MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE

(An Autonomous College)

Affiliated to Periyar University, Salem | Accredited by **NAAC** with '**A**' Grade

Recognized by **UGC** under Section 2(f) & 12 (B)

ESTD-1994

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (Autonomous)

A UNIT OF VANETRA GROUP

Learn. Lead

DEGREE OF BACHELOR OF SCIENCE

Learning Outcomes - Based Curriculum Framework

- Choice Based Credit System

Syllabus for B.Sc., Microbiology

(Semester Pattern)

(For Candidates admitted from the academic year 2023-2024 and onwards)

Regulation and Syllabus

for B.Sc., Microbiology

(With effect from the Academic Year 2023-24)

Vision:

To redefine the scope of higher education by infusing into each of our pursuits, initiatives that will encourage intellectual, emotional, social and spiritual growth, thereby nurturing a generation of committed, Knowledgeable and socially responsible citizens.

Mission:

*To Ensure State of the world learning experience

*To Espouse value based Education

*To Empower rural education

*To Instill the sprite of entrepreneurship and enterprise

*To create a resource pool of socially responsible world citizens

QUALITY POLICY

To Seek – To Strive – To Achieve greater heights in Arts and Science, Engineering, Technological and Management Education without compromising on the Quality of Education.

DEPARTMENT OF MICROBIOLOGY

Vision:

*To provide education that gives self-employment and build a strong Academic industry.

Mission:

*To provide value and need based education

PREAMBLE

Microbiology is a wide discipline of biology which encompasses five groups of microorganisms i.e. bacteria, protozoa, algae, fungi, and viruses. It studies their interaction with their environments as well as how these organisms are harnessed in human endeavor and their impact on society. The study has its extensions in various other conventional and advanced fields of biology by employing microbes as study models. Since the inception of microbiology as a branch of science, it has remained an ever-expanding field of active research, broadly categorized as pure and applied science. Knowledge of different aspects of Microbiology has become crucial and indispensable to the society.

Study of microbes has become an integral part of education and human progress. There is a continuous demand for microbiologists as work force in education, industry and research. Hence Microbiological tools andtechniques are used in almost all fields which are indispensable for people working in fields like Agriculture, Food Industry, Medical Sciences, Environmental Science and Pharmaceutical Science etc. The syllabi for the three-year B.Sc. degree course in Microbiology are framed in such a way that the students at the end of the course, can be adept at Microbiological techniques for pursuing higher studies and can also apply Microbiological methods judiciously to a variety of industrial needs.

PROGRAMME LEARNING OUTCOME

NATURE AND EXTENT OF THE PROGRAMME

The undergraduate programme in Microbiology is the first level of college or university degree in the country as in several other parts of the world. After obtaining this degree, a microbiologist may enter into the job market or opt for undertaking further higher studies in the subject. After graduation the students may join industry, academia, or public health departments and play their role as microbiologists in a useful manner contributing their knowledge to the welfare of the society. Thus the undergraduate level degree in Microbiology must prepare the students for all these objectives. The LOCF curriculum has been developed encompassing all the diversified aspects of Microbiology with reasonable depth of knowledge and skills as to specialize them in the various aspects of the subject. It also equips them with the expected professional expertise.

AIM OF THE PROGRAMME

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in a wide ranging context which

involve the use of knowledge and skills of Microbiology. Their understanding, knowledge and skills in Microbiology needs to be developed through a thorough teaching learning process in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts.

GRADUATE ATTRIBUTES

The students graduating in this degree must have an intricate knowledge of the fundamentals of Microbiology as applicable to wide ranging contexts. They should have the appropriate skills of Microbiology so as to perform their duties as Microbiologists. They must be able to analyze the problems related to Microbiology and come up with most suitable solutions. As microbiology is an inter – disciplinary subject the students might have to take inputs from other areas of expertise. So the students must develop the spirit of team work. Microbiology is a very dynamic subject and practitioners might have to face several newer problems. To this end, the microbiologists must be trained to be innovative to solve such newer problems. Several newer developments are taking place in Microbiology. The students aretrained to pick up leads and see the possibility of converting these into products through entrepreneurship. Furthermore, the students are made to interact with industry experts so that they may able to see the possibility of their transition in to entrepreneurs. They are also made aware of the requirements of developing a Microbiology enterprise by having knowledge of patents, copyrights and various regulatory processes to make their efforts a success.

Besides attaining the attributes related to the Profession of Microbiology, the graduates in this discipline should also develop ethical awareness which is mandatory for practicing a scientific discipline including ethics of working in a laboratory and ethics followed for scientific publishing of their research work in future. The students graduating in Microbiology should also develop excellent communication skills both in the written as well as spoken language which is indispensable for them to pursuehigher studies from some of the best and internationally acclaimed universities and research institutions spread across the globe.

GA 1 Analytical Reasoning

GA 2 Critical Thinking

GA 3 Problem Solving Skills

GA 4 Communication Skills

GA 5 Leadership Quality

GA 6 Team work

GA 7 Lifelong Learning

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Graduates will be able to promote learning environment to meet the industry expectation

PEO2: Graduates will be incorporated the critical thinking with Good Communication and Leadership skills to become a self-employed

PEO3: Graduates will be uphold the human values and environmental sustenance for the betterment of the society.

PROGRAMME OUTCOMES (POs)

PO1: Graduates will acquire dynamic skills through proper perception of the course Objectives that leads to scientific and analytical comprehension of the concepts.

PO2: Graduates will focus on sustainable goals that might bring about spherical developments

PO3: Graduates will infuse a spirit converging on bricking a team work, interpersonal and administrative skills to think critically and execute effectively

PO4: Graduates will apply reasoning appropriately to scale the humps in learning and solute them to the core.

PO5: Graduates will engage the skills obtained in independent and collaborative learning as a perennial process.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO-1: The under graduate students will acquire fundamental and applied knowledge in history, classification, morphology and physiological characteristic of Bacteria, Fungi, Virus, algae and protozoa.

PSO-2: Become expertise in the use and application of various laboratory protocols for basic and advanced microbiological, immunological and molecular techniques with Good laboratory practices.

PSO-3: Understand the epidemiological status, pathogenesis, immune response, diagnosis, treatment, prevention and control of microbial diseases in Human being, animal and

plants.

PSO-4: Apply for career development, entrepreneurship, placement as skilled person in various field of life sciences, research and technology development.

PSO-5: Develop social responsibility through microbiological importance related to the betterment of environment and mankind at national and global prospective.

REGULATIONS (2023-2024)

1. DURATION OF THE PROGRAME

1.1. Three years (six semesters)

1.2. Each academic year shall be divided into two semesters. The odd semesters shall consist of the period from June to November of each year and the even semesters from December to May of each year.

1.3. There shall be not less than 90 working days for each semester.

2. ELIGIBILITY FOR ADMISSION

2.1. Candidate for admission to the first year of B.Sc. Degree Course in Microbiology shall be required to have passed the Higher Secondary Examination with Biological Sciences (Botany/Zoology, Biology) Academic/Vocational Stream Agri, Home Science, and Poultry as per norms set by the Government of Tamilnadu or an Examination Accepted as equivalent thereto by the syndicate.

3. CREDIT REQUIRMENTS AND ELIGIBILITY FOR AWARD OF DEGREE

3.1. A Candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study in a College affiliated to the University for a period of not less than three academic years and passed the examinations of all the Six Semesters prescribed earning a minimum of 140 credits as per the distribution given in Regulation for Part I, II, III, IV & V and also fulfilled such other conditions as have been prescribed there of.

4. COURSE OF STUDY, CREDITS AND SCHEME OF EXAMINATION

4.1. The Course Components and Credit Distribution shall consist of the following:

(Minimum Number of Credits to be obtained)

Part Wise Distribution	Study Components	Credit Distribution
PART I	Tamil or Other Languages	12
PART II	English	12
PART III	Core, Allied, Elective and Project Courses	91
PART IV	i. Basic Tamil/ Advanced Tamil/ NME	04
	ii. Soft Skill Courses / SBEC	10
	iii. Environmental Studies	02
	iv. Value Education	02
	v. Internship	02
	vi. Foundation Course	02
	vii. Professional Competency Skills	02
PARTV	Extension Activity	01
Total Credits		140

4.2 DETAILS OF COURSE OF STUDY OF PARTS I - V

4.2.1 PART I: Tamil and Other Languages Hindi or French at the option of candidates and according to the syllabus and text-books prescribed from time to time:

4.2.2 PART II: English: According to the syllabus and text-books prescribed from time to time

4.2.3 PART III: Core, Allied Project and Elective Courses: As prescribed by the concerned Board of Studies

4.2.4 PART IV:

i. Basic Tamil / Advanced Tamil/NME:

a. Students who have not studied Tamil up to XII STD and have taken any Language other than Tamil in Part I shall take Basic Tamil comprising of Two Courses (level will be at 6th Standard).
b. Students who have studied Tamil up to XII STD and have taken any Language other than Tamil in Part – I shall take Advanced Tamil comprising of Two Courses.
c. Students who have studied Tamil up to XII STD and also have taken Tamil in Part – I shall take Non-Major Elective comprising of Two Courses.

i. Soft Skill Courses/SBEC
ii. Environmental Studies
iii. Value Education
iv. Internship
v. Foundation Course
vi. Professional Competency Skills (Online)

4.2.5 PART V: Extension Activity:

Students shall be awarded a maximum of 1 Credit for Compulsory Extension Service. All the Students shall have to enroll for NSS /NCC/ NSO (Sports & Games) Retract / Youth Red Cross or any other Service Organizations in the College and shall have to put in compulsory minimum attendance of 40 hours which shall be duly certified by the Principal of the College before 31st March in a year. If a student lacks 40 hours attendance in the first year, he or she shall have to compensate the same during the subsequent years.

Those students who complete minimum attendance of 40 hours in one year will get 'half a credit and those who complete the attendance of 80 or more hours in Two Years will get 'one credit'. Literacy and Population Education and Field Work shall be compulsory components in the above extension service activities.

4.3. Inclusion of the Massive Open Online Courses (MOOCs) available on SWAYAM and NPTEL

4.3.1 Students can choose the MOOC Course Available on SWAYAM and NPTEL under Core, Elective or Soft skill category. He/ she will be awarded degree only after producing valid certificate of the MOOC course for credit Mobility

5. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

5.1. Eligibility: Students shall be eligible to go to subsequent semester only if they earn sufficient attendance as prescribed by the Periyar University.

5.2. Attendance: All Students must earn 75% and above of attendance for appearing for the End Semester Examination.(Theory/Practical)

5.3. Condonation of shortage of attendance: If a Student fails to earn the minimum attendance (Percentage stipulated), the Principals shall condone the shortage of attendance up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) after collecting the prescribed fee for Theory/Practical examination separately, towards the condonation of shortage of attendance. Such fees collected and should be remitted to the University.

5.4. Non-eligibility for condonation of shortage of attendance: Students who have secured less than 65% but more than 50% of attendance are NOT ELIGIBLE for condonation of shortage of attendance and such Students will not be permitted to appear for the regular examination, but will be allowed to proceed to the next year/next semester of the program and they may be permitted to take next University examination by paying the prescribed condonation fee

5.5. Detained students for want of attendance: Students who have earned less than 50% of attendance shall not be permitted to proceed to the next semester and to complete the Program of study. Such Students shall have to repeat the semester, which they have missed by rejoining after completion of final semester of the course, by paying the fee for the break of study as prescribed by the College from time totime.

5.6. Condonation of shortage of attendance for married women students: In respect of married women students undergoing UG programs, the minimum attendance for condonation (Theory/Practical) shall be relaxed and prescribed as 55% instead of 65% if they conceive during their academic career. Medical certificate from the Doctor (D.G.O) from the Government Hospital and the prescribed fee along with attendance details shall be forwarded to the college to consider the condonation of attendance mentioning the category

5.7. Zero Percent (0%) Attendance: The Students, who have earned 0% of attendance, have to repeat the program (by rejoining) without proceeding to succeeding semester and they have to obtain prior permission from the College/University immediately to rejoin the program.

5.8 Transfer of Students and Credits: The strength of the credits system is that it permits inter Institutional transfer of students. By providing mobility, it enables individual students to develop their capabilities fully by permitting them to move from one Institution to another in accordance with their aptitude and abilities by obtaining necessary permission from the university.

5.8.1 Transfer of Students is permitted from one Institution to another Institution for the same program with same nomenclature.

Provided, there is a vacancy in the respective program of Study in the Institution where the transfer is requested.

Provided the Student should have passed all the courses in the Institution from where the transfer is requested.

5.8.2 The marks obtained in the courses will be converted and grades will be assigned as per the College norms.

5.8.3 The transfer students are eligible for classification.

5.8.4 The transfer students are not eligible for Ranking, Prizes and Medals.

5.8.5 Students who want to go to foreign Universities up to two semesters or Project Work with the prior approval of the Departmental/College Committee are allowed to get transfer of credits and marks which will be converted in to Grades as per the University norms and are eligible to get CGPA and Classification; they are not eligible for Ranking, Prizes and Medals.

5.9 Students are exempted from attendance requirements for online courses of the College and MOOC's.

6. EXAMINATION AND EVALUATION

6.1. Register for all subjects: Students shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination. For this purpose, Students shall register for all the arrear subjects of earlier semesters along with the current (subsequent) Semester Subjects.

6.2. Marks for Internal and End Semester Examinations for PART I, II, III, and IV

Category	Theory	Practical
Internal Assessment	25	**40**
End semester Examination	**75**	**60**

6.3. Procedure for Awarding Internal Marks

Internal Examination Marks – Theory

Components	Marks
CIA I&II	**15**
Attendance	**5**
Assignment/Quiz	**5**
Total	**25**

6.4 Awarding Marks for Attendance (out of 5)

Percentage of Attendance	Marks
Below 60%	0 marks
60% to 75%	3 marks
75% to 90%	4 marks
Above 90%	5 marks

6.5 Components for Practical CIA.

Components	Marks
CIA -I	**15**
CIA - II	**15**
Observation Note	**05**
Attendance	**5**
Total	**40**

6.6 Components for Practical ESE.

Components	Marks
Completion of Experiments	**50**
Record	**05**
Viva voce	**05**
Total	**60**

6.7 Guidelines for Value Education Yoga and Environmental Studies (Part IV)

6.7.1. The Course Value Education Yoga is to be treated as 100% CIA course which is offered in V Semester for I year UG students.

6.7.2. The Course Environmental Studies is to be treated as 100% CIA course which is offered in IV Semester for I year UG students.

6.7.3. Total Marks for the Course = 100

Components	Marks
Two Tests(2 x30)	**60**
Field visit and report (10+10)	**20**
Two assignments (2 x10)	**20**
Total	**100**

The passing minimum for this course is 40%

6.7.4 In case, the candidate fails to secure 40% passing minimum, he/she may have to reappear for the same in the subsequent odd/even semesters.

6.8 . Internship/ Industrial Training, Mini Project and Major Project Work

Internship/Industrial Training		Mini Project	Major Project Work		
Components	Marks	Marks	Components		Marks
CIA*2			**CIA** a) Attendance b) Review / Work Diary*1	10 Marks 30 Marks	40
Work Diary	25	-			
Report	50	50			
Viva-voce	25	50			
Examination					
Total	100	100	ESE*2 a) Final Report- 40 Marks b)Viva-voce 20- Marks		60
			Total		100

*1. Review is for Individual Project and Work Diary is for Group Projects (Group consisting of minimum 3 and maximum 5)

*2 Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners

6.9 Guidelines for Professional Competency Skill- Online Mode (Part IV)- Online Exam 3 hours

Components	Marks
100 Objective Type Questions 100*1=100 Marks	**100**

Objective type Questions from Question Bank.

- The passing minimum for this paper is 40%
- In case, the candidate fails to secure 40% passing minimum, he/ she may have to reappear for the same in the subsequent semesters.

QUESTION PAPER PATTERN FOR CIA I, II AND ESE	
(3 HOURS)	**MAXIMUM: 75 Marks**
SECTION-A (Objective Type) **Answer ALL Questions** ALL Questions Carry EQUAL Marks	(10 x1=10 marks)
SECTION-B (Either or Type) **Answer ALL Questions** ALL Questions Carry EQUAL Marks	(5 x 5 = 25 marks)
SECTION-C (Either or Type) **Answer ALL Questions** ALL Questions Carry EQUAL Marks	(5 x 8 = 40 marks)
(Syllabus for CIA-I 2.5 Unit, Syllabus for CIA-II All 5 Unit)	

6.10. PASSING MINIMUM

6.10.1. There shall be no passing minimum for Internal.

6.10.2. For external examination, passing minimum shall be 40% [Forty Percentage] of the maximum marks prescribed for the course for each Course/Practical/Project and Viva-Voce.

6.10.3. In the aggregate [External/Internal] the passing minimum shall be of 40%.

6.10.4. He / She shall be declared to have passed the whole examination, if He / she passes in all the Courses and Practical wherever prescribed as per the scheme of the examinations by earning 140 CREDITS in Part I, II, III, IV & V. He/she shall also fulfill the extension activities prescribed earning a minimum of 1 credit to qualify for the Degree.

6.11. SUPPLIMENTARY EXAMINATION:

Supplementary Examinations is conducted for the students who appeared in the final semester examinations. Eligible criteria for appearing in the Supplementary Examinations are as follows:

6.11.1. Eligibility: A Student who is having arrear of only one theory course in any of the semester or two theory course in the Final semester of the UG degree programme alone is eligible for Supplementary Examinations.

6.11.2. Non-eligibility for those completed the program: Students who have completed their Program duration but having arrears are not eligible to appear for Supplementary Examinations.

6.12. RETOTALLING, REVALUATION AND PHOTOCOPY OF THE ANSWER SCRIPTS:

6.12.1. Re-totaling: All UG Students who appeared for their Semester Examinationsare eligible for applying for re-totaling of their answer scripts.

6.12.2. Revaluation: All current batch Students who have appeared for their Semester Examinations are eligible for Revaluation of their answer scripts. Passed out candidates are not eligible for Revaluation.

6.12.3. Photo copy of the answer scripts: Students who have applied for revaluation can apply for the Photocopy of answer scripts by paying prescribed fee.

7. CLASSIFICATION OF SUCCESSFUL STUDENTS

7

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
40-49	4.0-4.9	C	Satisfactory
00-39	0.0	U	Re-appear
ABSENT	0.0	AAA	**ABSENT**

7.1 Computation of Grade Point Average (GPA) in a Semester, Cumulative Grade Point Average (CGPA) and Classification

GPA for a Semester: = ∑iCiGi ,∑iCi

That is, GPA is the sum of the multiplication of grade points by the credits of the courses divided by the sum of the credits of the courses in a semester.

CGPA for the entire programme: = ∑n∑iCniGni ,∑n∑iCni That is, CGPA is the sum of the multiplication of grade points by the credits of the entire programme divided by the sum of the credits of the courses of the entire programme

Where,

Ci= Credits earned for course I in any semester,

Gi=GradePointsobtainedforcourseiinanysemestern=Semesterinwhichsuchcourseswere credited.

