students to understand,
1. Research approaches, way to write a thesis, research designing, hypothesis
2. To write the report, steps of writing thesis, finding the solution
3. To understand the molecular techniques in gene expression
4. To understand immunotechniques and principle, working mechanism of microscopy and electron microscopy

ARMT 2916 RESEARCH METHODOLOGY

UNIT I Research approaches and hypothesis **No. of hours: 12**

Research Methodology - Meaning and objectives and types of research. Research approaches - research Process. Defining the research problem - research design. Sampling – types and design. Data collection - methods - processing and analysis of data. Testing of Hypothesis. Fundamentals of Bioethics.

UNIT II Thesis writing **No. of hours: 12**

Writing the Research Report (Thesis and publications): Components of research report - Title, Authors, Addresses, Abstract, Keywords, Introduction, Materials and Methods, Results, Discussion, Summary, Acknowledgements and Bibliography.

UNIT III Molecular techniques **No. of hours: 12**

Molecular biology methods: In vitro mutagenesis and detection techniques. Gene knock out in bacterial and eukaryotic organisms. Methods for analysis of gene expression - RNA and protein level - micro array based techniques. Isolation, separation and analysis of protein, carbohydrate and lipid molecules.

UNIT IV Immunotechniques **No. of hours: 12**

Histochemical and immunotechniques: Flowcytometry and immunofluorescence microscopy. Detection of molecules in living cells - FISH and GISH. Biophysical methods: Analysis of biomolecules - UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy. Structure determination - X-ray diffraction, mass spectrometry and surface plasma resonance methods.

UNIT V Microscopy **No. of hours: 12**

Radiolabeling techniques: Radioisotopes used in biology – properties, detection and measurement. Molecular imaging of radioactive material and safety guidelines. Miscroscopic techniques: Microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM - Image processing methods in microscopy.

Total hours : 60

Course outcomes:
CO 1: To understand the basic framework of research process and gain knowledge in how to design an experiment
CO 2: To improvise the problem solving ability using technical inputs
CO 3: To know the mechanism of isolation techniques and immune assays, specificity of antigen antibody interaction
CO 4: To develop an understanding of the ethical dimensions of conducting applied research
CO5 : To understand the principle and working mechanism of different types of microscopy

References:

1. Davis, B.D., Delbecco, R., Eisen, H.N. and Ginsburg,H.S. (1990) Microbiology, 5th Edn. Harper & Row, New York.
2. Arora, D.R. (2003) Text Book of Microbiology, 2nd Edn. CBS Publishers & Distributors, New Delhi.
3. .Dubey, R.C. and Maheswari, D.K. (2003) A Text Book of 4. Microbiology, 1st Edn. S. Chand & Co. Ltd., New Delhi.
4. Boyd, R.F. (1998) General Microbiology. Times Mirror, 5. Mosby College Publishing ,St Louis.
5. Prescott, L.M., Harley, J.P. and Klein, D.A. (1999) 6. Microbiology. McGraw Hill, New Delhi
6. Microbial Diversity by Colwd, D. 1999, Academic Press
7. Microbial ecology Fundamentals and applications by Ronald. M. Atlas and Rchard Bartha 2nd and 4th edition by The Benjamin Cummins Pub. Co. inc
8. Parija, S.C. (1996) Text Book of Medical Parasitology. Orient Longman, Chennai.
9. Chatterjee (1986) Medical Parasitology. Tata McGraw Hill, 27.Calcutta
10. Dubey, R.C. and Maheshwari, D.K. (2002) Practical Microbiology, 1st Edn. S. Chand & Co. Ltd., New Delhi
11. Ketchum, P.A. (1984) Microbiology: Concepts and Applications. John Wiley and Sons, New York
12. Salle, A.J. (1992) Fundamental Principles of Bacteriology. 7th Edn. Tata McGraw Hill, New Delhi
13. Ananthanarayan, R. and Jeyaram Paniker, C.K. (1994) Text.Book of Microbiology,6th Edn. Orient Longman, Chennai
14. Jeyaram Paniker, C.K. (2006) Text Book of Parasitology. Jay Pee Brothers, New Delhi.
15. Alexender, M. (1977) Introduction to Soil Microbilogy. John Wiley and Sons, New York.
16. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1995) Principles of Fermentation Technology, 2nd Edn. Pergamon , Press, Oxford.
17. Frazier, W.C. and Westhoff, D.C. (1988) Food Microbiology, 4th Edn. McGraw Hill, New York.
18. Old, R. and Primrose, S.B. (1995) Principles of Gene Manipulation: An Introduction to Genetic Engineering, 5th Edn. Blackwell Scientific Publications, Oxford.
19. Freifelder, D. (1995) Molecular Biology. Narosa PublishingHouse, New Delhi.
20. Timbury, M.C. (1986) Medical Virology, 9th Edn. Churchill Livingstone, London.
21. Jagadish Chander (1996) A Text Book of Medical Mycology. Interprint, New Delhi.
22. .Arora, D.R. (2003) Text Book of Microbiology, 2nd Edn. CBS Publishers & Distributors, New Delhi.
23. Arora, D.R. and Arora, B.(2002) Medical Parasitology, 1st Edn. CBS Publishers & Distributors, New Delhi.
24. Dubey, R.C. and Maheswari, D.K. (2003) A Text Book of 73. Microbiology, 1st Edn. S. Chand & Co. Ltd., New Delhi..
25. Dubey, R.C. and Maheswari, D.K. (2002) Practical 74. Microbiology, 1st Edn. S. Chand & Co. Ltd., New Delhi
26. Ignacimuthu, S. (2005) Basic Bioinformatics, Ist Edn. Narosa Publishing House, New Delhi, India.
27. Sundararaj, T. (2002) Microbiology Laboratory Manual, Ist Edn.Mrs.Aswathy Sundararaj Publication, Chennai
28. Bernard D. Davis. Renato Dulbecco. Herman N. Eisen.and Harold, S. Ginsberg. (1990).Microbiology (4th edition). J.B.Lippincott company, New York.
29. Alexopoulus C.J. and C W. Mims.(1993). Introductory Mycology(3rd edition).Wiley Eastern Ltd, New Delhi. A-8 7 3.

