B.Sc., MICROBIOLOGY

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS – LOCF)

***(For the candidates admitted in the academic year* 2023-2024)**

SYLLABUS

PROGRAMME CODE: 3USMIC

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

(Affiliated to Bharathidasan University, Tiruchirappalli)

Accredited by NAAC-An ISO 9001:2015 Certified Institution

SUNDARAKKOTTAI, MANNARGUDI – 614 016

TAMIL NADU, INDIA.

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B.Sc., MICROBIOLOGY

CHOICE BASED CREDDIT SYSTEM– LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (CBCS–LOCF)

(For the candidates admitted in the academic year 2023–2024)

CHOICE BASED CREDIT SYSTEM

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Our College have has moved to CBCS and implemented the grading system.

OUTCOME-BASED EDUCATION (OBE)

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that higher education qualifications are awarded on the basis of demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and academic standards expected of graduates of a programme of study. Learning outcomes specify what graduates completing a particular programme of study are expected to know, understand and be able to do at the end of their programme of study. The expected learning outcomes are used as reference points that would help formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes which in turn will help in curriculum planning and development, and in the design, delivery and review of academic programmes. They provide general guidance for articulating the essential learnings associated with programmes of study and courses with in a programme, maintain national standards and international comparability of learning outcomes and academic standards to ensure global competitiveness, and to facilitate student/graduate mobility and provide higher education

institutions an important point of reference for designing teaching-learning strategies, assessing student learning levels, and periodic review of programmes and academic standards.

Some important aspects of the Outcome Based Education

Course: is defined as a theory, practical or theory cum practical subject studied in a semester. **Course Outcomes (COs):** are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage. **Programme:** is defined as the specialization or discipline of a Degree. **Programme Outcomes (POs):** Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes. **Programme Specific Outcomes (PSOs):** PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC) A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Specific Elective Courses (DSE) Elective course may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective (DSE). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are **also more applied in nature. Generic Elective Courses** An elective course chosen generally from an **unrelated discipline/subject,** with an intention to seek exposure is called a Generic Elective. Generic Elective courses are designed for the students of **other disciplines**. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opt Generic Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programme are being offered by the college. Ability Enhancement Compulsory Courses "AECC" are the courses based upon the content that leads to Knowledge enhancement especially in Communicative English and other soft skills.

Skill Enhancement Courses (SECs) These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme. These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge**.**

Field Study/Industrial Visit/Case Study: It has to be completed during the fifth semester of the degree programme. Credit for this course will be entered in the fifth semester's marks statement.

Internship: Students must complete internship during summer holidays after the fourth semester. They have to submit a report of internship training with the necessary documents and have to appear for a viva-voce examination during fifth semester. Credit for internship will be entered in the fifth semester's mark statement.

Extra Credit Courses: In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, the extra credit are at three semesters after verifying the course completion certificates. According to the guidelines of UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL etc.

Undergraduate Programme:

Programme Pattern: The Under Graduate degree programme consists of **FIVE** vital components. They are as follows:

Part -I : Languages (Tamil / Hindi / French / Sanskrit)

Part-II : General English

Part-III: Core Course (Theory, Practicals, Generic Elective courses , Discipline Specific Elective courses , Compulsory and Optional Allied courses, Project)

Part-IV: Non Major Elective, Foundation Course, Ability Enhancement Compulsory Course, Value Education, Environmental studies, Skill Enhancement Courses/ Soft Skills, Internship / field visit / industrial visit/ Case Study), Professional Competency Course

Part –V

Extension activity, Gender studies

EXAMINATION

Continuous Internal Assessment (CIA):

UG - Distribution of CIA Marks

Passing Minimum: 40 %

Assisgnment-3	=	30%
Test-2	=	50%
Seminar	=	10%
Attendance	=	10%

Question Paper Pattern

Part A:

Part A 1 (10X1=10 marks)
One word question/ Fill in/ Match the following/True or False/ Multiple Choice Questions
Two Questions from Each unit

Part A 2 (5X2=10 marks)
Short Answers
One question from Each unit
Total Marks – 20
Part B: (5X5=25 marks)
Paragraph Answers
Either/ or type, One Questions from each unit
Part C: (10X3=30)
Essay Type Answers
Answer 3 out of 5 Questions
One Question from each unit
Part A: K1 Level
Part B: K2, K3 and K4 Level
Part C: K5 and K6 Level

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/ Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

WEIGHTAGE of K – LEVELS IN QUESTION PAPER

(Cognitive Level) K- LEVELS →	Lower Order Thinking			Higher Order Thinking			Total
	K1	K2	K3	K4	K5	K6	
END SEMESTER EXAMINATIONS (ESE)	20	25			30		**75**
Continuous Internal Assessment (CIA)	20	25			30		**75**

QUESTION PATTERN FOR SEMESTER EXAMINATION/ Continuous Internal Assessment		
PART		**MARKS**
PART –A I. (No choice ,One Mark) **TWO** questions from each unit **II.** (No choice ,Two Mark) **ONE** question from each unit	(10x1 =10) (5x2 =10)	20
PART -B (Either/ or type ,5-Marks) **ONE** questions from each unit	(5x5 =25)	25
PART -C (3 out of 5) (10 Marks) **ONE** question from each unit	(3x10 =30)	30
	Total	**75**