7.2 Letter Grade and Classification

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5-10.0	O+	First Class -Exemplary*
9.0 and above but below9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction*
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.5 and above but below 5.0	C +	Third Class
4.0 and above but below 4.5	C	
0.0 and above but below 4.0	U	Re-appear

*The Students who have passed in the first appearance and within the prescribed semester of the UG Programme (Major, Allied and Elective courses only) are eligible.

8. RANKING

Students who pass all the examinations prescribed for the Program in the FIRST APPEARANCE ITSELF ALONE are eligible for Ranking I, II and III.

9. MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAM TO QUALIFY FOR A DEGREE

9.1. A Student who for whatever reasons is not able to complete the program within the normal period (N) or the Minimum duration prescribed for the programme, may beallowed two years period beyond the normal period to clear the backlog to be qualified for the degree. (Time Span =N+2years for the completion of programme)

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MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (Autonomous)
A UNIT OF VANETRA GROUP | Learn. Lead.

B.Sc., MICROBIOLOGY abstract under LOCF- CBCS Pattern with effect from 2023 -2024

Onwards Structure of Credit Distribution as per the TANSCHE / UGC Guidelines

S. No.	Study Components	Part	Sem. I		Sem. II		Sem. III		Sem. IV		Sem. V		Sem. VI		No .of Paper	Total Credit
			No. of Paper	Credit	No. of Paper	Credit	No. of Paper	Credit	No. of Paper	Credit	No. of Paper	Credit	No. of Paper	Credit		
1	LANGUAGE-I	I	1	3	1	3	1	3	1	3					4	12
2	LANGUAGE-II	II	1	3	1	3	1	3	1	3					4	12
3	DISCIPLINE SPECIFIC COURSE (DSC)-THEORY	III	1	5	1	5	1	5	1	5	2	10	2	10	8	40
4	DSC-PRACTICAL	III	I	3	1	3	1	3	1	3	1	4	1	4	6	20
5	GENERIC ELECTIVE COURSES (GEC)- THEORY	III	1	3	1	3	1	3	1	3					4	12
6	GEC PRACTICAL	III														
7	DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)	III									2	8	2	8	4	16
8	PROJECT WORK	III											1	3	1	3
9	INTERNSHIP	IV									1	2			1	2
10	Professional competency skill	IV											1	2	1	2
11	SKILL ENHANCEMENT COURSES (SEC)	IV			1	2	2	4	2	4					5	10
12	NON MAJOR ELECTIVE COURSES (NMEC)	IV	1	2	1	2									2	4
13	FOUNDATION COURSE (FC)	IV	1	2											1	2
14	ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) - EVS	IV							1	2					1	2
15	ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) - VALUE EDUCATION - YOGA	IV									1	2			1	2
16	EXTENSION ACTIVITY	V											1	1	1	1
	Cumulative Credits		7	21	7	21	7	21	8	23	7	26	8	28	44	140

Total No. of Subjects	44
Marks	4300

PART	No. of Credits
PART-I	12
PART-II	12
PART-III	91
PART-IV	24
PART-V	1
Grand Total	140

Extra Credit	4
	144

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (Autonomous)
Rasipuram-637408
Scheme of Examinations LOCF - CBCS Pattern
(for the Students Admitted from the Academic Year: 2023 – 2024 Onwards)
Programme: B.Sc. MICROBIOLOGY

S.No.	PART	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX. MARKS		
					Lect.	Lab.		CIA	ESE	TOTAL
SEMESTER - I										
1	I	LANGUAGE - I	23M1UFTA01	TAMIL - I	6		3	25	75	100
2	II	LANGUAGE - II	23M1UFEN01	ENGLISH - I	6		3	25	75	100
3	III	DSC THEORY - I	23M1UMBC01	FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY	5		5	25	75	100
4	III	DSC PRACTICAL - I	23M1UMBP01	PRACTICAL : FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY		5	3	40	60	100
5	III	GEC THEORY - I	23M1UBCA01	ALLIED: BASIC AND CLINICAL BIOCHEMISTRY	4		3	25	75	100
6	III	NMEC - I		NMEC - I	2		2	25	75	100
7	IV	FC THEORY - I	23M1UMBFC1	INTRODUCTION TO MICROBIAL WORLD	2		2	25	75	100
				TOTAL	**25**	**5**	**21**	**190**	**510**	**700**
SEMESTER - II										
1	I	LANGUAGE - I	23M2UFTA02	TAMIL - II	6		3	25	75	100
2	II	LANGUAGE - II	23M2UFEN02	ENGLISH - II	6		3	25	75	100
3	III	DSC THEORY - II	23M2UMBC02	MICROBIAL PHYSIOLOGY AND METABOLISM	5		5	25	75	100
4	III	DSC PRACTICAL - II	23M2UMBP02	PRACTICAL : MICROBIAL PHYSIOLOGY AND METABOLISM		5	3	40	60	100
5	III	GEC THEORY - II	23M2UBCA03	ALLIED : BIOINSTRUMENTATION	4		3	25	75	100
6	III	NMEC - II		NMEC - II	2		2	25	75	100
7	IV	SEC THEORY - I	23M2UMBS01	SERICULTURE	2		2	25	75	100
				TOTAL	**25**	**5**	**21**	**190**	**510**	**700**
SEMESTER - III										
1	I	LANGUAGE - I	23M3UFTA03	TAMIL - III	6		3	25	75	100
2	II	LANGUAGE - II	23M3UFEN03	ENGLISH - III	6		3	25	75	100
3	III	DSC THEORY - III	23M3UMBC03	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	5		5	25	75	100
4	III	DSC PRACTICAL - III	23M3UMBP03	PRACTICAL : MOLECULAR BIOLOGY AND MICROBIAL GENETICS		5	3	40	60	100
5	III	GEC THEORY - III	23M3UBCA05	ALLIED : CLINICAL LABORATORY TECHNOLOGY	4		3	25	75	100
6	IV	SEC THEORY - II	23M3UMBS02	ORGANIC FARMING AND BIOFERTILIZER TECHNOLOGY	2		2	25	75	100
7	IV	SEC THEORY - III	23M3UMBS03	AQUACULTURE	2		2	25	75	100
				TOTAL	**25**	**5**	**21**	**190**	**510**	**700**

S.No.	PART	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX. MARKS		
					Lect.	Lab.		CIA	ESE	TOTAL
SEMESTER - IV										
1	I	LANGUAGE - I	23M4UFTA04	TAMIL - IV	6		3	25	75	100
2	II	LANGUAGE - II	23M4UFEN04	ENGLISH-IV	6		3	25	75	100
3	III	DSC THEORY - IV	23M4UMBC04	IMMUNOLOGY AND IMMUNOTECHNOLOGY	5		5	25	75	100
4	III	DSC PRACTICAL - IV	23M4UMBP04	PRACTICAL : IMMUNOLOGYAND IMMUNOTECHNOLOGY		5	3	40	60	100
5	III	GEC THEORY - IV	23M4UBCA06	ALLIED: FOOD PROCESSING TECHNOLOGY	4		3	25	75	100
6	IV	SEC THEORY - IV	23M4UMBS04	VACCINE TECHNOLOGY	2		2	40	60	100
7	IV	SEC THEORY - V	23M4UMBS05	APICULTURE	2		2	25	75	100
8	IV	AECC - ENVIRONMENTAL STUDIES*	23M4UEVS01	ENVIRONMENTAL STUDIES			2	100		100
		*Self-Study		**TOTAL**	**25**	**5**	**23**	**305**	**495**	**800**
SEMESTER - V										
1	III	DSC THEORY - V	23M5UMBC05	BACTERIOLOGY AND MYCOLOGY	6		5	25	75	100
2	III	DSC THEORY - VI	23M5UMBC06	VIROLOGY AND PARASITOLOGY	6		5	25	75	100
3	III	DSC PRACTICAL - V	23M5UMBP05	PRACTICAL : BACTERIOLOGY, MYCOLOGY AND PARASITOLOGY		6	4	25	75	100
4	III	DSE THEORY - I	23M5UMBE01	ELECTIVE - I	5		4	40	60	100
5	III	DSE THEORY - II	23M5UMBE02	ELECTIVE - II	5		4	25	75	100
6	IV	AECC - VALUE EDUCATION	23M5UVED01	YOGA	2		2	100		100
7	IV	INTERNSHIP	23M5UMBIS1	INTERNSHIP			2	100		100
				TOTAL	**24**	**6**	**26**	**340**	**360**	**700**
SEMESTER - VI										
1	III	DSC THEORY - VII	23M6UMBC07	ENVIRONMENTAL AND AGRICULTURE MICROBIOLOGY	5		5	25	75	100
2	III	DSC THEORY - VIII	23M6UMBC08	FOOD, DAIRY AND PROBIOTIC MICROBIOLOGY	5		5	25	75	100
3	III	DSC PRACTICAL - VI	23M6UMBP06	PRACTICAL : ENVIRONMENTAL, AGRICULTURE AND FOOD MICROBIOLOGY		6	4	40	60	100
4	III	DSE THEORY - III	23M6UMBE03	ELECTIVE - III	5		4	25	75	100
5	III	DSE THEORY - IV	23M6UMBE04	ELECTIVE - IV	5		4	25	75	100
6	III	PROJECT WORK	23M6UMBPR1	PROJECT WORK		4	3	40	60	100
7	IV	Professional competency skill	23M6UMBOE1	MICROBIOLOGY FOR COMPETITIVE EXAMINATIONS			2	100		100
8	IV	EXTENSION ACTIVITY	23M6UEXA01	EXTENSION ACTIVITY	-		1			
				TOTAL	**20**	**10**	**28**	**280**	**420**	**700**
				OVER ALL TOTAL	**144**	**36**	**140**	**1495**	**2805**	**4300**
1	V	EXTRA CREDIT COURSE-ONLINE		MOOC Courses offered in SWAYAM/NPTEL	-	-	2	-	-	-
2	V	VALUE ADDED COURSE			-	-	2	-	-	-

HOD **Member Secretary Academic Council** **Principal**

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M1UMBC01	**FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY**	**DSC THEORY - I**	**I**	**5**	**5**	**-**	**-**	**5**
Objective	Students Learn the fundamental principles about different aspects of Microbiology							

Unit	Course Content	Knowledge Levels	Sessions
I	**History and Evolution of Microbiology, Classification** – three kingdoms, Five kingdoms, Six kingdoms and Eight kingdoms. Microbial biodiversity: Introduction to microbial biodiversity- ecological niche. Basic concepts of Eubacteria, Archaebacteria and Eucarya. Conservation of Biodiversity.	K1	12
II	**General characteristics of cellular microorganisms** (Bacteria, Algae, Fungi and Protozoa) and acellular microorganisms - (Viruses, Viroids, Prions), Differences between prokaryotic and eukaryotic microorganisms. Structure of Bacterial cell wall, cell membrane, capsule, flagella, pili, mesosomes, chlorosomes, phycobilisomes, spores, and gas vesicles. Structure of fungi (Mold and Yeast), Structure of microalgae.	K2	12
III	**Bacterial culture media and pure culture techniques**. Mode of cell division, Quantitative measurement of growth. Anaerobic culture techniques.	K3	12
IV	**Microscopy** – Simple, bright field, dark field, phase contrast, fluorescent, electron microscope – TEM & SEM, Confocal microscopy, and Atomic Force Microscopy. Stains and staining methods.	K4	12
V	**Sterilization**–moist heat - autoclaving, dry heat – Hot air oven, radiation – UV, Ionization, filtration – membrane filter and disinfection, antiseptic; Antimicrobial agents.	K5	12
Course Outcome	**CO1:** Remember the historical events, discoveries and inventions of Microorganisms.	K1	
	CO2: Summarize the structure and functions of prokaryotes and Eukaryotes.	K2	
	CO3: Apply the various culture media for growth of microorganisms.	K3	
	CO4: Analyze the bacterial morphology using Microscope.	K4	
	CO5: Evaluate the concept of asepsis through sterilization and disinfectants**.**	K5	
Learning Resources			

Text Books	1. Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7th Edition. McGraw –Hill, New York. 2. Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11th Edition. A La Carte Pearson.
Reference Books	1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers. 2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall 3. Madigan MT, and Martinko JM. (2006). Brock Biology of Micro-organisms. 8th edition. Parker J. Prentice Hall International, Inc.
Website Link	1. https://www.cliffsnotes.com/study-guides/biology/microbiology/introduction-to microbiology/a-brief-history-of-microbiology 2. https://www.keyence.com/ss/products/microscope/bz-x/study/principle/structure.jsp 3. https://bio.libretexts.org/@go/page/9188

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M1UMBC01	**FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY**	**DSC THEORY - I**	**I**	**5**	**5**	**-**	**-**	**5**	

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	M	M	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	M	S	S	S	S	S	S
CO5	S	S	S	M	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Mrs.N.Sathiyabama	Dr.M.Selvan	Dr.S.Shahitha

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE
(Autonomous)
Rasipuram - 637408.

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M1UMBP01	**PRACTICAL : FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY**	**DSC PRACTICAL - I**	**I**	**5**	**-**	**-**	**5**	**3**
Objective	Students learn about the basic microbial identification methods.							

S.No.	Course Content	Knowledge Levels	Sessions
1	Cleaning of glass wares, Microbiological good laboratory practice and safety.	K1-K5	3
2	Sterilization and assessment of sterility– Autoclave, hot air oven, and membrane filtration.	K2-K5	3
3	Media preparation: liquid media, solid media, semi-solid media, agar slants, agar deeps, agar plates.	K2-K5	9
4	Preparation of basal, differential and enriched media	K2-K5	3
5	Preparation of enrichment, transport, and selective media - quality control of media, growth supporting properties, sterility check of media.	K2-K4	6
6	Pure culture techniques: streak plate, pour plate, decimal dilution.	K2-K5	6
7	Culture characteristics of microorganisms: growth on different media, growth characteristics, and description.	K2-K5	6
8	Demonstration of pigment production.	K2-K5	3
9	Microscopy: light microscopy and bright field microscopy.	K2-K5	3
10	Staining techniques: smear preparation, simple staining, Gram's staining and endospore staining.	K5	9
11	Study on Microbial Diversity using Hay Infusion Broth	K4	3
12.	Study on Microbial Diversity -Wet mount to show different types of microbes, hanging drop method	K5	6
Course Outcome	**CO1:** Remember the laboratory good practices.	K1	
	CO2: Understand and Apply the culture media preparation.	K2	
	CO3: Identify the various cultural characters of Bacteria.	K3	

	CO4: Categorize the microscopic observation of microorganisms.	K4	
	CO5: Evaluate the microorganisms by Staining Methods.	K5	
Learning Resources			
Text Books	1. Aneja KR (2017). Experiments in Microbiology, Plant pathology and Biotechnology. 5th Edition, New Age International Publishers, Chennai. 2. Sundararaj T. Microbiology laboratory manual. Revised and published by Aswathy Sundararaj. No.5 First Cross Street, Thirumalai Nagar, Perungudi, Chennai.		
Reference Books	1. James G Cappuccino and Natalie Sherman (2007). Microbiology: A laboratory manual. 8th edition, Published by Pearson Education. 2. Kannan N (2002). Laboratory Manual in General Microbiology. First edition, Palani Paramount Publications, Palani. Tamil Nadu. 3. Harold J Benson (2006).Microbiological Applications Laboratory Manual in General Microbiology. 10th International edition, Me Grew - Hill, Boston.		
Website Link	1. https://onlinecourses.swayam2.ac.in/cec20_ag09/preview 2. https://onlinelibrary.wiley.com/doi/book/10.1002/0471223867 3.https://bio.libretexts.org/Learning_Objects/Laboratory_Experiments/Microbiology_Labs/Book%3A_General_Microbiology_Lab_Manual_(Pakpour_and_Horgan)		

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M1UMBP01	**PRACTICAL : FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY**			**DSC PRACTICAL - I**		**I**	**5**	**-**	**-**	**5**	**3**
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	S	M	S	L	M	S	S	S	S	S	
CO2	S	S	S	L	S	S	S	S	S	S	
CO3	S	S	S	M	M	S	S	S	S	S	
CO4	S	S	S	M	M	S	S	S	S	S	
CO5	S	S	S	M	S	S	S	S	S	S	
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG		
Tutorial Schedule	-									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation									
Assessment Methods	CIA I, CIA II and ESE									
Designed By			**Verified By**				**Approved By Member Secretary**			
Dr.S.Anbalagan			Dr.M.Selvan				Dr.S.Shahitha			

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M2UMBC02	**MICROBIAL PHYSIOLOGY AND METABOLISM**	**DSC THEORY - II**	**II**	**5**	**5**	**-**	**-**	**5**

Objective	Students learn the basic principles of microbial growth and metabolism		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Physiology of microbial growth:** Batch – continuous - synchronous cultures; Growth Curve and measurement method (turbidity, biomass and cell count). Control of microbial growth.	K1	10
II	**Nutrition requirements** - Photoautotrophs, Photoorganotrophs, Chemolithotrophs (Ammonia, Nitrite, Sulfur, Hydrogen, Iron oxidizing Bacteria), Chemoorganotrophs. Nutrition transport mechanisms – Passive diffusion and Active transport. Factors affecting microbial growth.	K2	10
III	**An overview of Metabolism** - Embden Meyerhof Pathway, Entner-Doudoroff Pathway, Pentose Phosphate Pathway, Tricarboxylic Acid Cycle. Electron Transport Chain and Oxidative Phosphorylation. ATP synthesis. Fermentation - Homolactic Fermentation, Heterolactic Fermentation, Mixed Acid Fermentation, Butanediol Fermentation.	K3	14
IV	**Photosynthesis** - An Overview of chloroplast structure. Photosynthetic Pigments, Light Reaction-Cyclic and non-cyclic Photophosphorylation. Dark Reaction - Calvin Cycle.	K3	12
V	**Bacterial reproduction** - Binary fission, Budding, Reproduction through conidia, cyst formation, endospore formation. Fungi asexual and sexual reproduction, Microalgae reproduction. Asexual and sexual reproduction of protozoa.	K4	14
Course Outcome	**CO1:** Remember about microbial growth and measurement.	K1	
	CO2: Understand the concept of nutritional requirements and various factors for microbial growth.	K2	
	CO3: Construct the ways of microbial metabolism.	K3	
	CO4: Make use of energy production in Photosynthesis.	K3	
	CO5: Characterize the microbial reproductions.	K4	
Learning Resources			

Text Books	1. Schlegal, H.G. (1993). General Microbiology.,7th Edition, Press syndicate of the University of Cambridge. 2. Rajapandian K. (2010). Microbial Physiology, Chennai: PBS Book Enterprises India.
Reference Books	1. Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49. 2. Daniel R. Caldwell. (1995). Microbial Physiology & Metabolism Wm. C. Brown Communications, Inc. USA. 3. Moat, A.G and J.W Foaster (1995). Microbial Physiology, 3rd edition. Wiley – LISS, A John Wiley & Sons. Inc. Publications. 4. Bhanu Shrivastava. (2011). Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism. Lambert academic Publication.
Website Link	1. https://sites.google.com/site/microbial physiology odd sem. /teaching-contents 2. https://onlinecourses.swayam2.ac.in/cec20_bt14/preview 3. https://www.frontiersin.org.microbial-physiology-and-metabolism