30. Elizabeth Moore - Landecker. (1996).Fundamentals of the fungi. (4th edition). Prentice Hall International, Inc, London.
31. Heritage,J. Evans E.G.V. and Killington, R.A. (1996). Introductory Microbiology. Cambridge University Press
32. Holt, J.S., Kreig, N.R., Sneath, P.H.A and Williams, S.T. Bergey's Manual of Determinative Bacteriology (9th Edition), Williams and Wilkins, Baltimore.
33. John Webster (1993). Introduction to Fungi. (2nd edition).Cambridge University press, Cambridge.
34. Prescott L.M. Harley J.P. and Klein D.A. (2003). Microbiology (5th edition) McGraw Hill, New York.
35. Larry Mc Kane.and Judy Kandel (1996). Microbiology- Essentials and applications. (2nd edition). Mc Fraw Hill Inc, Newyork.
36. Madigan, M.T. Martinko.J.M and Parker J Brock T.D. (1997). Biology of roorganisms.(8th edition).Prentice Hall International Inc, London.
37. .Schaechter M and Leaderberg J (2004). The Desk encyclopedia of Microbiology. Elseiver Academic press, California.
38. Nester, E.W., Roberts, C.V. and Nester, M.T. (1995). Microbiology, A human perspective. IWOA, U.S.A.
39. Pelczar Jr, M.J. Chan, E.C.S. and Kreig, N.R. (1993). Microbiology, Mc. Graw Hill. Inc, New York.
40. Salle, A.J. (1996). Fundamental principles of Bacteriology.(7th edition).Tata McGraw - Hill publishing company Ltd, New Delhi
41. Caldwell, D.R. (1995). Microbial Physiology and metabolism, Wm. C. Brown Publishers, U.S.A.
42. Lansing M. Prescott, John P. Harley and Donald A. Klein. (2003). Microbiology.(5th edition). McGraw - Hill company, New York.
43. Moat, A.G. and Foster, J.W. (1988). Microbial Physiology (Second Edition). John Wiley & Sons, New York. A-8 8 7
44. White, D. (1995). The physiology and biochemistry of Prokaryotes, Oxford University Press, Oxford, New York.
45. Prescott, L.M., Harley, J.P. and Klein, D.A. (1999) Microbiology. McGraw Hill, New Delhi
46. Ketchum, P.A. (1984) Microbiology: Concepts and Applications. John Wiley and Sons, New York.
47. Mandelstam, J., McQuillen, K. and Dawes, L. (1992) Biochemistry of Bacterial Growth, 3rd Edn. Blackwell Scientific Publications, Oxford.
48. Doelle, H.W. (1975) Bacterial Metablism. 2nd Edn. Academic Press, London. 22.Moat, A.G. and Foster, J.W. (1995) Microbial Physiology, 3rd Edn. John Wiley and Sons, New York.
49. Rose, A.H. (1976) Chemical Microbiology: An Introduction to Microbial Physiology, 3rd Edn. Plenum, New York.
50. Gottschalk, G. (1986) Bacterial Metabolism, 2nd Edn. Springer-Verlag, New York.
51. Ingraham, J.L. and Ingraham, C.A. (2000) Introduction to Microbiology, 2nd Edn. Books / Cole Thomson Learning, UK.
52. Schelegel, H.G. (1993) General Microbiology,7th Edn. Cambridge University Press, Cambridge