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M2UMBC02	**MICROBIAL PHYSIOLOGY AND METABOLISM**		**DSC THEORY - II**	**II**	**5**	**5**	**-**	**-**	**5**	
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	S	M	M	S	M	M	M	S
CO2	S	M	S	M	M	S	M	M	S	S
CO3	S	M	S	S	M	S	S	M	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-		
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation		
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE		
Designed By	**Verified By**	**Approved By Member Secretary**	
Mrs.N.Sathyabama	Dr.M.Selvan	Dr.S.Shahitha	

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M2UMBP02	**PRACTICAL : MICROBIAL PHYSIOLOGY AND METABOLISM**	**DSC PRACTICAL - II**	**II**	**5**	**-**	**-**	**5**	**3**
Objective	Students learn about the basic physiological factors and bacterial identification methods							

S.No.	Course Content	Knowledge Levels	Sessions
1	Motility demonstration: hanging drop, wet mount preparation, semi-solid agar, Craigie's tube method.	K1-K4	6
2	Staining techniques: Smear preparation, permanent specimen preparation, Capsular and Acid-fast staining	K2-K4	6
3	Direct counts – Direct cell count (Petroff - Hausser counting chamber), Turbidometry.	K2-K4	6
4	Viable count - pour plate, spread plate. Bacterial growth curve.	K2-K3	9
5	Anaerobic culture methods.	K2-K4	3
6	Antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains.	K2-K4	6
7	Morphological variations in algae, fungi and protozoa.	K2-K4	3
8	Micrometry: Demonstration of the size of yeast, fungal filaments and protozoa.	K3	6
9	Methods of bacterial identification- morphological and physiological method.	K2-K4	6
10	Methods of bacterial identification- Biochemical methods - IMViC test, H2S, TSI, Oxidase, Catalase, Urease test and Carbohydrate fermentation test.	K5	9
11	Maintenance of pure culture, paraffin method, stab culture, maintenance of mould culture.	K2-K5	6
Course Outcome	**CO1:** Remember about the staining methods and motility determination of bacteria.	K1	
	CO2: Understand and Apply the bacterial growth determinations.	K2	
	CO3: Apply the anaerobic culture methods and AST methods.	K3	
	CO4: Analyze the morphology and size determination of Eukaryotes.	K4	

	CO5: Recommended the identification of bacteria and its pure culture maintenance.	K5	

Learning Resources	
Text Books	1. Aneja KR (2017). Experiments in Microbiology, Plant pathology and Biotechnology. 5th Edition, New Age International Publishers, Chennai. 2. Sundararaj T. Microbiology laboratory manual. Revised and published by A Swathy Sundararaj. No.5 First Cross Street, Thirumalai Nagar, Perungudi, Chennai.
Reference Books	1. James G Cappuccino and Natalie Sherman (2007). Microbiology: A laboratory manual. Sixth edition, Published by Pearson Education. 2. Kannan N (1996). Laboratory Manual in General Microbiology. First edition, Palani Paramount Publications, Palani. Tamil Nadu. 3. Harold J Benson (2006).Microbiological Applications Laboratory Manual in General Microbiology. Tenth International edition, Me Grew - Hill, Boston.
Website Link	1. https://www.frontiersin.org/books/Microbial_Physiology_and_Metabolism 2. https://onlinecourses.swayam2.ac.in/cec20_bt14/preview 3.https://www.agr.hokudai.ac.jp/microbial-physiology

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M2UMBP02	**PRACTICAL : MICROBIAL PHYSIOLOGY AND METABOLISM**	**DSC PRACTICAL - II**	**II**	**5**	**-**	**-**	**5**	**3**	

CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	M	L	S	S	S	S
CO2	S	S	S	S	L	M	S	S	S	S
CO3	S	S	S	S	M	M	S	S	S	S
CO4	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation
Assessment Methods	Mode Practical, CIA I, CIA II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Mrs.N.Sathyabama	Dr.M.Selvan	Dr.S.Shahitha

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3UMBC03	**MOLECULAR BIOLOGY AND MICROBIAL GENETICS**	**DSC THEORY - III**	**III**	**5**	**5**	**-**	**-**	**5**
Objective	Students acquire the knowledge about DNA structure, DNA replication and biological process							

Unit	Course Content	Knowledge Levels	Sessions
I	**DNA Structure**- Salient features of double helix, forms of DNA. Denaturation and renaturation. DNA topology – Super coiling, linking number, topoisomerases. DNA organization in prokaryotes, viruses, eukaryotes. Replication of DNA in prokaryotes and eukaryotes - Bidirectional and unidirectional replication, semi-conservative and semi-discontinuous replication. Mechanism of DNA replication – enzymes involved –DNA polymerases, DNA ligase, primase. DNA replication modes- rolling circle, D-loop modes.	K1	12
II	**Transcription in Prokaryotes**. Concept of transcription. RNA Polymerases - prokaryotic and eukaryotic. General transcription factors in eukaryotes. Distinction between transcription processes in prokaryotes versus eukaryotes. Translation in prokaryotes and eukaryotes - Translational machinery - ribosome structure in prokaryotes and eukaryotes, tRNA structure and processing. Inhibitors of protein synthesis in prokaryotes and eukaryotes. Overview of regulation of gene expression - *lac, trp* and *ara* operons as examples. Regulation of gene expression by DNA methylation	K2	12
III	**Mutation** - Definition and types- base substitutions, frame shifts, deletions, insertions, duplications, inversions. Silent, conditional, and lethal mutations. Physical and chemical mutagens. Reversion and suppression. Uses of mutations. Repair Mechanisms – Photo reactivation, Nucleotide Repair, Base Excision Repair, Methyl Directed Mismatch Repair and SOS Repair.	K3	12
IV	**Plasmid replication** and partitioning, host range, plasmid incompatibility, plasmid amplification, regulation of plasmid copy number, curing of plasmids. Types of plasmids – R Plasmids, F plasmids, colicinogenic plasmids, metal resistance plasmids, Ti plasmid, linear plasmids, yeast 2µ plasmid. Bacteriophage-T4, Virulent Phage – Structure and life cycle. Lambda phage- Structure. Lytic and Lysogenic cycle. Applications of Phages in Microbial Genetics	K3	12
V	**Gene Transfer Mechanisms** - Conjugation and its uses. Transduction - Generalized and Specialized, Transformation - Natural Competence and Transformation. Transposition and Types of Transposition reactions. Mechanism of transposition: Replicative and non- replicative transposition. Transposable elements - Prokaryotic transposable	K3	12

	elements – insertion sequences, composite, and non-composite transposons. Uses of Transposons. **Current Trends- *Interaction of genes, behaviour and social environment***		
	…… Self Study.		
Course Outcome	**CO1:** Recall about DNA structure and their replication	K1	
	CO2: Summarize the transcription process and regulation of gene expression	K2	
	CO3: Identify the types of mutation and repair mechanisms	K3	
	CO4: Choose the various plasmids in Microbial Genetics	K3	
	CO5: Develop the various gene transfer mechanisms	K3	

Learning Resources				
Text Books	1. Brown T. A. (2016). Gene Cloning and DNA Analysis- An Introduction. (7th Edition). John Wiley and Sons, Ltd. 2. Dale J. W., Schantz M.V. and Plant N. (2012). From Gene to Genomes – Concepts and Applications of DNA Technology. (3rd Edition). John Wileys and Sons Ltd. 3. Malacinski G.M. (2008). Freifelder's Essentials of Molecular Biology. 4th Edition. Narosa Publishing House, New Delhi.			
Reference Books	1. Glick B. R. and Patten C.L. (2018). Molecular Biotechnology – Principles and Applications of Recombinant DNA. 5th Edition. ASM Press. 2. Nelson, D.L. and Cox, M.M. Lehninger (2017). Principles of Biochemistry. 7th Edition, W.H. Freeman. 3. Synder L., Peters J. E., Henkin T.M. and Champness W. (2013). Molecular Genetics of Bacteria, 4th Edition, ASM Press Washington-D.C. ASM Press.			
Website Link	1. https://microbenotes.com/gene-cloning-requirements-principle-steps-applications/ 2. https://courses.lumenlearning.com/boundless-biology/chapter/dna-replication/ 3. Molecular Biology Notes - Microbe Notes			
Self-Study Material	1. https://www.prb.org/wp-content/uploads/2012/12/TodaysResearchAging27.pdf			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3UMBC03	**MOLECULAR BIOLOGY AND MICROBIAL GENETICS**		**DSC THEORY - III**		**III**	**5**	**5**	**-**	**-**	**5**

CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	S	S	M	M	S	S	S	S	S
CO5	S	S	S	M	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Mrs.S.Vahithabanu	Dr.M.Selvan	Dr.S.Shahitha

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3UMBP03	**PRACTICAL : MOLECULAR BIOLOGY AND MICROBIAL GENETICS**	**DSC PRACTICAL - III**	**III**	**5**	**-**	**-**	**5**	**3**
Objective	Students acquire the knowledge of isolation and separation methods of biomolecules							

S. No.	Course Content	Knowledge Levels	Sessions
1	Study of different types of DNA and RNA using micrographs and model / schematic representations.	K1	5
2	Study of semi-conservative replication of DNA through micrographs / schematic representations	K2	5
3	Isolation of Genomic and Plasmid DNA from *E. coli* and Analysis by Agarose gel electrophoresis.	K5	10
4	Estimation of DNA using colorimeter (diphenylamine reagent), UV spectrophotometer (A260 measurement).	K4	5
5	Resolution and visualization of proteins by polyacrylamide gel electrophoresis (SDS-PAGE)	K3	5
6	UV induced auxotrophic mutant production and isolation of mutants by replica plating technique	K3	5
7	Perform artificial Transformation in *E. coli.*	K3	5
8	Isolation of antibiotic resistant mutants by gradient plate method.	K3	5
9	Screening and isolation of phages from sewage.	K4	5
10	Perform RNA isolation.	K5	5
11	Estimate RNA.	K4	5
Course Outcome	**CO1:** Label the DNA and RNA micrograph	K1	
	CO2: Outline the DNA replication process	K2	
	CO3: Identify the methods to separation of bio molecules	K3	
	CO4: Categorize the bio molecules estimation and isolation of bacteriophage	K4	
	CO5: Evaluate the bio molecules isolation.	K5	

Learning Resources	
Text Books	1. Crichton. M. (2014). Essentials of Biotechnology. Scientific International Pvt. Ltd. New Delhi. 2. Dale J. W., Schantz M. V. and Plant N. (2012). From Gene to Genomes – Concepts and Applications of DNA Technology. (3rd Edition). John Wileys and Sons Ltd. 3. James G Cappucino. and Natalie Sherman. (2016). Microbiology – A laboratory manual. (5th Edition). The Benjamin publishing company. New York.

Reference Books	1. Glick B. R. and Patten C.L. Molecular Biotechnology – Principles and Applications of Recombinant DNA. 5th Edition. ASM Press. 2018 2. Nelson, D.L. and Cox, M.M. Lehninger (2017). Principles of Biochemistry. 7th Edition, W.H. Freeman. 3. Brown T.A. (2016). Gene Cloning and DNA Analysis. (7th Edition). John Wiley and Jones, Ltd
Website Link	1. https://www.molbiotools.com/usefullinks.html 2. https://www.molbiotools.com/usefullinks.html 3. https://geneticgenie.org3/

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3UMBP03	**PRACTICAL : MOLECULAR BIOLOGY AND MICROBIAL GENETICS**			**DSC PRACTICAL - III**		**III**	**5**	**-**	**-**	**5**	**3**
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	S	M	S	L	M	S	S	S	S	S	
CO2	S	S	S	L	S	S	S	S	S	S	
CO3	S	S	S	M	M	S	S	S	S	S	
CO4	S	S	S	M	M	S	S	S	S	S	
CO5	S	S	S	M	S	S	S	S	S	S	
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG		
Tutorial Schedule	-									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation									
Assessment Methods	CIA I, CIA II and ESE									
Designed By			**Verified By**				**Approved By Member Secretary**			
Mrs.S.Vahithabanu			Dr.M.Selvan				Dr.S.Shahitha			

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBC04	**IMMUNOLOGY AND IMMUNOTECHNOLOGY**	**DSC THEORY - IV**	**IV**	**5**	**5**	**-**	**-**	**5**

Objective	Students gain knowledge about immune system, organs of immunity and cells involved.		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Organs and Cells in Immune System and Immune Response:** Scope and history of Immunology. Physiology of immune response- innate, humoral and cell mediated immunity. Cells and organs of immune system. Haematopoiesis- B cell, T cell- subpopulation, antigen presenting cells. Phagocytosis. Primary lymphoid organs, secondary lymphoid organs, and lymphoid tissues. Apoptosis.	K1	12
II	**Antigen and Antibody:** Antigens - Properties of haptens, epitopes, adjuvants, and cross reactivity; Antibodies- structure, properties, classes; Antigen and Antibody Reactions: precipitation, agglutination, opsonisation and neutralization. Complement system – Classical and Alternate pathway. Vaccines – active and passive immunization; Vaccine - definition, classification, types and Vaccination schedule	K2	12
III	**Immunological disorders and diseases** - Hypersensitivity reactions (Type I, II, III and IV); acquired immunodeficiency syndrome; Auto immune disorders and diseases: organ specific and non-organ specific	K3	12
IV	**Transplantation and Tumor Immunology** - MHC Antigens - structure and function; HLA system - Regulation and response to immune system; Transplantation immunology - tissue transplantation and grafting; Mechanism of graft acceptance and rejection; HLA typing; Tumor specific antigens; Immune response to tumors; Immune diagnosis; cancer immune therapy.	K3	12
V	**Immunoassay and Immunotechniques** - Preparation and standardization of bacterial antigens; Raising of monoclonal and polyclonal antibodies; Purification of antibodies. Immunohematology – ABO Blood grouping. Immunotechniques - RIA, CFT, RAST, ELISA, Immuno fluorescence techniques and Flow cytometry. **Current trends: "Impacts of vaccines"**	K4	12
	…… Self Study.		
Course Outcome	**CO1:** List out the cells and organs of immune system	K1	
	CO2: Illustrate the antigen antibody interactions	K2	
	CO3: Build the various immunological techniques	K3	
	CO4: Experiment the transplantation immunology	K3	
	CO5: Compare the various hypersensitive conditions and its consequences.	K4	

Learning Resources	
Text Books	1. Judith A.Owen, Jenni Punt, Sharon A. Stranford, Janis Kuby. (2013). Immunology, 7th Edition. W. H. Freeman and Company, New York. 2. Robert R. Rich, Thomas A. Fleisher, William T. Shearer, Harry Schroeder, Anthony J. Frew, Cornelia M. Weyand (2018) Clinical Immunology: Principles and Practice, 5th Edition. Elsevier. 3. Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai (2021) Cellular and Molecular Immunology, 10thEdition. Elsevier.
Reference Books	1. William R Clark. (1991). The Experimental Foundations of Modern Immunology. 3 rd Edition. John Wiley and Sons Inc. New York 2. Frank C. Hay, Olwyn M. R. Westwood. (2002). Practical Immunology, 4thEdition. Wiley-Blackwell. 3. Peter J. Delves, Seamus Martin, Dennis R. Burton, Ivan M. Roitt. (2006). Roitt's Essential Immunology, 11thEdition. Wiley-Blackwell.
Website Link	1. https://www.ncbi.nlm.nih.gov/books/NBK279395/ 2. https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall 005/ pages/ lecture-notes/
Self-Study Material	1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7371956/ 2. https://www.who.int/news-room/feature-stories/detail/counting-the-impact-of-vaccines

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBC04	**IMMUNOLOGY AND IMMUNOTECHNOLOGY**		**DSC THEORY - IV**		**IV**	**5**	**5**	**-**	**-**	**5**
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	M	M	S	S	M	M	M	S
CO2	S	S	S	M	M	M	S	S	M	S
CO3	S	M	M	S	S	S	S	S	S	S
CO4	S	S	M	S	S	S	S	S	M	S
CO5	S	M	S	S	M	M	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation	
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By Member Secretary**
Dr.K.Vithiya	Dr.M.Selvan	Dr.S.Shahitha

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBP04	**PRACTICAL : IMMUNOLOGY AND IMMUNOTECHNOLOGY**	**DSC PRACTICAL - IV**	**IV**	**5**	**-**	**-**	**5**	**3**
Objective	Students become proficient in basic immunological techniques							

S.No.	Course Content	Knowledge Levels	Sessions
1	Identification of blood group and typing. Coomb's test. TPHA	K1	12
2	T cell identification (Demonstration) Latex Agglutination reactions- RF, ASO, Widal Slide test, Pregnancy card test and CRP	K2	12
3	Ouchterlony's Double Diffusion Method (antigen pattern). Single Radial Immuno Diffusion Method	K3	12
4	Electrophoresis - Serum, Counter and Immuno.	K3	12
5	Separation of Lymphocytes by gradient centrifugation method. ELISA: Hepatitis/ HIV	K4	12
Course Outcome	**CO1:** Find the blood groups and types	K1	
	CO2: Explain the serological diagnostic tests	K2	
	CO3: Construct the methods for antigen antibody reactions	K3	
	CO4: Contrast antigens and antibodies in electrophoresis.	K3	
	CO5: Analyze the concept of ELISA	K4	

Learning Resources	
Text Books	1. Richard Coico, Geoffrey Sunshine, Eli Benjamini. (2003). Immunology – A Short Course. 5thEdition. Wiley-Blackwell, New York. 2. Talwar. (2006). Hand Book of Practical and Clinical Immunology, Vol. I, 2nd edition, CBS. 3. Judith A.Owen, Jenni Punt, Sharon A. Stranford, Janis Kuby. (2013). Immunology, 7 edition. W. H. Freeman and Company, New York.
Reference Books	1. Peter J. Delves, Seamus Martin, Dennis (2006). Roitt's Essential Immunology, 11thEdition., Wiley-Blackwell 2. Frank C. Hay, Olwyn M. R. Westwood. (2008). Practical Immunology, 4th Edition, Wiley-Blackwell. 3. Wilmore Webley. (2016). Immunology Lab Manual, LAD Custom Publishing.
Website Link	1. https://www.researchgate.net/publication/275045725_Practical_Immunology 2. https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/labs/frelinger-lab/documents/Immunology-Lab-Manual.pdf 3. https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC106J-lab-manual.pdf

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBP04	**PRACTICAL : IMMUNOLOGY AND IMMUNOTECHNOLOGY**			**DSC PRACTICAL - IV**		**IV**	**5**	**-**	**-**	**5**	**3**
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	M	S	S	M	S	S	S	S	S	
CO2	S	S	S	S	M	M	S	S	S	
CO3	S	S	S	S	M	S	S	S	M	
CO4	S	S	S	S	M	M	S	S	M	
CO5	S	M	M	M	M	M	S	S	M	
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	
Tutorial Schedule	-									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation									
Assessment Methods	Model Practical, CIA I, CIA II and ESE									
Designed By			**Verified By**				**Approved By Member Secretary**			
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MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE
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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBC05	**BACTERIOLOGY AND MYCOLOGY**	**DSC THEORY - V**	**V**	**6**	**4**	**2**	**-**	**5**
Objective	Students acquire a knowledge about pathogenic microbes of various diseases and clinical diagnosis							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction**: History, Classification of Medically Important Microbes, Koch's, and River's postulate - A brief account on the Normal microbial flora of the healthy human body. – Host-pathogen interactions: Definitions of infection, invasion, primary and opportunistic pathogens, pathogenicity, virulence, toxigenicity, carriers, endemic, epidemic, pandemic diseases and epidemiology – putative virulence factors of human pathogens – infectious disease cycle. Collection and transport of clinical specimens for bacterial and fungal infections.	K1	12
II	**Medically important Gram - Positive infections** - Causative agent, clinical symptoms, Pathogenesis, mode of transmission, prevention and treatment of the following bacterial diseases Streptococcal infections (*Streptococcus pyogenes, Streptococcus pneumoniae*). Staphylococcal infections (*Staphylococcus aureus*), Tetanus (*Clostridium tetani)* Diphtheria (*Corynebacterium diphtheriae*) Anthrax (*Bacillus anthracis*) Tuberculosis (*Mycobacterium tuberculosis*), Leprosy (*Mycobacterium leprae*).	K2	12
III	**Medically important Gram - Negative infections** - Causative agent, clinical symptoms, pathogenesis, mode of transmission, prevention, and treatment of the following bacterial diseases Meningitis (*Neisseria meningitidis*) Typhoid (*Salmonella typhi*, *Salmonella paratyphi*). Cholera (*Vibrio cholerae*) (bacillary dysentery (*Shigella dysenteriae*); Sexually Transmitted disease (syphilis – *Treponema pallidum*. Gonorrhoea – *Neisseria gonorrhoeae*); Nosocomial infections – definition, importance and their control (*Pseudomonas aeruginosa*).	K3	12
IV	**Medically important Fungi** - Classification of medically important fungi; Superficial mycoses: *Pityriasis versicolor*; *Tinea nigra;* Piedra. Cutaneous mycoses: *Microsporum sps, Trichophyton sps*, and *Epidermophyton floccosum*. Subcutaneous mycoses: Chromoblastomycosis; Sporotrichosis; Systemic Mycoses - Blastomycosis; Histoplasmosis; Opportunistic Infections - Candidiasis; Cryptococcosis; Zygomycosis; Mycotoxins: Aflatoxin	K4	12
V	**Antimicrobial agents** - General characteristics and mode of action of Antibacterial agents: Modes of action with an example for each: Inhibitor of	K5	12

	nucleic acid synthesis, cell wall synthesis, cell membrane function, protein synthesis and metabolism. Antifungal agents: Mechanism of action of Amphotericin B and Griseofulvin**. Current Trends-* MRSA in the 21st Century- Emerging Challenges***		
	…… Self Study.		
Course Outcome	**CO1:** Recite the importance of normal flora of human body.	K1	
	CO2: Interpret the various bacterial pathological events	K2	
	CO3: Compile a list of disease causing bacteria	K3	
	CO4: Comprehend human-fungal interaction on fungal diseases	K4	
	CO5: Evaluate the types of mycoses caused in human	K5	

Learning Resources	
Text Books	1. Ananthanarayanan, R. and JayaramPanicker C.K. (2020) Text book of Microbiology. Orient Longman, Hyderabad. 2. Jagdish Chander (2018). Textbook of Medical Mycology, 4th edition, Jaypee brother's medical publishers. 3. Greenwood, D., Slack, R.B. and Peutherer, J.F. (2012) Medical Microbiology, 18thEdition. Churchill Livingstone, London.
Reference Books	1. Kevin Kavanagh, (2018). Fungi Biology and Applications 3rd Edition. Wiley Blackwell publishers. 2. Christopher C. Kibbler, Richard Barton, Neil A. R. Gow, Susan Howell, Donna M. MacCallum, Rohini J. Manuel (2017). Oxford Textbook of Medical Mycology. Oxford University Press. 3. C.J. Alexopoulos, C.W. Mims, M. Blackwell, (2007). Introductory Mycology, 4th edition. Wiley publishers.
Website Link	1. https://microbiologysociety.org/members-outreach-resources/links.html 2. https://www.isham.org/mycology-resources/mycological-links 3. http://textbookofbacteriology.net/nd
Self-Study Material	1. https://ebookcentral.proquest.com/lib/inflibnet-ebooks/reader.action?docID=3035907 2. https://link.springer.com/chapter/10.1007/978-0-387-72418-8_2#Bib1

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBC05	**BACTERIOLOGY AND MYCOLOGY**			**DSC THEORY - V**		**V**	**6**	**4**	**2**	**-**	**5**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	M	S	M	S
CO2	S	M	M	S	S	S	M	S	M	S
CO3	S	S	M	S	S	S	M	S	M	S
CO4	S	S	S	M	S	S	M	S	M	S
CO5	S	S	S	S	S	S	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation	
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By Member Secretary**
Dr.S.Shahitha	Dr.M.Selvan	Dr.S.Shahitha

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBC06	**VIROLOGY AND PARASITOLOGY**	**DSC THEORY - VI**	**V**	**6**	**4**	**2**	**-**	**5**
Objective	Students gain knowledge on medically important viruses and parasites							

Unit	Course Content	Knowledge Levels	Sessions
I	**Viruses** - General Properties, replication and Classification (Baltimore classification), Cultivation in animals, embryonated eggs and tissue culture. Virus purification assays - collection and transport of clinical specimens for viral infections.	K1	10
II	**Viral diseases** with reference to symptoms, pathogenesis, transmission, prophylaxis and control – Arboviruses (Flavi virus), Picorna viruses (Polio virus and Rhinovirus), Hepatitis viruses (HAV and HBV), Rabies virus, Orthomyxoviruses (Influenza virus) and Paramyxoviruses (Mumps and Measles virus), Pox viruses (Variola, Vaccinia), Herpes viruses (Herpes simplex, Varicella zoster), Adeno viruses and HIV viruses. Oncogenic viruses (Human Papilloma virus): Introduction, characteristics of transformed cells, mechanism of viral oncogenesis and clinical manifestations.	K2	14
III	**Emerging and re-emerging viral infections:** (SARS, Swine flu, Ebola, Dengue, Chikungunya- and Corona) – causes, spread and preventive measures. Detection of viruses in clinical specimens – Serological and Molecular diagnosis of virus infections – Antiviral agents, Interferons and Viral Vaccines, Immunization schedules.	K3	12
IV	**General introduction to Medical Parasitology:** Classification of medically important parasites. Morphology, life cycle, pathogenesis, clinical features, laboratory diagnosis, prevention and treatment of diseases caused by the following organisms: *Entameoba histolytica*, flagellates (*Giardia lamblia, Leishmania donovani*), Sporozoa- *Plasmodium sps.*	K3	12
V	**Introduction to Helminthes:** Platyhelminthes – *Taenia* – *Fasciola* – *Paragonimus* – *Schistosoma sps.* Nemathelminthes – Ascaris– *Ankylostoma* – *Enterobius* – *Trichuris - Trichinella* – *Wuchereria.* Laboratory techniques in parasitology - Collection, transport and examination of specimen. Examination of faeces for ova and cyst by direct wet mount and iodine wet mount, Concentration methods (Floatation and Sedimentation techniques), Examination of blood for parasites. Cultivation of parasites**. Current Trends- * Impacts of Covid-19***	K4	14
	…… Self Study.		

Course Outcome	**CO1:** Recall the structure and properties of viruses, cultivation methods and diagnosis of viral diseases.				K1
	CO2: Classify themedically important viruses				K2
	CO3: Choose the methods to diagnosis of viral infections				K3
	CO4: Identify the protozoan parasites and their characterization				K3
	CO5: Classify the general characters, clinical manifestation and diagnosis of helminthes				K4
Learning Resources					
Text Books	1. S. Rajan (2007). Medical microbiology, MJP publisher. 2. Jeyaram Paniker, C.K. (2006). Text Book of Parasitology Jay Pee Brothers, New Delhi. 3. Parija S. C. (1996). Text Book of Medical Parasitology.4th edition, Orient Longman, All India Publishers & Distributors.				
Reference Books	1. Jawetz, E., Melnick, J.L. and Adel berg, E.A. (2000). Review of Medical Microbiology, 19th Edition. Lange Medical Publications, U.S.A. 2. Ananthanarayan, R. and Jeyaram Paniker, C.K. (2009). Text Book of Microbiology, 8th Edition. Orient Longman, Chennai. 3. Topley & Wilsons's (1990). Principles of Bacteriology, Virology and Immunity, 8th Edition, Vol. III Bacterial Diseases, Edward Arnold, London.				
Website Link	1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4047123/ 2. https://www.ncbi.nlm.nih.gov/pubmed/21722309				
Self-Study Material	1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8767375/ 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9217716/ r.				
	L-Lecture	T-Tutorial	P-Practical	C-Credit	

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBC06	**VIROLOGY AND PARASITOLOGY**		**DSC THEORY - VI**		**V**	**6**	**4**	**2**	**-**	**5**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	M	S	M	S
CO2	S	M	M	S	M	S	M	S	M	S
CO3	S	S	M	S	M	S	M	S	M	S
CO4	S	S	S	M	M	S	M	S	M	S
CO5	S	S	L	S	M	S	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Dr.M.Selvan	Dr.M.Selvan	Dr.S.Shahitha

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBP05	**PRACTICAL : BACTERIOLOGY, MYCOLOGY AND PARASITOLOGY**	**DSC PRACTICAL - V**	**V**	**6**	**-**	**-**	**6**	**4**
Objective	Students learn the techniques for isolation and identification of Microbial pathogens.							

Unit	Course Content	Knowledge Levels	Sessions
I	1. Collection and Transport of Clinical specimens. 2. Simple, Differential and Special staining of Clinical materials. 3. Culture techniques used to isolate microorganisms.	K2	12
II	4. Identification of bacterial pathogens by their biochemical reactions. 5. Antimicrobial susceptibility testing by disc-diffusion technique and determination of Minimum Inhibitory Concentration.	K3	12
III	6. Isolation of Bacteriophages from Sewage and other natural sources. 7. Identification of Viruses in Slides/Smears/Spotters. Demonstration of Negri bodies (Staining). 8. Cultivation of Viruses in Embryonated eggs – Amniotic, Allantoic, Yolk sac routes and Chorioallantois membrane.	K4	12
IV	9. Microscopic identification of medically important Fungi – KOH and Lactophenol cotton Blue staining. 10. Slide culture techniques for fungal Identification 11. Identification of Dermatophytes. 12. Germ tube test, Carbohydrate fermentation and assimilation tests for Yeasts.	K4	12
V	13. Direct Examination of Faeces – wet mount and Iodine mount – Demonstration of Protozoan cysts and Helminthes eggs. 14. Concentration techniques of stool specimen – Floatation and Sedimentation methods. 15. Examination of blood for Malarial parasites – thick and thin smear preparations. 16. Identification of Medically important parasites in slides / specimens as spotters.	K5	12
Course Outcome	**CO1:** Demonstrate methods to observe and measure microorganisms by standard microbiological techniques	K2	
	CO2: Interpret the sensitivity of Pathogenic microorganisms	K3	
	CO3: Characterize clinically important viruses and bacteriophages	K4	

	CO4: Elucidate clinically important fungi.			K4	
	CO5: Evaluate Parasite of Medial Importance			K5	
Learning Resources					
Text Books	1. Dubey, R.C. and Maheswari, D.K. (2020). S. Chand Publishers. ISBN-13: 978- 8121921534, ISBN-10: 8121921538. 2. K.R. Aneja (2017). Experiments in Microbiology, Plant Pathology, Tissue Culture and Microbial Biotechnology. 5th Edition. New Age International Publishers. ISBN-10: 9386418304, ISBN-13: 978-9386418302. 3 James H. Jorgensen, Karen C. Carroll, Guido Funke, Michael A. Pfaller, Marie Louise Landry, Sandra S. Richter, David W. Warnock (2015). Manual of Clinical Microbiology, 11th Edition, ASM press				
Reference Books	1. Patricia M. Tille (2021). Bailey & Scott's Diagnostic Microbiology, 15th Edition. Elsevier. ISBN-10: 0323681050, ISBN-13: 978-0323681056. 2 Monica Cheesbrough (2006). District Laboratory Practice in Tropical Countries. Part 1. 2 nd Edition. Cambridge University Press. ISBN-10: 0521171571, ISBN-13: 978- 0521171571. 3 Michael A. P faller (ed.) (2015). Manual of Clinical Microbiology. Vol. 1 and 2. 11th Edition. ASM Press. ISBN-10: 9781555817374, ISBN-13: 978-1555817374.				
Website Link	1. https://www.microcarelab.in/media/microcarelab.in/files/Sample-Collection-Manual.pdf 2.http://ssu.ac.ir/cms/fileadmin/user_upload/Daneshkadaha/pezeshki/microb/file_amuzeshi/Lab_QA_Microbiology_QA.pdf 3.https://www.academia.edu/11977315/Basic_Laboratory_Procedures_in_Clinical_Bacteriology				
	L-Lecture	T-Tutorial	P-Practical	C-Credit	

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBP05	**PRACTICAL : BACTERIOLOGY, MYCOLOGY AND PARASITOLOGY**			**DSC PRACTICAL - V**	**V**	**6**	**-**	**-**	**6**	**4**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	S	S	L	M	M	S
CO2	S	S	S	M	M	L	S	S	M	S
CO3	S	M	M	S	S	S	S	S	S	S
CO4	S	S	M	S	S	S	S	S	M	S
CO5	S	M	S	S	M	M	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation
Assessment Methods	CIA I, CIA II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Dr.S.Shahitha	Dr.M.Selvan	Member Secretary

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBC07	**ENVIRONMENTAL AND AGRICULTURE MICROBIOLOGY**	**DSC THEORY - VII**	**VI**	**5**	**5**	**-**	**-**	**5**
Objective	Students become competent in microorganisms involved in agricultural and environmental aspects							

Unit	Course Content	Knowledge Levels	Sessions
I	**Microorganisms and their Habitats:** Structure and function of ecosystems. Soil profile and soil microflora, Microbial succession in decomposition of soil organic matter. Role of microorganisms in elemental cycles in nature: Carbon, Nitrogen. Aquatic Environment: Microflora of fresh water and marine habitats, factors influencing microbial growth in the aquatic environments. Water borne diseases and their control measures. Atmosphere: Aeromicroflora and dispersal of microbes, Assessment of air quality, Enumeration of microorganism in air, Air borne diseases.Air sanitation. Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels. Environmental Protection Agency (EPA) - role in environmental protection.	K1	12
II	**Water potability:** Sources and types of water surface, ground, stored, distilled, mineral and de-mineralized water and their pollution, biological indicators of water Pollution, Eutrophication. Conventional Bacteriological standards of Water Quality, MPN index, coliform test, Membrane filtration. BOD, COD. Advanced molecular methods for water analysis. Water borne diseases. Central Pollution Control Board (CPCB) standards.	K2	12
III	**Microbial Interactions**: Rhizosphere microflora. Concepts of Nitrogen fixation – Symbiotic and asymbiotic nitrogen fixers. Brief account of microbial interactions: Symbiosis, Neutralism, Commensalism, Competition, Amensalism, Synergism, Parasitism, and Predation. General account and Significance of Biofertilizers and biocontrol agents – Bacterial, cyanobacterial, VAM. Mass production of Rhizobial biofertilizer. Bio control agents – Bacterial, viral, fungal.	K3	12
IV	**Waste treatment and bioremediation:** Solid waste management: Sources and types of solid waste, composting, vermin composting, production of biogas. Liquid waste management: Primary, secondary, and tertiary sewage treatment. Bioremediation and waste management: Need and scope of bioremediation. Degradation of hydrocarbons, oil spills, heavy metals – Chromium, lead, and xenobiotics – PCB.	K4	12

V	**Plant pathology:** Mode of entry of pathogens, Microbial enzymes, toxins, growth regulators and suppressor of plant defence in plant diseases. Plant defence mechanisms. Bacterial diseases – Citrus canker, Blight of paddy. Viral disease – TMV, CMV. Fungal disease- red rots of sugarcane, Tikka disease. Plant disease management. **Current Trends-*Role of Microbes in sustainable Agriculture***	K5	12
	…… Self Study.		
Course Outcome	**CO1:** Recall about physical and biological factors for microbes in environment	K1	
	CO2: Summarize the knowledge of water pollution and their potability	K2	
	CO3: Construct the knowledge about the microbial interactions in environment	K3	
	CO4: Categorize the liquid and solid waste management	K4	
	CO5: Evaluate the knowledge about the plant disease and their control measures for crop productivity	K5	

Learning Resources	
Text Books	1. Joseph C. Daniel. (2006). Environmental aspects of Microbiology 2nd Edition. Bright Sun Publications. 2. K.Vijaya Ramesh. (2004).Environmental Microbiology. 1 st Edition. MJP Publishers. 3. Subba Rao. N.S. (2017). Soil Microbiology.4 th Edition. Oxford and IBH Publishing Pvt. Ltd.
Reference Books	1. Dirk, J. Elasas, V., Trevors, J.T., Wellington, E.M.H. (1997). Modern Soil Microbiology, Marcel Dekker INC, New York, Hong Kong. 2. EcEldowney S, Hardman D.J., Waite D.J., Waite S. (1993). Pollution: Ecology and Bio treatment – Longman Scientific Technical. 3. Clescri, L.S., Greenberg, A.E. and Eaton, A.D. (1998). Standard Methods for Examination of Water and Wastewater, 20th Edition. American Public Health Association.
Website Link	1. https://nptel.ac.in/courses/126105016 2. https://www.classcentral.com/course/swayam-plant-pathology-and-soil-health-14236 3. https://www.wasteonline.org.uk/resources/InformationSheets/WasteDisposal.htm
Self-Study Material	1. http://www.jnkvv.org/PDF/02042020180252Yogranjan_Lecture%20notes_Agricultural%20Microbiology.pdf 2. https://agritech.tnau.ac.in/pdf/sustainableagriculture.pdf

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBC07	**ENVIRONMENTAL AND AGRICULTURE MICROBIOLOGY**		**DSC THEORY - VII**		**VI**	**5**	**5**	**-**	**-**	**5**

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	M	S	S	S	S	M	M	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Mrs.N.Sathyabama	Dr.M.Selvan	Dr.S.Shahitha

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Rasipuram - 637408.

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBC08	**FOOD, DAIRY AND PROBIOTIC MICROBIOLOGY**	**DSC THEORY - VIII**	**VI**	**5**	**5**	**-**	**-**	**5**
Objective	Students gain the knowledge about food spoilage causing microbes and production of fermented foods and probiotics							

Unit	Course Content	Knowledge Levels	Sessions
I	**Food as a substrate for microbes** - Microorganisms and their importance in the food microbiology – molds, yeast, bacteria. Factors influencing microbial growth in food - extrinsic and intrinsic factors. Food preservation: principles and methods of food preservation, asepsis, control of microorganism, anaerobic condition, high temperature, low temperature, drying, radiation and chemical preservation. Food additives. Nanoscience in food preservation; microencapsulation.	K1	12
II	**Contamination and spoilage of food products** – Food borne infections (*Bacillus cereus*, Salmonellosis, Shigellosis, *Listeria monocytogenes* and *Campylobacter jejuni*) and intoxications – (*Staphylococcus aureus*, *Clostridium botulinum*, *Clostridium perfringens* and mycotoxins) Food borne disease outbreaks - newly emerging pathogens. Conventional and Novel technology in control of food borne pathogens and preventive measures - Food sanitation - plant sanitation - Employees health standards. Regulatory Agencies &criteria for food safety.	K2	12
III	**Microflora of raw milk** - Sources of contamination. Spoilage and preservation of milk and milk products -antimicrobial systems in raw milk. Importance of biofilms, their role in transmission of pathogens in dairy products and preventive strategies.	K3	12
IV	**Fermented foods:** Indian Pickles, Bread, vinegar, fermented vegetables (sauerkraut), Oriental fermented foods - Miso – Tempeh Ontjom. Natto, Idli. Fermented dairy products (yoghurt, cheese, Acidophilus Milk, Kefir, Koumiss). Spoilage and defects of fermented dairy products - Functional fermented foods and nutraceuticals, bioactive proteins and bioactive peptides, genetically modified foods.	K4	12
V	**Probiotic microorganisms -** concept, definition safety of probiotic microorganisms, legal status of probiotics. Characteristics of Probiotics for selection: stability maintenance of probiotic microorganisms. Role of probiotics in health and disease: Mechanism of probiotics. Application of bacteriocins in foods. Biopreservation. Prebiotics: concept, definition, criteria, types, sources and health benefits. **Current Trends-*Rapid and advanced techniques in food microbiology***	K5	12

	…… Self Study.		
Course Outcome	**CO1:** List out the microorganisms in food	K1	
	CO2: Summarize the various types of food borne diseases and their prevention methods	K2	
	CO3: Identify the microorganisms of milk and their transmission	K3	
	CO4: Simplify the production of fermented products	K4	
	CO5: Validate the current knowledge of probiotics, prebiotics and functional dairy foods for the health benefits	K5	

Learning Resources	
Text Books	1. Aneja K.R (2022) Modern Food Microbiology. 1st edition, Med tech Scientific International. 2. Adams M.R, Moss M.O (2022). Food Microbiology, 2nd edition, New Age International Publishers. 3. Frazier WC and West off DC. (2017). Food microbiology. 5th Edition TATA McGraw Hill Publishing Company Ltd. New Delhi.
Reference Books	1. Omar A. Oyarzabal, Steffen Backert, (2016). Microbial Food Safety: An Introduction, Springer 2. Dongyou Liu (2021). 1st edition, CRC Press. 3. Dharumaurai Dhansekaran, Alwarappan Sankaranarayanan. (2021). Advances in Probiotics Microorganisms in Food and Health 1st Edition. EBook ISBN: 9780128230916.
Website Link	1. https://www.onlinebiologynotes.com/detection-of-microorganisms-in-foods-methods-and-techniques/ 2. https://www.rapidmicrobiology.com/test-method/separation-and-concentration-of-microorganisms-from-food-matrices 3. https://www.youtube.com/watch?v=8WIvSjFngWs
Self-Study Material	1. https://egyankosh.ac.in/bitstream/123456789/12429/1/Unit-8.pdf

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBC08	**FOOD, DAIRY AND PROBIOTIC MICROBIOLOGY**		**DSC THEORY - VIII**		**VI**	**5**	**5**	**-**	**-**	**5**

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	M	S	M	S
CO2	S	M	M	S	S	S	M	S	M	S
CO3	S	M	M	S	M	S	M	S	M	S
CO4	S	S	S	M	M	S	M	S	M	S
CO5	S	S	S	S	S	S	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-		
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation		
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE		
Designed By	**Verified By**	**Approved By Member Secretary**	
N.Radhakrishnan	Dr.M.Selvan	Dr.S.Shahitha	

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBP06	**PRACTICAL : ENVIRONMENTAL, AGRICULTURE AND FOOD MICROBIOLOGY**	**DSC PRACTICAL - VI**	**VI**	**6**	**-**	**-**	**6**	**4**
Objective	Students acquire skill about the basic microbial identification methods.							

S.No.	Course Content	Knowledge Levels	Sessions
1	i). Physical, chemical, and microbiological assessment of water and potability test for water. a). Physical – Color, pH, b). Chemical - alkalinity, acidity, DO, BOD, COD c). Microbiological – MPN index (Presumptive, Completed and Confirmatory test) ii). Study of air microflora by settle plate method.	K5	9
2	Isolation and identification of bacteria and fungi from fruits and vegetables	K4	3
3	Direct microscopic count of milk.	K5	3
4	Methylene blue reductase test and Resazurin test	K5	3
5	Microbiological examination of milk by SPC.	K4	3
6	Isolation of extracellular enzyme producers –Amylase, protease and lipase	K3	6
7	Microbiological assay of antibiotics by cup plate method and other methods	K2-K4	6
8	Isolation of *Rhizobium*/ *Azotobacter*/ phosphate solubilizing organisms	K2-K5	6
9	Preparation of biofertilizers – Demonstration	K3	3
10	Study of plant pathogens- Tikka Disease, Red rot of sugarcane, Citrus canker, Blight of paddy.	K5	9
11	Study of fungi - *Mucor, Curvularia, Alternaria, Rhizopus, Aspergillus*	K3	3
12.	Isolation of constituent flora of fermented milk.	K3	3
13.	Growth of probiotic LAB in broth, milk and whey.	K2	3
14	Preparation of probiotic fermented milks like curd, yoghurt, lassi and whey drink.	K3	6
15	Effect of prebiotics on the growth of LAB in milk and broth.	K3	3
16	Survivability of probiotic organisms in fermented food product.	K3	3

17	Antimicrobial potential of the functional dairy products	K3	3
Course Outcome	**CO1:** Choose the methods for dairy products and enzyme production by microbes	K3	
	CO2: Develop the antibiotic assay techniques	K3	
	CO3: Analyze the plant disease and their control measures	K4	
	CO4: Categorize the preparation and effect of probiotics	K4	
	CO5: Evaluate the physical, chemical and microbiological factors and potability of water	K5	

Learning Resources

Text Books	1. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th Edition. Pearson Education Limited. 2. R C Dubey and D K Maheswari. (2002). Practical Microbiology. S. Chand Publishing 3. Aneja, KR. (2010). Experiments in Microbiology, Plant pathology and Biotechnology. New Age International (P) Limited
Reference Books	1. Christon J. Hurst Editor in Chief, Ronald L. Crawford, Jay L. Garland, David A. Lipson, Aaron L. Mills, Linda D. Stetzenbach (2007). Manual of Environmental Microbiology, Third Edition, Wiley publication. 2. Marylynn V. Yates, Cindy H. Nakatsu, Robert V. Miller, Suresh D. Pillai 2016). Manual of Environmental Microbiology, 4th Edition, ASM press 3. Ian Pepper, Charles Gerba, Jeffrey Brendecke (2004). Environmental Microbiology-A laboratory manual, Elsevier.
Website Link	1. https://bio.libretexts.org 2. https://www.google.com 3. https://www.sfamjournals.onlinelibrary.wiley.com 4. https://www.degruyter.com

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M6UMBP06	**PRACTICAL : ENVIRONMENTAL, AGRICULTURE AND FOOD MICROBIOLOGY**		**DSC PRACTICAL - VI**	**V**	**6**	**-**	**-**	**6**	**4**	
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	
Tutorial Schedule	-									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation									
Assessment Methods	Model Practical, CIA I, CIA II and ESE									
Designed By		**Verified By**				**Approved By Member Secretary**				
Mrs.N.Sathyabama		Dr.M.Selvan				Dr.S.Shahitha				

List of Foundation Course (FC) offered by the B.Sc., Microbiology

SYLLABUS - LOCF-CBCS Pattern

EFFECTIVE FROM THE ACADEMIC YEAR 2023-2024 Onwards

S. No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	I	23M1UMBFC1	INTRODUCTION TO MICROBIAL WORLD

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M1UMBFC1	**INTRODUCTION TO MICROBIAL WORLD**	**FC THEORY - I**	**I**	**2**	**2**	**-**	**-**	**2**

Objective	Students gain knowledge on economic importance of microorganisms.		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**General features and economic importance of bacteria**- General characteristics and morphology of bacteria, mycoplasma, and archaebacteria. Economic importance of bacteria with examples in antibiotic production (*Streptomyces*), biofertilizer (*Rhizobium*), superbugs (*Pseudomonas*), fermentation (*Lactobacillus*). Harmful aspects such as food spoilage (*Clostridium*) and diseases (*Xanthomonas, Salmonella, Vibrio*).	K1	8
II	**General features and economic importance of fungi-** General characteristics and morphology of fungi, Economic importance of fungi with examples in biopesticide (*Beauveria*), industry (*Saccharomyces*), medicine (*Penicillium*). Harmful aspects-food spoilage (mold), diseases in crops (*Fusarium*), humans (*Aspergillus*), allergic reactions (*Mucor*).	K2	8
III	**General features and economic importance of algae-** General characteristics and morphology of algae. Beneficial aspects of algae with examples in single cell protein (*Spirulina*), soil fertility (*Anabaena*), environment (Phytoplanktons). Harmful aspects-Eutrophication and phycotoxins.	K3	8
IV	**General features and economic importance of virus-** General characteristics of virus. Economic importance of virus with examples in vaccine production (Rabies virus), gene therapy (Adenovirus), biopesticides (Cauliflower mosaic virus). Harmful aspects - diseases (plant-TMV, human-Influenza virus).	K3	8
V	**General features and economic importance of protozoa-** General characteristics of protozoa. Beneficial applications of protozoa with examples – Biocontrol (*Haemogregarina*), sanitation (*Amoeba*), oil exploration (*Radiolaria*). Harmful aspects –diseases (*Entamoeba, Giardia*).	K4	8
Course Outcome	**CO1:** Remember about the economic importance of bacteria.	K1	
	CO2: Understand the economic importance of fungi.	K2	
	CO3: Apply the economic importance of algae.	K3	

	CO4: Identify the economic importance of virus.	K3	
	CO5: Classify the economic importance of protozoa.	K4	

Learning Resources	
Text Books	1. Pelczar, M.J., Chan, E. C. S. and Kreig, N. R. (2006). Microbiology. 5th edition, Tata Mc Grow Hill Inc, New York. 2. Subba Rao, N.S. (1995). Soil microorganisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
Reference Books	1. Hurst, C.J., Crawford, R.L., Garland, J.L., Lipson, D.A. and Mills, A.L. (2002). Manual of Environmental Microbiology, 2nd Edition. A. SM Press, New Delhi. 2. Atlas, R.A. (1995). Principles of Microbiology. Mosby Publications, USA. 3. Madigan, M.T. and Martinko, J.M. (2014). Brock Biology of Microorganisms. 14th Edition. Prentice Hall International Inc., USA
Website Link	1. https://microbiologyinfo.com/category/basic-microbiology/ 2. https://www.britannica.com/science/microbiology

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M1UMBFC1	**INTRODUCTION TO MICROBIAL WORLD**	**FC THEORY - I**	**I**	**2**	**2**	**-**	**-**	**2**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	M	S	M	M	M
CO2	M	S	S	M	S	S	S	M	S	S
CO3	S	M	M	S	S	M	S	S	S	S
CO4	S	S	S	M	S	S	S	M	M	S
CO5	S	S	M	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Dr.M.Selvan	Dr.M.Selvan	Dr.S.Shahitha

List of Elective Course (DSE) Details for B.Sc., Microbiology SYLLABUS - LOCF-CBCS Pattern EFFECTIVE FROM THE ACADEMIC YEAR 2023-2024 Onwards			
S. No.	**SEM**	**COURSE_CODE**	**TITLE OF THE COURSE**
1	V	23M5UMBE01	RECOMBINANT DNA TECHNOLOGY
2	V	23M5UMBE02	BIOSAFETY & BIOETHICS
3	VI	23M6UMBE03	PHARMACEUTICAL MICROBIOLOGY
4	VI	23M6UMBE04	ENTREPRENEURSHIP AND BIO-BUSINESS

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBE01	**RECOMBINANT DNA TECHNOLOGY**	**DSE THEORY - I**	**V**	**5**	**3**	**2**	**-**	**4**
Objective	Students acquire skill about the molecular tools, various molecular techniques and their Importance to human welfare							

Unit	Course Content	Knowledge Levels	Sessions
I	**Scope and definition of rDNA Technology**–History and milestone in rDNA Technology. Restriction endonuclease - Discovery, Types, Mode of action - Application of Ligase, DNA Polymerase, DNA Modifying enzymes and Topoisomerases. Gene Manipulation – Strategies in Gene Cloning. Isolation of Chromosomal and Plasmid DNA.	K1	12
II	**Artificial Gene transfer methods and vectors**- Calcium Chloride Induction, Electroporation, Microinjection, Biolistic method, Liposome and Viral-mediated delivery. Cloning vectors – Properties and Applications - Plasmid Based Vectors- Natural Vectors-pSC101 and pMB1. Artificial Vectors - pBR322 and pUC. Phage Based Vectors - Lambda phage. Hybrid Vectors, Phagemid, Cosmid, BAC and YAC. Screening of Recombinants. Genomic DNA and cDNA library - Construction and Screening.	K2	12
III	**Molecular Tools**– PCR- Types. Gel Electrophoresis- AGE and PAGE Blotting Techniques- Southern, Western & Northern. DNA sequencing methods-Sanger's and Automated method. Recent Trends in Genetic Engineering - Targeted Genome Editing-ZFNs, TALENs, CRISPRs. Gene Targeting-Knock-in & Knock-outs. DNA Finger Printing.	K3	12
IV	**Plant Biotechnology** – Media, Growth Regulators and Equipment for Plant Tissue Culture - Explant Culture – Micropropagation- Callus and Protoplast Culture - Production of Bio-Active Secondary Metabolites by Plant Tissue Culture - Agrobacterium and Crown Gall Tumors, Ti Plasmid and Ri Plasmid. **Animal Biotechnology**-Principles of Animal Cell Culture, Media and Equipment for Animal Cell Culture – Primary and Secondary Cultures - Cell Lines- Types, Establishment and Maintenance of Cell Lines.	K3	12
V	**Applications of Genetic Engineering** - Transgenic Animals – Mice and Sheep Recombinant Cytokines and their use in the Treatment of Animal infections-Monoclonal Antibodies in Therapy - Vaccines and their Applications in Animal Infections - Human Gene Therapy - Germline and Somatic Cell Therapy -Ex-vivo Gene Therapy-SCID (Severe Combined Immuno Deficiency) – In-vivo Gene Therapy- CFTR (Cystic Fibrosis Transmembrane Regulator) – Vectors in Gene Therapy - Viral and Non - Viral Vectors. Transgenic Plants– Bt Cotton, Bt Corn, Round Ready soybean, FlavrSavr Tomato and Golden	K4	12

	Rice. **Current Trends-*CRISPR-Cas 9 technology***		
	***……* Self Study.**		
Course Outcome	**CO1:** Find the enzymes involved in recombinant DNA technology	K1	
	CO2: Construct the various cloning vectors and their applications	K2	
	CO3: Develop the usage and advantages of molecular tools.	K3	
	CO4: Experiment about the plant and animal tissue culture	K3	
	CO5: Contrast the techniques of gene therapy.	K4	

Learning Resources				
Text Books	1. Brown T.A. (2016). Gene Cloning and DNA Analysis. 7th Edition. John Wiley and Jones, Ltd. 2. SiddraIjaz, Imran UlHaq (2019). Recombinant DNA Technology. Cambridge Scholars Publishing. 3. Monika Jain (2012). Recombinant DNA Techniques: A Textbook, I Edition, Alpha Science International Ltd			
Reference Books	1. Glick B. R. and Patten C. L. (2018). Molecular Biotechnology – Principles and Applications of Recombinant DNA. 5th Edition. ASM Press. 2. Synder L., Peters J. E., Henkin T.M. and Champness W. (2013). Molecular Genetics of Bacteria, 4th Edition. ASM Press Washington-D.C. ASM Press. 3. Maloy S. R., Cronan J.E. Jr. and FreifelderD. (2011). Microbial Genetics. 2nd Edition. Narosa Publishing Home Pvt Ltd.			
Website Link	1. https://www.britannica.com/recombinant-DNA-technology 2. https:// www.rpi.edu/ 3. https:// www.ncbi.nlm.nih.gov/			
Self-Study Material	1. https://www.synthego.com/learn/crispr			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBE01	**RECOMBINANT DNA TECHNOLOGY**			**DSE THEORY – I**		**V**	**5**	**3**	**2**	**-**	**4**
CO-PO Mapping											
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	S	S	S	S	S	S	S	M	S	S	
CO2	M	S	S	S	S	M	S	S	S	S	
CO3	S	S	M	S	S	S	S	S	M	S	
CO4	S	S	S	S	S	S	S	S	S	S	
CO5	M	S	S	S	S	S	S	S	S	S	
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG		
Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app										
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation										
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE										
Designed By			**Verified By**				**Approved By Member Secretary**				
Mrs. S.Subana			Dr.M.Selvan				Dr.S.Shahitha				

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBE02	**BIOSAFETY AND BIOETHICS**	**DSE THEORY - II**	**V**	**5**	**3**	**2**	**-**	**4**
Objective	Students acquire the knowledge about a comprehensive understanding of biosafety principles and ethical considerations within the realm of microbiology.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Basics of Biosafety-** Laboratory Hazards and Hazard Symbols. Define and classify - Biohazard, Biosafety and Biosecurity. Biological Risk Groups. LAI, BP. Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP).	K1	12
II	**Hazardous materials in Biotechnology -** Categories of Waste in the Biotechnology Laboratories, Biohazardous waste and their disposal and treatments- issues in the use of GMOs, risk for animal/human/ agriculture and environment owing to GMO. Hazardous materials, Emergency response/ first aid in Laboratories.	K2	12
III	**Biological Safety Containment in Laboratory-** Primary and secondary containments - Physical and biological containment. Types of biosafety containments (level I, II, III), PPE, Biosafety guidelines in India - Roles of Institutional Biosafety Committee, RCGM, GEAC.	K2	12
IV	**Introduction and need of Bioethics** - its relationship with other branches, Ethical implications of biotechnological products and techniques. Ethical Issues involving human cloning, human genome project, prenatal diagnosis, agriculture and animal rights, Social and ethical implications of biological weapons.	K3	12
V	**IPR, Patents and Patent laws-** Intellectual property rights – TRIP- GATT International conventions patents, Methods of application of patents, Legal implications. Biodiversity and farmer rights, Objectives of the patent system, Basic principles and general requirements of patent law, Biotechnological inventions, and patent law. Legal development subjects and protection in biotechnology. The patenting of living organisms. **Current Trends-*Ethical issues in Patents***	K2-K3	12
	…… Self Study.		
Course Outcome	**CO1:** Find out the need and applications of biosafety	K1	
	CO2: Interpret the hazardous waste materials	K2	
	CO3: Summarize the physical and biological safety in laboratory	K2	
	CO4: Identify the bioethical process	K3	

	CO5: Plan to getting patent for biotechnological inventions.		K3	
Learning Resources				
Text Books	1. Usharani. B, S Anbazhagi, C K Vidya, (2019). Biosafety in Microbiological Laboratories- 1st Edition, Notion Press, ISBN-101645878856. 2. Deepa Goel and ShominiParashar, (2013). IPR, Biosaftey and Bioethics- 1st Edition, Pearson education: Chennai, ISBN-13: 978-8131774700. 3. Sateesh. M.K. (2013). Bioethics and Biosafety. i.K. International pvt, Ltd.			
Reference Books	1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management, India, IN: Cengage Learning India Private Limited, ISBN-10: 9386668572 2. Ahuja, V K. (2017). Law relating to Intellectual Property Rights, India, IN: Lexis Nexis, ISBN-10: 8131251659. 3. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights, India, IN: PHI learning Private Limited, ISBN : 9788120349896			
Website Link	1. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf. 2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub _489.pdf.			
Self-Study Material	1. https://guides.library.iit.edu/c.php?g=474695&p=3248753 2. https://egyankosh.ac.in/bitstream/123456789/90502/1/Unit-15.pdf			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBE02	**BIOSAFETY AND BIOETHICS**		**DSE THEORY - II**		**V**	**5**	**3**	**2**	**-**	**4**

CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	M	S	M	M	S	M	S
CO2	S	S	S	S	S	M	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Dr.M.Sankareswaran	Dr.M.Selvan	Dr.S.Shahitha

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBE03	**PHARMACEUTICAL MICROBIOLOGY**	**DSE THEORY - III**	**VI**	**5**	**3**	**2**	**-**	**4**

Objective	Students acquire a knowledge about the pharmaceutical products production and their contaminants		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Introduction to Pharmaceutical microbiology:** Ecology of microorganisms in pharmaceutical industry: Atmosphere, water, skin and respiratory flora of workers, raw materials, packaging, building and equipment's and their control measures; Design and layout of sterile manufacturing	K2	12
II	**Microbial contamination and spoilage of pharmaceutical products:** Microbial aspects of pharmaceutical products; Sterilization of pharmaceutical products: Heat, gaseous, radiation and filtration; Contamination and Spoilage of Pharmaceutical products: sterile injectable and non-injectable, ophthalmologic preparation, implants.	K3	12
III	**Production of antibiotics:** Production of antibacterial – Penicillin, Tetracycline; antifungal – Griseofulvin, Amphotericin; antiparasitic agents – Artemesin, Metronidazole; Semi-synthetic antibiotics and anticancerous agents; Additional application of microorganisms in pharmaceutical sciences: Enzymes- Streptokinase, Streptodornase, Lasperginase and clinical dextrin; Immobilization procedures for pharmaceutical applications (liposomes); Biosensors in pharmaceuticals.	K5	12
IV	**Production of immunological products and their quality control:** Vaccines - DNA vaccines, synthetic peptide vaccines, multivalent vaccines; Vaccine clinical trials; Immunodiagnostics - immuno sera and immunoglobulin; Quality control in Pharmaceutical: In – Process and Final Product Control; Sterility tests.	K5	12
V	**Quality Assurance and Validation:** Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry; Regulatory aspects of quality control; Quality assurance and quality management in pharmaceuticals – BIS (IS), ISI, ISO, WHO and US certification. **Current Trends-*Antibiotic resistance and development of new therapeutics***	K5	12
	…… Self Study.		
Course Outcome	**CO1:** Restate the knowledge on basics of chemotherapy	K2	
	CO2: Relate the assays and testing methods of antibiotics	K3	
	CO3: Appraise the information about spoilage of pharmaceutical products	K5	
	CO4: Discriminate the knowledge on drug discovery and clinical trials	K5	

	CO5: Evaluate the regulations in pharmaceutical industry	K5	

Learning Resources	
Text Books	1. Chand Pasha Kedernath. (2021). Text book of Pharmaceutical Microbiology. Ramnath Publisher. 2. Priyatama Powar, Shital Nimbargi, VaijayantiSapre (2020). Pharmaceutical Microbiology, Ist edition, Technical publication
Reference Books	1. Handa, S.S. and Kapoor, V.K. (2022) Pharamcognosy.4thEdition.Vallabh Prakashan Publishers, New Delhi. 2. Kokate, C.K., Durohit, A.P. and Gokhale, S.R., (2002). Pharmacognosy. 12thedition Nirali Prakasham Publishers, Pune.
Website Link	1. Introduction to Pharmaceutical Microbiology - Pharmapproach.com 2.https://www.pharmanotes.org/2021/11/pharmaceutical-microbiology-b-pharma.html 3. https://snscourseware.org/snscphs/notes.php?cw=CW_604b15c6313c5
Self-Study Material	1. https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance 2. https://www.youtube.com/watch?v=P6htK_5ZFpU

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBE03	**PHARMACEUTICAL MICROBIOLOGY**	**DSE THEORY - III**	**VI**	**5**	**3**	**2**	**-**	**4**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	M	S	M	S
CO2	S	M	S	S	S	S	S	S	M	S
CO3	S	M	M	S	M	S	M	S	S	S
CO4	S	S	S	M	M	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBE04	**ENTREPRENEURSHIP AND BIO-BUSINESS**	**DSE THEORY - IV**	**VI**	**5**	**3**	**2**	**-**	**4**
Objective	Students acquire skill in the entrepreneurship, bio-business and the life sciences industry							

Unit	Course Content	Knowledge Levels	Sessions
I	**Bio Entrepreneurship:** Introduction to bio-business, SWOT analysis of bio-business. Ownership, Development of Entrepreneurship; Stages in entrepreneurial process; Government schemes and funding.	K1	12
II	**Entrepreneurship Opportunity in Agricultural Biotechnology:** Business opportunity, Essential requirement, marketing, strategies, schemes, challenges and scope with case study on Plant cell and tissue culture technique, polyhouse culture. Herbal bulk drug production, Nutraceuticals, value-added herbal products. Bioethanol production using Agricultural waste and Algal source. Integration of system biology for agricultural applications. Biosensor development in Agriculture management.	K2	12
III	**Entrepreneurship Opportunity in Industrial Biotechnology:** Business opportunity, Essential requirement, marketing strategies, schemes, challenges, and scope- Pollution monitoring and Bioremediation for Industrial pollutants. Integrated compost production - microbe enriched compost. Bio pesticide/ insecticide production. Biofertilizer. Single-cell protein.	K3	12
IV	**Therapeutic and Fermented products:** Stem cell production, stem cell bank, production of monoclonal/polyclonal antibodies, secondary metabolite production – antibiotics, probiotics and prebiotics.	K3	12
V	**Project Management, Technology Management and Start up Schemes**: Building Biotech business challenges in Indian context-biotech partners (DBT - BIRAC, Incubation centres. etc.,), operational biotech parks in India. Entrepreneurship Development and Innovation Institute-Tamil Nadu- EDII, TANSIDCO, TANSIM, TANSI and FaMe TN. Indian Company act for Bio business schemes and subsidies. Project proposal preparation, Successful start-ups-case study. Current Trends-***Tamil Nadu Start up and Innovation Policy 2023***	K3	12
	…… Self Study.		
Course Outcome	**CO1:** Recall about the bio - business	K1	
	CO2: Summarize the entrepreneurship opportunity in Agriculture	K2	
	CO3: Choose the opportunities in Industrial Biotechnology	K3	

	CO4: Construct the Pharmaceutical products production strategies	K3	
	CO5: Develop the knowledge of Project management in business	K3	

Learning Resources	
Text Books	1. Craig Shimasaki. (2014). Biotechnology Entrepreneurship: Starting, Managing and Leading Biotech Companies. Academic Press. 2. Jennifer Merritt, Jason Feifer (2018). Start Your Own Business, 7th edition, Entrepreneur Press publisher.
Reference Books	1. Crueger, W, and Crueger. A. (2000). Biotechnology: A Text Book of Industrial microbiology, 2nd Edition, Sinauer Associates: Sunderl and Mass. 2. Paul S Teng. (2008). Bioscience Entrepreneurship in Asia World Scientific Publishing Company. 3. Stephanie A. Wisner (2022). Building Backwards to Biotech: The Power of Entrepreneurship to Drive Cutting-Edge Science to Market, International Kindle paper white.
Website Link	1.https://www.bio-rad.com/webroot/web/pdf/lse/literature/Biobusiness.pdf 2.https://www.crg.eu/biobusiness-entrepreneurship 3. https://www.birac.nic.in
Self-Study Material	1. https://startuptn.in/wp-content/uploads/2024/01/Tamil-Nadu-Startup-and-Innovation-Policy-2023.pdf

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBE04	**ENTREPRENEURSHIP AND BIO-BUSINESS**	**DSE THEORY - IV**	**VI**	**5**	**3**	**2**	**-**	**4**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	M	M	M	M	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion, Quiz program, Model preparation and Kahoot app
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Dr.M.Sankareswaran	Dr.M.Selvan	Dr.S.Shahitha

List of Skill Based Elective Course (SEC) for B.Sc., Microbiology

SYLLABUS - LOCF-CBCS Pattern

EFFECTIVE FROM THE ACADEMIC YEAR 2023-2024 Onwards

S.No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	II	23M2UMBS01	SERICULTURE
2	III	23M3UMBS02	ORGANIC FARMING & BIOFERTILIZER TECHNOLOGY
3	III	23M3UMBS03	AQUACULTURE
4	IV	23M4UMBS04	VACCINE TECHNOLOGY
5	IV	23M4UMBS05	APICULTURE

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M2UMBS01	**SERICULTURE**	**SEC THEORY - I**	**II**	**2**	**2**	**-**	**-**	**2**

Objective	Students gain knowledge on Sericulture as science and scientific approach of mulberry plant.		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**General introduction to Sericulture**, its distribution in India. Botanical distribution and taxonomical characters of mulberry varieties and species. Biology of Mulberry plant and Mulberry crop cultivation and protection.	K1	6
II	**Silkworm-** biology-morphology of silkworm. Life cycle of silkworm- egg, larva, pupa and moth.	K2	6
III	**Silkworm pathology:** Introduction to Parasitism, Commensalism, Symbiosis and Parasite relationship - Mulberry Silkworm Diseases: Introduction, types, Pebrine, Grasserie, Muscardine, Flacherie, Symptoms and Pathogens, Mode of Infection, Prevention and Control - Non – mulberry silkworm diseases: Pebrine, Bacterial and viral diseases. Brief Account of Pests and Predators of Silkworms, Nature of damage and control measures.	K3	6
IV	**Rearing of silkworm**. Cocoon assessment and processing technologies. Value added products of mulberry and silkworms.	K4	6
V	**Entrepreneurship and rural development in sericulture:** Planning for EDP, Project formulation, Marketing, Insectary facilities and equipment's Location, building specification, air conditioning and environmental control, furnishings and equipment, sanitation and equipment, subsidiary facilities.	K4	6
Course Outcome	**CO1:** Remember about the distribution and crop production of mulberry plant.	K1	
	CO2: Understand the knowledge about the silk worm.	K2	
	CO3: Identify the Silkworm diseases and its control measures.	K3	
	CO4: Categorize the value added products of Silkworm.	K4	
	CO5: Classify the Plan and facilities required for sericulture development.	K4	
Learning Resources			

Text Books	1. Ganga, G. and Sulochana Chetty (2010). Introduction to Sericulture, J., Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi. 2. Dandin S B, Jayant Jayaswal and Giridhar K (2010). Handbook of Sericulture technologies, Central Silk Board, Bangalore.
Reference Books	1. T.V. Satheand Jadhav.A.D. (2021). Sericulture and Pest Management, Daya Publishing House. 2. M. Johnson, M. Kesary (2019). Sericulture, 5th. Edition. Saras Publications. 3. Manisha Bhattacharyya (2019). Economics of Sericulture, Rajesh Publications. 4. Muzafar Ahmad Bhat, Suraksha Chanotra, Zafar Iqbal Buhroo, Abdul Aziz and Mohd. Azam (2020). A Textbook on Entrepreneurship Development Programme in Sericulture, IP Innovative Publication.
Website Link	1. https://egyankosh.ac.in › bitstream 2. https://archive.org › details › Sericulture Hand book 3. https://www.sericulture.karnataka.gov.in 4. https://www.silks.csb.gov.in

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M2UMBS01	**SERICULTURE**		**SEC THEORY - I**		**II**	**2**	**2**	**-**	**-**	**2**
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	M	S	S	S	S	S	S
CO2	M	S	S	M	S	S	S	S	S	S
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	
Tutorial Schedule	-									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, Poster Presentation and Video presentation									
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE									
Designed By		**Verified By**				**Approved By Member Secretary**				
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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3UMBS02	**ORGANIC FARMING AND BIOFERTILIZER TECHNOLOGY**	**SEC THEORY - II**	**III**	**2**	**2**	**-**	**-**	**2**

Objective	Students gain the knowledge on the importance, types and advantages of organic farming and biofertilizer and sustainable agriculture.		
Unit	**Details**	**Knowledge Levels**	**Sessions**
I	**Principle of organic farming:** principles of health, fairness, ecological balance, and care. Environmental benefits of organic farming: sustainability- reduces non-renewable energy by decreasing agrochemical need. Biodiversity-crop rotation, inter-cropping. Ecological services – biological control, soil formation and nutrient cycling.	K1	6
II	**Organic farming for urban space;** Create a Sustainable Organic Garden (Backyard- Square Foot Gardening, Small Space Gardening, Mini Farming) Composting, Vermicomposting	K3	6
III	**Biofertilizers:** Introduction, advantages and future perspective. Structure and characteristic features of bacterial biofertilizers- *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*	K4	6
IV	**Structure and characteristic features** of Cyanobacterial biofertilizers- *Anabaena, Nostoc;* Structure and characteristic features of fungal biofertilizers - VAM mycorrhiza.	K4	6
V	**Production** of *Rhizobium, Azotobacter, Anabena*; Biofertilizers - Storage, shelf life, quality control and marketing. **Current Trends- *Principles of Organic Farming***	K4	6
	…… Self Study.		
Course Outcome	**CO1:** Find out the basic knowledge in organic farming	K1	
	CO2: Plan the gardening of organic farming	K3	
	CO3: Analyze the application of microbial bio-fertilizers in large scales, thereby increasing soil fertility	K4	
	CO4: Compare the algal biofertilizer effects in agriculture	K4	
	CO5: Conclude the production of solid and liquid biofertilizer and their quality assessment	K4	

Learning Resources				
Text Books	1. Gaur A.C. (2006). Hand book of Organic Farming and Biofertilizers. Ambika Book Agency. 2. Rakshit A and Singh H.B. (2015).ABC of Organic Farming. (1st Edition). Jain Brothers. 3. Subba Rao N.S. (2017). Bio-fertilizers in Agriculture and Forestry. (4th Edition). Med Tech publisher.			
Reference Books	1. Sujit Chakrabarty (2018). Organic Home Gardening Made Easy, 1st Edition 2. Bansal M. (2019). Or Basics of Organic Farming. CBS Publisher. 3. Singh and Purohit (2008). Biofertilizer technology. Agrobios, India.			
Website Link	1. https://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html. 2. https://www.fao.org/organicag/oa-faq/oa-faq6/en/			
Self-Study Material	1 https://agritech.tnau.ac.in/org_farm/orgfarm_principles.html			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3UMBS02	**ORGANIC FARMING AND BIOFERTILISER TECHNOLOGY**		**SEC THEORY - II**		**III**	**2**	**2**	**-**	**-**	**2**
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	S	S	M	S
CO2	S	S	M	S	M	S	S	S	S	S
CO3	S	M	S	S	S	M	M	S	S	M
CO4	S	S	M	S	M	S	S	S	S	S
CO5	S	S	S	S	M	S	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	
Tutorial Schedule	-									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation									
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE									
Designed By	**Verified By**					**Approved By Member Secretary**				
Mrs.N.Sathyabama	Dr.M.Selvan					Dr.S.Shahitha				

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M3UMBS03	**AQUACULTURE**	**SEC THEORY - III**	**III**	**2**	**2**	**-**	**-**	**2**
Objective	Students acquire skill about the cultivation of various species in Aquaculture Systems							

Unit	Course Content	Knowledge Levels	Sessions
I	**Aquaculture Systems and Methods** - Scope and definition. Traditional, extensive, semi - intensive and intensive culture. Monoculture, poly culture, composite culture, mixed culture, mono-sex culture, cage culture, pen culture, raft culture and race way culture.	K1	6
II	**Aquaculture Engineering** - Design and construction of pond, lay - out and design of aquaculture farm, construction, water intake system, drainage system – aeration and aerators. Ponds - Types of ponds.	K2	6
III	**Selection of Species** - Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection and transportation. Pre - Stocking Management-Sun drying, ploughing / tilling, desilting, liming and fertilization, eradication of weed fishes. Stocking - Acclimatization of seed and release-species combinations-stocking density and ratio	K3	6
IV	**Post Stocking Management** - Water and soil quality parameters required for optimum production, control of aquatic weeds and aquatic insects, algal blooms and microorganisms. Food conversion ratio (FCR). Growth-Measurement of growth, length - weight relationship.	K3	6
V	**Major cultivable species for aquaculture** – Culture of Indian Major Carps. Culture of Giant fresh water prawn, *Macrobrachium rosenbergii* - seed collection formation sources. Hatchery management Culture of tiger shrimp, *Penaeus monodon* and *Litopenaeus Vannamei, Culture* of pearl oysters. Culture of sea weeds. Methods of Crab culture .Culture of ornamental fishes. Culture of Molluscs. **Current Trends: *Fish Farming Techniques***	K4	6
	…… Self Study.		
Course Outcome	**CO1:** List out the various culture methods in Aquaculture	K1	
	CO2: Outline the construction of aquaculture pond	K2	
	CO3: Identify the biological characters of species in aquaculture	K3	
	CO4: Construct the growth parameters of aquaculture	K3	
	CO5: Classify the various fish species in cultivation aspect	K4	

Learning Resources	
Text Books	1. Santhanam, R. Velayutham, P. Jegatheesan, G. A (2019). Manual of Freshwater Ecology: An Aspect of Fishery Environment. Daya Publishing House, New Delhi. 2. Mushlisin Z.A. (2012). Aquaculture. InTech. 3. AkpaniteakuR.C. (2018). Basic Handbook of Fisheries and Aquaculture. AkiNik Publications.
Reference Books	1. Arumugam N. (2014). Aquaculture. Saras Publication. 2. Pillay T.V.R. and Kutty M.N. (2005). Aquaculture: Principles and Practices. 2nd Edition. Wiley India Pvt. Ltd. 3. Tripathi S.D., Lakra W.S. and Chadha N.K. (2018).Aquaculture in India. Narendra Publishing House.
Website Link	1. Fisheries Department-TamilNadu(tn.gov.in) 2. Aquaculture-GoogleBooks 3. aquaculture|Definition,Industry,Farming,Benefits,Types,Facts,&Methods |Britannica
Self-Study Material	1. https://www.seafoodwatch.org/seafood-basics/fishing-and-farming-methods

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M3UMBS03	**AQUACULTURE**	**SEC THEORY - III**	**III**	**2**	**2**	**-**	**-**	**2**	

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	M	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	M	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Mrs.S.Vahithabanu	Dr.M.Selvan	Dr.S.Shahitha

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBS04	**VACCINE TECHNOLOGY**	**SEC THEORY - IV**	**IV**	**2**	**2**	**-**	**-**	**2**
Objective	Students acquire a knowledge of vaccine technology							

Unit	Course Content	Knowledge Levels	Sessions
I	**History of vaccination -** Active and passive immunization; requirements for induction of immunity, Epitopes, linear and conformational epitopes, characterization and location of APC, MHC and immunogenicity.	K1	6
II	**Viral / bacterial / parasite vaccine** - differences, methods of vaccine preparation – Live, killed, attenuated, sub unit vaccines; Licensed vaccines, Viral Vaccine - Poliovirus vaccine-inactivated & Live, Rabies vaccines, Hepatitis A & B vaccines, Bacterial Vaccine - Anthrax vaccines, Cholera vaccines, Diphtheria toxoid, Parasitic vaccine - Malaria Vaccine.	K2	6
III	**Vaccine technology** - Role and properties of adjuvants, recombinant DNA and protein - based vaccines, plant - based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines. Recent advances in Malaria, Tuberculosis and HIV.	K3	6
IV	**Fundamental research to rational vaccine design** - Antigen identification and delivery, T-Cell expression cloning for identification of vaccine targets for intracellular pathogens, Rationale vaccine design based on clinical requirements: Scope of future vaccine strategies.	K4	6
V	**Vaccine additives and manufacturing residuals** - Regulation and testing of vaccines, Regulation of vaccines in developing countries, Quality control and regulations in vaccine research, Animal testing, Rational design to clinical trials, Large scale production, Commercialization. Vaccine safety ethics and Legal issues. **Current Trends-* Vaccine development: Current trends and technologies***	K4	6
	…… Self Study.		
Course Outcome	**CO1:** Recall about the immunization process	K1	
	CO2: Interpret the types of vaccines.	K2	
	CO3: Choose the various tools in vaccine technology	K3	
	CO4: Conclude the strategies for developing an innovative vaccine technology	K4	
	CO5: Examine the regulatory issues and guidelines for the management of vaccine production.	K4	
Learning Resources			

Text Books	1. Cheryl Barton. (2009). Advances in Vaccine Technology and Delivery. Espicom Business Intelligence. 2. Male, David. Ed. (2007). Immunology. 7th Edition. Mosby Publication. 3. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne. (2002). Immunology. 6th Edition, Freeman.
Reference Books	1. Stanley A. Plotkin, Walter Orenstein& Paul A. off it. (2013). Vaccines, 6th Edition. BMA Medical Book Awards Highly Commended in Public Health. Elsevier Publication. . 2. Abbas, A.K. *et al.* (2007).The Cellular and Molecular Immunology. 6th Edition, Sanders / Elsevier. 3. Stanley A. Plotkin, Walter Orenstein& Paul A. Offit.(2013). Vaccines, 6th Edition. BMA Medical Book Awards Highly Commended in Public Health. Elsevier Publication.
Website Link	1. https://www.bio.fiocruz.br/en/images/stories/pdfs/mpti/2013/selecao/vaccine-process technology.pdf 2. https://www.dcvmn.org/IMG/pdf/ge_healthcare_dcvmn_introduction_to_pd_for_vaccine_ production_29256323aa_10mar2017.pdf 3. https://www.researchgate.net/publication/313470959_Vaccine_Scaleup_and_Manufacturing
Self-Study Material	1. https://www.sciencedirect.com/science/article/abs/pii/S0024320523009669

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M4UMBS04	**VACCINE TECHNOLOGY**	**SEC THEORY - IV**	**IV**	**2**	**2**	**-**	**-**	**2**	

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	M	S	M	S
CO2	S	M	M	S	S	S	M	S	M	S
CO3	S	S	M	S	S	S	M	S	M	S
CO4	S	S	S	M	S	S	M	S	M	S
CO5	S	S	L	S	S	S	M	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Dr.M.Selvan	Dr.M.Selvan	Dr.S.Shahitha

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBS05	**APICULTURE**	**SEC THEORY - V**	**IV**	**2**	**2**	**-**	**-**	**2**

Objective	Students acquire a knowledge about honey bee, hives and Entrepreneurship basis		
Unit	**Course Content**	**Knowledge Levels**	**Sessions**
I	**Biology of Bees:** Honeybee - Systematic position - Species of Honey bees - Life history of Honey bee - behaviour - swarming - Pheromone	K1	6
II	**Social life in Bees**: Bee colony - Castes - natural colonies and their yield - Types of bee hives - Structure - location, care and management.	K2	6
III	**Bee Rearing:** Apiary - Care and Management - Artificial bee hives - types - construction of space frames - Selection of sites - Handling - Maintenance - Instruments employed in Apiary - Extraction instruments	K3	6
IV	**Bee Economy:** Honey - Composition - uses - Bee wax and its uses -yield in national and international market - Diseases of honey bees and their control methods. Economics of bee culture.	K4	6
V	**Entrepreneurship:** venture - Preparing proposals for financial assistance and funding agencies - Bee Keeping Industry - Recent Efforts, Modern Methods in employing artificial Bee hives for cross pollination in horticultural gardens. **Current Trends-*Health and Therapeutic Qualities of Honey***	K4	6
	…… Self Study.		
Course Outcome	**CO1:** List out the history and classification of honey bees	K1	
	CO2: Demonstrate the types of bee hives	K2	
	CO3: Choose the process of bee bearing and handling	K3	
	CO4: Survey about the honey bee production	K4	
	CO5: Conclude the process of apiculture in entrepreneurship aspect	K4	

Learning Resources	
Text Books	1. Ted Hooper. (2010). Guide to Bees & Honey: The World's Best Selling Guide to Beekeeping. Northern Bee Books. Oxford. ISBN 10: 1904846513 2. Jayashree K.V., Tharadevi C.S. and Arumugam N. (2014) Apiculture. Saras Publication 3. RajH. (2020). Vinesh Text Book of Apiculture. S.Vinesh and Co.
Reference Books	1. Eva Crane. (1999). The World History of Bee keeping and Honey Hunting. Rout ledge. India.ISBN-10:0415924677 2. Pagar B.S. (2016). Textbook of Apiculture. Sahitya Sagar. 3. Sehgal P.K. (2018).Text Book of Sericulture, Apiculture and Entomology. Kalayani.

Website Link	1.https://denton.agrilife.org/files/2013/08/beekeeping-basics.pdf 2. https://lupinepublishers.com/agriculture-journal/pdf/CIACR.MS.ID.000270.pdf 3. https://www.ars.usda.gov/ARSUserFiles/20800500/BumbleBeeRearingGuide.pdf
Self-Study Material	1. https://www.healthline.com/nutrition/benefits-of-honey#TOC_TITLE_HDR_2

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M4UMBS05	**APICULTURE**	**SEC THEORY - V**	**IV**	**2**	**2**	**-**	**-**	**2**	

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	M
CO4	S	S	S	S	M	S	S	S	S	M
CO5	S	S	S	S	S	S	S	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Mrs.S.Vahithabanu	DrM.Selvan	Dr.S.Shahitha

List of Non Major Elective Course (NMEC) offered by the B.Sc., Microbiology

SYLLABUS - LOCF-CBCS Pattern

EFFECTIVE FROM THE ACADEMIC YEAR 2023-2024 Onwards

S. No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	I	23M1UMBN01	SOCIAL AND PREVENTIVE MEDICINE
2	II	23M2UMBN02	NUTRITION AND HEALTH HYGIENE

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M1UMBN01	**SOCIAL AND PREVENTIVE MEDICINE**	**NME THEORY - I**	**I**	**2**	**2**	**-**	**-**	**2**
Objective	Students gain knowledge about the health management system and preventive medicine							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction to social medicine:** History of social medicine - concepts of health and disease - social determinants of health and disease - Health and quality of life - Health information system- measures of population health - health policies	K1	6
II	**Health management:** Applications of behavioural sciences and psychology in health management - nutritional programs for health management - water and sanitation in human health - national programs for communicable and non-communicable diseases- environmental and occupational hazards and their control.	K2	6
III	**Health care and services:** Health care of the community - information, education, communication and training in health - maternal and child health - school health services - Geriatrics-care and welfare of the aged-mental health - health services through general practitioners.	K3	6
IV	**Preventive medicine:** Introduction- role of preventive medicine - levels of prevention - Risk assessment in communities and vulnerable population – surveillance, monitoring and reporting of disease outbreaks - forecasting and control measures in community setting – early detection methods.	K4	6
V	**Prevention through alternate medicine:** Unani, Ayurveda, Homeopathy, Naturopathy systems in epidemic and pandemic outbreaks. International health regulations. Infectious disease outbreak case studies and precautionary response during SARS and MERS coronavirus, Ebola and novel SARS - COV2 outbreaks.	K4	6
Course Outcome	**CO1:** Identify the health information system	K1	
	CO2: Associate various factors with health management system	K2	
	CO3: Choose the appropriate health care services	K3	
	CO4: Appraise the role of preventive medicine in community setting	K4	
	CO5: Recommend the usage of alternate medicine during outbreaks	K4	
Learning Resources			

Text Books	1. Park.K (2021). Textbook of preventive and social medicine, 26th edition. Banarsidas Bhanot publishers. 2. Vivek Jain (2020). Review of Preventive and Social Medicine: Including Biostatics. 12th edition, Jaypee Brothers Medical Publishers. 3. La lAdarsh Pankaj Sunder (2011). Textbook of Community Medicine: Preventive and Social Medicine, CBS publisher.
Reference Books	1. Howard Waitzkin, Alina Pérez, Matt Anderson (2021). Social Medicine and the coming Transformation. First Edition. Routl edge publishers. 2. GN Prabhakara (2010). Short Textbook of Preventive and Social Medicine. Second Edition. Jaypee publishers. 3. Jerry M. Suls, Karina W. Davidson, Robert M. Kaplan (2010).Handbook of Health Psychology and Behavioral Medicine. Guilford Press.
Website Link	1. https://www.omicsonline.org/scholarly/social--preventive-medicine-journals-articles-ppts-list.php 2. https://www.teacheron.com/online-md_preventive_and_social_medicine-tutors 3. https://www.healthcare-management-degree.net

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M1UMBN01	**SOCIAL AND PREVENTIVE MEDICINE**	**NME THEORY - I**	**I**	**2**	**2**	**-**	**-**	**2**	

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	M	S	M	S
CO2	S	S	M	M	S	S	M	S	M	S
CO3	M	S	M	M	S	S	M	S	M	S
CO4	S	M	S	M	S	S	M	S	M	S
CO5	S	S	M	S	S	S	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-	
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation	
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By Member Secretary**
Dr.M.Selvan	Dr.M.Selvan	Dr.S.Shahitha

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M2UMBN02	**NUTRITION AND HEALTH HYGIENE**	**NME THEORY - II**	**II**	**2**	**2**	**-**	**-**	**2**
Objective	Students learn about nutrition and different health indicators and types of hygiene methods							

Unit	Course Content	Knowledge Levels	Sessions
I	**Nutrition** – definition, importance, Good nutrition, and mal nutrition; Balanced Diet: Basics of Meal Planning. Carbohydrates, Lipids, Proteins and Vitamins – functions, dietary sources, effects of deficiency. Macro and micro minerals – functions, effects of deficiency; food sources of Calcium, Potassium, and Sodium; food sources of Iron, Iodine, and Zinc. Importance of water – functions, sources, requirements and effects of deficiency	K1	6
II	**Nutrition for Life Cycle:** Balanced diet - Normal, Pregnant, lactating women, Infancy, young children Adolescents, Adults, and the Elderly; Diet Chart; Nutritive value of Indian foods.	K2	6
III	**Improper diets:** Definition, Identification, Signs and Symptoms - malnutrition, under-nutrition, over-nutrition, Protein Energy Malnutrition, obesity; Nutritional Disease and Disorder - hypertension, diabetes, anaemia, osteomalacia, cardiovascular disease.	K3	6
IV	**Health -** Determinants of health, Key Health Indicators, Environment health and Public health; Health - Education: Principles and Strategies. Health Policy and Health Organizations: Health Indicators and National Health Policy of Govt. of India; Functioning of various nutrition and health organizations in India.	K5	6
V	**Hygiene –** Definition; Personal, Community, Medical and Culinary hygiene; WASH (Water, Sanitation and Hygiene) programme. Rural Community Health: Village health sanitation and Nutritional committee. Community and Personal Hygiene: Environmental Sanitation and Sanitation in Public places.	K6	6
Course Outcome	**CO1:** Remember the importance of nutrition for a healthy life	K1	
	CO2: Understand the nutrition for life cycle	K2	
	CO3: Make use of the health care programmes of India	K3	
	CO4: Categorize the importance of community and personal health and hygiene measures	K5	
	CO5: Create awareness on community health and hygiene	K6	
Learning Resources			

Text Books	1. SK. Haldar (2022). Occupational Health and Hygiene in Industry. CBS Publishers 2. Acharya, Sankar Kr, Rama Das, MinatiSen (2021). Health Hygiene and Nutrition Perception and Practices. Satish Serial Publishing House 3. Dass (2021).Public Health and Hygiene, Notion Press
Reference Books	1. Revilla M. K. F., Titchenal A. and Draper J. (2020). Human Nutrition. University of Hawaii, Mānoa. 2. Sharma D. (2015).Textbook on Food Science and Human Nutrition. Daya Publishing House. 3. VijayaKhader (2000)Food, nutrition & health, Kalyan Publishers, New Delhi
Website Link	1. https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=969&lid=49 2. https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=970&lid=137 3. https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=149&lid=225

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M2UMBN02	**NUTRITION AND HEALTH HYGIENE**		**NME THEORY - II**		**II**	**2**	**2**	**-**	**-**	**2**

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	M	S	S	S	S	S	M	S
CO4	M	S	S	M	S	S	M	S	S	S
CO5	S	S	L	S	S	S	M	S	S	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Dr.M.Selvan	Dr.M.Selvan	Dr.S.Shahitha

Allied Course for any Degree offered by the B.Sc., Microbiology LOCF-CBCS Pattern EFFECTIVE FROM THE ACADEMIC YEAR 2023-2024 Onwards LIST OF GEC - ALLIED COURSES			
S. No.	**Sem.**	**COURSE_CODE**	**TITLE OF THE COURSE**
1	IV	23M4UMBA01	FUNDAMENTALS OF MICROBIOLOGY
2	IV	23M4UMBAP1	ALLIED PRACTICAL : FUNDAMENTALS OF MICROBIOLOGY

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B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBA01	**ALLIED : FUNDAMENTALS OF MICROBIOLOGY**	**GEC THEORY - I**	**IV**	**4**	**4**	**-**	**-**	**3**
Objective	Students learn the basic principles of microbiology							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction to microbiology:** History and scope of Microbiology, Spontaneous generation – Biogenesis theory – Contribution of Anton van Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner and Alexander Fleming.	K1	9
II	**Principles of microscopy:** Microscope- Principles, working mechanism and application – Simple and compound microscope - Dark field – Phase contrast, Fluorescence, Electron microscopy (SEM and TEM).	K2	9
III	**Principles and types of staining:** Structure and organization of bacterial cell, Gram positive and Gram negative bacterial cell wall. Types of Staining – Simple, Differential (Gram's, AFB), Special – Capsular staining (negative), Spore and LPCB staining.	K3	10
IV	**Sterilization and Disinfection:** principles – methods of sterilization – physical methods – Dry heat- Moist heat- Radiation. Filtration (Membrane and HEPA). Chemical sterilization – Chemical agents – mode of action- Phenol Coefficient test- Sterility testing –Autoclave, Hot air oven and Laminar air flow	K4	10
V	**Cultivation of Bacteria:** Culture and media preparation – solid and liquid. Types of media- Semi synthetic, Synthetic, Enriched, Enrichment, Selective and Differential media. Pure culture techniques – Tube dilution, Pour, Spread, Streak plate. Anaerobic culture technique- Candle jar and Anaerobic Jar. **Current Trends-* Microbiology in the 21st Century**	K5	10
	…… Self Study.		
Course Outcome	**CO1:** Recall the history of Microbiology.	K1	
	CO2: Explain and relate the commonly used microscope	K2	
	CO3: Describe basic and specialized staining technique and indicate its importance.	K3	
	CO4: Compare the diverse kinds of sterilization techniques to value	K4	

	samples.		
	CO5: Assess the knowledge about Culture and media preparation	K5	

Learning Resources	
Text Books	1. Willey J., Sherwood L., and Woolverton C. J., (2017). Prescott's Microbiology. 10th Edition. McGraw-Hill International edition. 2. Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11th Edition. A La Carte Pearson.
Reference Books	1. Jeffrey C. Pommerville., Alcamo's Fundamentals of Microbiology (9th Edition). Jones & Bartlett learning 2010. 2. Madigan M.T., Martinko J.M., Stahl D.A, and Clark D. P. (2010). Brock - Biology of Microorganisms, 13th Edition Benjamin-Cummings Pub Co.
Website Link	1. https://www.cliffsnotes.com/study-guides/biology/microbiology/introduction-to- microbiology/a-brief-history-of-microbiology 2. https://www.keyence.com/ss/products/microscope/bz-x/study/principle/structure.jsp 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/#
Self-Study Material	https://www.ncbi.nlm.nih.gov/books/NBK560448/

	L-Lecture	T-Tutorial	P-Practical	C-Credit

B.Sc. - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBA01	**ALLIED : FUNDAMENTALS OF MICROBIOLOGY**	**GEC THEORY - I**	**IV**	**4**	**4**	**-**	**-**	**3**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	S	M	M	S	M	S
CO2	M	S	S	S	S	M	S	S	M	M
CO3	S	S	S	S	S	M	M	S	S	S
CO4	S	S	S	S	S	S	M	S	M	M
CO5	S	S	S	S	S	M	M	S	M	S

Level of Correlation between CO and PO	L-LOW	M-MEDIUM	S-STRONG

Tutorial Schedule	-
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Assignment, PPT Presentation and Video presentation
Assessment Methods	Class Test, Unit Test, Assignment, CIA-I, CIA-II and ESE

Designed By	**Verified By**	**Approved By Member Secretary**
Dr.M.Selvan	Dr.M.Selvan	Dr.S.Shahitha

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE
(Autonomous)
Rasipuram - 637408.

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBAP1	**ALLIED PRACTICAL : FUNDAMENTALS OF MICROBIOLOGY**	**GEC PRACTICAL - I**	**IV**	**3**	**-**	**-**	**3**	**3**
Objective	Students learn about the microbial staining techniques and handling of instruments							

S.No.	Course Content	Knowledge Levels	Sessions
1	Laboratory practice & precautions	K1-K3	3
2	Handling of Instruments & cleaning of glassware's.	K3	3
3	Handling of microscopes and its operations	K3	3
4	Handling of laboratory instruments a) Autoclave b) Hot air oven c) Laminar air flow d) pH meter e) Colony counter f) Incubator.	K3	6
5	Staining techniques a. Smear preparation: Heat fixation, simple staining procedure b. Differential staining (Gram's and Acid fast staining) c. Special staining (Spore and Capsular staining methods) d. Fungal staining - LCB Staining	K4	9
6	Media preparation a. Liquid media – Peptone water, Nutrient broth. b. Solid media – Nutrient agar (Agar slant, Agar plate – streaking method c. Enriched Medium – Blood agar d. Differential medium – Mac Conkey agar, SS Agar. e. Selective medium – EMB, MSA.	K5	9
7	Anaerobic cultivation – Candle jar and Anaerobic Jar (Demonstration)	K5	3
Course Outcome	**CO1:** Remember the laboratory good practices.	K1	
	CO2: Evaluate the microorganisms by Staining Methods.	K3	
	CO3: Categorize the microscopic observation of microorganisms.	K3	
	CO4: Categories the different sterilization methods.	K4	
	CO5: Evaluate the suitable medium for cultivation of bacteria.	K5	
Learning Resources			

Text Books	1. Gunasekaran P. (2007). Laboratory Manual in Microbiology. New Age International. 2. Sundararaj T. Microbiology laboratory manual. Revised and published by Aswathy Sundararaj. No.5 First Cross Street, Thirumalai Nagar, Perungudi, Chennai.
Reference Books	1. James G Cappuccino and Natalie Sherman (2007). Microbiology: A laboratory manual. 8th edition, Published by Pearson Education. 2. Kannan N (2002). Laboratory Manual in General Microbiology. First edition, Palani Paramount Publications, Palani. Tamil Nadu. 3. Harold J Benson (2006). Microbiological Applications Laboratory Manual in General Microbiology. 10th International edition, Me Grew - Hill, Boston.
Website Link	1.https://onlinelibrary.wiley.com/doi/book/10.1002/0471223867 2.https://bio.libretexts.org/Learning_Objects/Laboratory_Experiments/Microbiology_Labs/Book%3A_General_Microbiology_Lab_Manual_(Pakpour_and_Horgan)

B.Sc - Microbiology Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**		**Course Type**		**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M4UMBAP1	**ALLIED PRACTICAL : FUNDAMENTALS OF MICROBIOLOGY**		**GEC PRACTICAL - I**		**IV**	**3**	**-**	**-**	**3**	**3**
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	S	S	S	S	S	S	S	S
CO2	S	M	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	
Tutorial Schedule	-									
Teaching and Learning Methods	Audio Video lecture, Chalk and Board class, Poster Presentation, Demonstration and Video presentation									
Assessment Methods	CIA I, CIA II and ESE									
Designed By	**Verified By**					**Approved By Member Secretary**				
Dr.M.Selvan	Dr.M.Selvan					Dr.S.Shahitha				

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B.Sc- Microbiology Syllabus LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M5UMBIS1	**INTERNSHIP**	**INTERNSHIP**	**V**	**-**	**-**	**-**	**-**	**2**
Objective	To give optimum exposure on the practical aspects of Microbiology industry							

S. No.	Guidelines for Internship Training Programme	Knowledge Levels	Sessions
1	The student should undergo **15 Days Internship** training in any Microbiology lab / Food industry / Poultry farm / Water plant / Biofertilizer industry during the vacation which falls at the end of the 2nd Semester.	K2-K4	
2	The training bridges the gap between the theoretical knowledge gained in the college and the practical application of the same in the industry / company / stores. The student will have a better exposure about the workplace and its nuances.		
3	Schedule of visit to be made by the staff is to be prepared by the HOD / Staff-in-charge.		
4	The trainees should strictly adhere to the rules and regulations and office timings of the institutions to which they are attached.		
5	A Staff member of a Department (Guide) will be monitoring the performance of the Candidate.		
6	The students should maintain a daily logbook where the student should record his details of the training.		
7	The trainees have to obtain a certificate on successful completion of the internship from the chief executive of an organization.		
8	The student should submit an attendance certificate to the institution for 15 days internship training from an organization.		
9	Internship Training Report (30 – 50 pages) should be prepared by the student and submitted in a month's time and at the end of the semester student should present the report with a power point presentation.		
10	Industrial training reports shall be prepared by the students under the supervision of the faculty of the department.		
11	Industrial training report must contain the following: Cover page Copy of training certificate, Profile of an industry report about the work undertaken by them during the tenure of training observation about the concern findings.		
12	Practical viva – voce examination will be conducted with internal & external examiners at the end of the **5th semester** and the credits will be awarded.		

13	Report Evaluation: External Viva-Voce examination will be conducted and the maximum mark is 100.		
Course Outcome	**CO1:** Apply new techniques and ideas in microbiology industry	K3	
	CO2: Analyze the results of new initiatives	K4	
	CO3: Create a new work plan with greater output	K6	
	CO4: Create a framework of work execution ideas	K6	
	CO5: Create a detailed technical work plan and terminologies to be followed in industry.	K6	

Learning Resources	
Text Books	1. The Successful Internship by H. Frederick Sweitzer, Mary A. King, 2013. 2. Social Media Tools in Experiential Internship Learning by Samuel Kai Wah Chu, 2020.
Reference Books	1. The Intern Files: How to Get, Keep and Make the Most of Your Internship by Jamie Fedorko, 2006.
Website Link	1. http://gen.lib.rus.ec/

B.Sc - Microbiology LOCF-CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M5UMBIS1	**INTERNSHIP**	**INTERNSHIP**	**V**	**-**	**-**	**-**	**-**	**2**	
CO-PO Mapping									
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	S	S	S	S	M	S	S	S	S
CO2	S	M	S	S	S	S	M	S	S	S
CO3	M	S	S	S	S	M	S	S	S	S
CO4	S	M	S	S	S	S	M	S	S	S
CO5	M	S	S	S	S	M	S	S	S	S
Level of Correlation between CO and PO		L-LOW		M-MEDIUM			S-STRONG			
Tutorial Schedule				-						
Teaching and Learning Methods				-						
Assessment Methods				**CIA – 100 Marks** 1. Work Log Book – 25 Marks 2. Training Report and Viva-Voce – 75 Marks						
Designed By			**Verified By**			**Approved By Member Secretary**				
Dr.M.Selvan			Dr.M.Selvan			Dr.S.Shahitha				

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B.Sc., Microbiology LOCF-CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBPR1	**PROJECT WORK**	**PROJECT WORK**	**VI**	**4**	**-**	**-**	**4**	**3**
Objective	To inculcate/impart skills on experiment designing, experiment execution and research report to provide skills on writing thesis dissertation							

Details	**Course Content**	**Knowledge Levels**	**Sessions**
PROJECT PREPARATION FORMAT			
Cover Page & Title Page	**Cover Page & Title Page:** The fonts and locations of various items on this page should be exactly as shown in a specimen copy**.**		
Inside cover page	Inside cover page Same as cover page.		
Bonafide Certificate	**Bonafide Certificate**: The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14.		
Acknowledgement	**Acknowledgement:** This should not exceed one page.		
Abstract	**Abstract:** Abstract should be one page synopsis of the project report typed double line spacing, Font Style Times New Roman and Font Size 14.		
Contents	**Table of Contents:** The table of contents should list all headings, sub headings after the table of contents page, as well as any titles preceding it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents. One and a half spacing should be adopted for typing the matter under this head.		
Tables	**List of Tables**: The list should use exactly the same captions as they appear above the tables in the text. 1.5 spacing should be adopted for typing the matter under this head.		
Figures	**List of Figures**: The list should use exactly the same captions as they appear below the figures in the body of the text. One and a half spacing should be adopted for typing the matter under this head. All charts, graphs, maps, photographs and diagrams should be designated as figures. X and Y axes titles are mandatory for all the graphs.		
Symbols	**List of Symbols, Abbreviations and Nomenclature:** 1.5 spacing should be adopted or typing the matter under this head. Standard symbols, abbreviations etc. should be used.		
Chapters	**Chapter I** - **Introduction:** Statement of the Problem, Significance, Need for the study, Objectives		

	Chapter II- Review of literature		
	Chapter III- Methodology: Tools used, Procedures, Hypothesis.		
	Chapter IV- Results and Discussion: Tables and Figures, Statistical Presentations, Hypothesis Testing.		
	Chapter V- Summary and conclusion		
	Chapter VI-Scope of the Project		
	References		

Guidelines For Project Preparation			
Numbering	• Every page in the project report, except the project report title page, must be accounted for and numbered. • The page numbering, starting from acknowledgements and till the beginning of the introductory chapter, should be printed in small Roman numbers, i.e, i, ii, iii, iv • The page number of the first page of each chapter should not be printed (but must be accounted for). All page numbers from the second page of each chapter should be printed using Arabic numerals, i.e. 2,3,4,5. • All printed page numbers should be located at the right corner at the bottom of the page.	K4-K6	
Chapters	• Use only Arabic numerals. Chapter numbering should be centered on the top of the page using large bold print. <Size 14><Times New Roman>	K4-K6	
TEXT			
Regular Text	**Regular Text**: Times Roman 12 pts and normal print.	K4-K6	
Chapter Heading	**Chapter Heading -** Times Roman 14 pts. Bold and capital.	K4-K6	
Section Headings	**Section Headings -** Times roman 12 pts. Bold and capital.	K4-K6	
Subsection Headings	**Subsection Headings** - times roman 12 pts. bold print and Leading capitals i.e, only first letter in each word should be in capital.	K4-K6	
Special Text	**Special Text-** Italics/Superscript /Subscript/Special symbols, etc., as per necessity. Special text may include footnotes, endnotes, physical or chemical symbols, mathematical notations, etc.	K4-K6	
Sections	**Sections:** Use only Arabic numerals with decimals. Section numbering should be left justified using bold print. Example: 1.1, 1.2, 1.3, etc.	K4-K6	
Sub Sections	**Sub Sections:** Use only Arabic numerals with two decimals. Subsection numbering should be left Justified using bold print. Example: 1.1.1, 1.1.2, 1.1.3, etc.	K4-K6	
References	Use only Arabic numerals. Serial numbering should be carried out based on Alphabetical order of surname or last name of first author. The format is written like, author name followed by year followed by title of the work followed by details of the journal. Same font as regular text, serial number and all authors names to be in bold print. Title and Journal names should be in italic. One Author: Williams, G. State and Society in. Onco State, Nigeria, Afrographika, 1980. Two Authors: Phizacklea, A & Miles, R. Labour and Racism. London, Routledge & Kegan Paul, 1980.	K4-K6	

	3+ Authors: O'Donovan, P., *et al.* The United States. Amsterdam, Time-Life International, 1966.		
Typing Instructions	**Typing Instructions:** The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style 'Times New Roman' and Font size 12. Use A4 (210 mm X 297 mm) bond un-ruled paper (80 gsm) for all copies submitted. Use one side of the paper for all printed/typed matter.	K4-K6	
Justification	**Justification:** The text should be fully justified	K4-K6	
Margins	**Margins:** The margins for the regular text are as follows LEFT - 1.5" RIGHT - 1" TOP - 1" BOTTOM - 1"	K4-K6	
Paragraph Spacing	Use 6 pts before & 6 pts after paragraphs. All paragraphs in the seminar/project report should be left justified completely, from the first line to the last line. Use 1.5 spacing between the regular text and quotations. Provide double spaces between: (a) From top of page to chapter title, (b) Chapter title and first sentence of a chapter, Use single spacing (a) In footnotes and endnotes for text. (b) In explanatory notes for tables and figures. (c) In text corresponding to bullets, listings, and quotations in the main body of seminar/project report. (d) Use single space in references and double space between references.	K4-K6	
Tables	All tables should have sharp lines, drawn in black ink, to separate rows/columns as and when necessary. Tables should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including tables on a page, should be avoided. Provide double spaces on the top and the bottom of all tables to separate them from the regular text, wherever applicable. The title of the table etc. should be placed on the top of the table. The title should be centered with respect to the table. The titles must be in the same font as the regular text and should be single spaced.	K4-K6	
Figures	All figures, drawings, and graphs should be drawn in black ink with sharp lines and adequate contrast between different plots if more than one plot is present in the same graph. The title of the figure etc. should be placed on the bottom of the figure. Figures should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including figures on a page, should be avoided. Provide double spaces on the top and the bottom of	K4-K6	

	all figures to separate them from the regular text, wherever applicable. Figures should be centered with respect to the figure. The titles must be in the same font as the regular text and should be single spaced. The title format is given below: Fig. <blank><chapter number>.<serial number><left indent><figure		
Page Dimension &Binding Specifications	The project report should be prepared in A4 size. The dissertation shall be properly bound; The bound front cover should indicate in Silver and embossed letter.		
Course Outcome	**CO1:** Identification of research idea	K4	
	CO2: Analyze of problem solving skills	K4	
	CO3: Analyze sources for conduct of Research	K4	
	CO4: Evaluate the research report	K5	
	CO5: Create the research report	K6	

Learning Resources	
Text Books	1. Research Methodology: Methods and Techniques, by C.R. Kothari, New Age Publications, 2009.
Reference Books	1. Research Methodology: Methods and Techniques by C.R. Kothari, New Age Publications, 1985. 2. Essentials of Research Design and Methodology by: Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005.
Website Link	1. http://gen.lib.rus.ec/

B.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2023-2024 Onwards									
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**	
23M6UMBPR1	**PROJECT WORK**	**PROJECT WORK**	**VI**	**4**	**-**	**-**	**4**	**3**	

CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	L	M	M	L	S	L	M	S	S	S
CO2	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	S	S	S	S	M	M
CO4	S	S	S	M	S	S	S	S	M	M
CO5	M	M	M	S	S	M	M	S	L	S
Level of Correlation between CO and PO		L-LOW			M-MEDIUM			S-STRONG		
Tutorial Schedule					-					
Teaching and Learning Methods					-					

Assessment Methods	EA - 100% 1. Project Report - 150 Marks 2. Viva-Voce - 50 Marks 3. Total - 200 Marks	
Designed By	**Verified By**	**Approved By Member Secretary**
Dr. M.Selvan	Dr. M.Selvan	Dr.S.Shahitha

B.Sc., Microbiology for Competitive Examination Syllabus-LOCF-CBCS-Pattern with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem.**	**Hours**	**L**	**T**	**P**	**C**
23M6UMBOE1	**Microbiology for Competitive Examination**	**Self-study Online - Competitive Examination**	**VI**	**-**	**-**	**-**	**-**	**2**
Objective	Creating the awareness on competitive examination among students. Imparting knowledge about appearing for Competitive Examination and it impacts and developing an attitude for appearing such Examinations.							
	Course Content						**Knowledge Levels**	**Sessions**
	Assemblage of different papers related to Microbiology in particular, Fundamentals of Microbiology, Immunology, Bacteriology, Mycology, Virology, Food, Dairy, Environmental and Agri. Microbiology etc., Major emphasis has been put forth to include recent developments in the subjects. This course aims to give a holistic view of all the topics which comprised of some factual text points, multiple choice questions (MCQ), it is extremely suitable for students pursuing their higher degree in University/institute for their entrance exams, students preparing for various national and state level competitive entrance exams such as ICAR, Central and State level University Entrance exam, etc. to get admission in M.Sc. Microbiology and Medical Microbiology, etc., In addition, it is also useful for UPSC and PSC. **Rules for creating MCQ pattern.** 1. Objective type online examination will be conducted at the end of 6th semester. 2. Questions must be taken from all previous question papers of CSIR-NET, SET, NEET, UPSC, IBPS and Common Entrance Test for Ph.D. 3. **Test for critical thinking**. Multiple choice questions to test the superficial knowledge. Learners to interpret facts, evaluate situations, explain the causes and effect, make inferences, and predict the results. 4. **Emphasize for Higher-Level Thinking** Use memory-plus, application oriented questions. These questions require students to recall the principles, rules and facts in a real life context. **Eg.1**							K1- K6	

	Ability to Justify Methods and Procedures Why is adequate lighting necessary in a balanced aquarium? a. Fish need light to see their food. b. Fish take in oxygen in the dark. c. Plants expel carbon dioxide in the dark. d. Plants grow too rapidly in the dark. **Eg.2** Ability to Interpret Cause-and-Effect Relationships What does a viral DNA becomes after being associated with the bacterial chromosome? a) plasmid b) plaque c) prophage d) gene **5. Mix up the order of the correct answers** Keep correct answers in random positions and don't let them fall into a pattern that can be detected 6. **Use a Question Format** Multiple-choice items to be prepared as questions (rather than incomplete statements) Incomplete Statement Format: The capital of California is in Direct Question Format------ Less Effective. In which of the following city is the capital of California? This is Best format. 7. **Keep Option Lengths Similar** Avoid making your correct answer the long or short answer 8. **Avoid the "All the Above" and "None of the Above" Options** Students merely need to recognize two correct options to get the answer correct 9. HOD's instruct to the faculty to prepare minimum 500 questions booklet (cumulatively for each programme) with solutions and circulate among the		

	students.		
Course Outcome	**CO1:** Students will remember the advanced biochemical and molecular techniques.	K1	
	CO2: Students will be able to understand the basic rules and the concepts.	K2	
	CO3: To be able to apply in real life situations.	K3	
	CO4: To analyze and create the new ideas for various competitive examinations.	K4-K5	
	CO5: To assess forms and levels of critical thinking.	K2	
Text Books	1. Tortora, G.J., Funke, B.R. and Case, C.L. (2016) Microbiology: An Introduction, 11th Edition, Pearson Education, India.		
	2. Owen,J.,Punt, J and Strandford, S. "Kuby Immunology", 7th Ed., W.H.Freeman Publication, NewYork, USA, 2012.		
	3. Watson JD, Hopkins NH, Roberts JW *et al.* (1987) Molecular Biology of the Gene, 4thedn. Menlo Park, CA: Benjamin-Cummings		
	4. Brown, T.A. 1995.Gene Cloning–An Introduction. [Third Edition]. Chapmanand Hall, UK.		
	5. Mcq's In Microbiology: Advanced by Balaram Mohapatra., 2019.		
Reference Books	1. Chetan D. M., Dr. S. Nanjunda Swamy, (2021). Microbiology Multiple-Choice Questions (Mcqs) For Neet and Net Examinations.		
Website Link	https://www.ugc.ac.in/old pdf /model curriculum/env.pdf https://swayam.gov.in/nc_details/NPTEL		

B.Sc-Microbiology Syllabus LOCF-CBCS with effect from 2023-2024 Onwards											
CO- PO Mapping											
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	S	S	S	S	M	S	S	M	S	S	
CO2	S	M	S	S	S	S	S	S	S	M	
CO3	M	S	S	S	S	M	S	S	S	S	
CO4	S	S	S	S	S	S	S	S	M	S	
CO5	S	S	S	S	M	S	S	S	S	S	
Level of Correlation between CO and PO					L-LOW		M-MEDIUM		S-STRONG		
Tutorial Schedule					NET/SET/GATE/CET/TRB/NEET Old question papers – solutions –online mock test						
Teaching and Learning Methods					Self-study, Group discussion, Chalk and Talk, Audio-Video Learning, learning through mock test and experienced learning						
Assessment Methods					100 multiple choice questions through computer based online examinations passing minimum is 50%						
Prepared By					**Verified By**				**Approved By Member Secretary**		
Dr.S.Anbalagan					Dr.M.Selvan				Dr.S.Shahitha		