BLUE PRINT OF QUESTION PAPER FOR SEMESTER EXAMINATION							
DURATION: 3. 00 Hours.							**Max Mark : 100**
K- LEVELS	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**Total**
PART							**Marks**
PART –A (One Mark, No choice) (10x1 =10)	10						10
(2-Marks, No choice) (10x2=20)	10						10
PART –B (5- Marks) (Either/or type) (5x5=25)		5	10	10			25
PART -C (10 Marks) (3 out of 5) (3x10=30) Courses having only **K5,K6** levels, K5 level- 3 Questions, K6 level- 2 Questions **(One K6 level question is compulsory)**					20	10	30
Total	**20**	**05**	**10**	**10**	**20**	**10**	**75**

EVALUATION

GRADING SYSTEM

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added and converted as final mark. The marks thus obtained will then be graded as per the scheme provided in Table-1.

Grade Point Average (GPA) will be calculated from the first semester onwards for all semester. From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA) , respectively. These twoare calculated by the following formulae:

$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{I=1}^{n} C_i}$	$WAM\,(Weighted\ Average\ Marks) = \frac{\sum_{i=1}^{n} C_i M_i}{\sum_{I=1}^{n} C_i}$
Where, C_i is the Credit earned for the Course i G_i is the Grade Point obtained by the student for the Course i M_i is the marks obtained for the course i and n is the number of Courses **Passed** in that semester.	

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

CLASSIFICATION OF FINAL RESULTS:

i) For each of the first three parts, there shall be separate classification on the basis of CGPA, as indicated in Table-2.

ii) For the purpose of declaring a candidate to have qualified for the Degree of Bachelor of Arts/Science/Commerce/Management as Outstanding/Excellent/Very Good/Good/Above Average/Average, the marks and the corresponding CGPA earnedby the candidate in Part-III alone will be the criterion, provided the candidate has secured the prescribed passing minimum in the all the Five parts of the Programme.

iii) Grade in Part –IV and Part-V shall be shown separately and it shall

not be taken into account for classification.

iv) A Pass in PART- V will be mandatory although the marks will not count for the calculation of the CGPA.

v) Absence from an examination shall not be taken an attempt.

Table-1: Grading of the Courses - UG

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
40 and above and below 50	5	C
Below 40	0	RA

Table- 2: Grading of the Courses - PG

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
Below 50	0	RA

Table-3: Final Result

CGPA	Corresponding Grade	Classification of Final Result
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
4.00 to 4.99	C	Average
Below 4.00	RA	Re-appearance

VISION

Empowering the women students with quality education on utility of microbes, microbial processes, products, to make them academics and entrepreneurs to serve for the welfare of society.

MISSION

- To initiate, promote, develop, sustain quality and innovative research using sophisticated instruments in the field of Microbiology.
- To motivate the students so as to exploit the potentiality of microbes and microbial processes for the betterment of the society

PROGRAMME OUTCOMES FOR B.Sc.,DEGREE PROGRAMMES

PO No.	Programme Outcomes (*Upon completion of the B.Sc. Degree Programme, the Undergraduate will be able to)*
PO-1	**Disciplinary knowledge**: Demonstrate comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate program of study in Bachelor of Science.
PO-2	**Critical thinking, Problem Solving and Reflective thinking:** think critically about the issues and identify, critically analyze and solve problems from the disciplines of concern using appropriate tools and techniques and the knowledge, skills and attitudes acquired and extrapolate the same to real life situations; show critical sensibility to life experiences, with self awareness and reflexivity of both self and society.
PO-3	**Analytical & Scientific Reasoning:** evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints; critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.
PO-4	**Research-related Skills:** develop a sense of capability for relevant/appropriate inquiry and asking questions, synthesize, articulate and report results and to recognize and predict cause and effect relationships, define problems, formulate and establish hypothesis, analyze and interpret and draw conclusions from data, execute and report the results of an experiment or investigation.
PO-5	**Digital literacy and Effective Communication:** use ICT in a variety of learning situations and **s**peak, read, write and listen clearly in person and through electronic media in English and in one or more Indian languages, and make meaning of the world by connecting people, ideas , books, media and technology; efficiently communicate thoughts and ideas in a clear and concise manner.
PO-6	**Individual and Team Work:** effectively accomplish tasks individually as well as work effectively and respectfully as member or leader with diverse teams, facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interest so for a common cause and work efficiently as a member of a team.
PO-7	**Multicultural Competence and Social Interaction:** understand the values and beliefs of multiple cultures, global perspectives, engage and interact respectfully with diverse groups and elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO-8	**Awareness of Ethical issues, Human values and Gender Issues:** embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work and understand the value of relationship between self and the community and aware of the various issues concerning women and society.
PO-9	**Awareness of Environment and Sustainability:** understand the impacts of technology and business practices in societal and environmental contexts, and sustainable development.
PO-10	**Self directed and Lifelong learning:** acquire knowledge and skills, including learning "how to learn", that are necessary for participating in learning activities throughout life and to engage in independent and life-long learning in the broadest context of socio-technological changes.

PROGRAMME SPECIFIC OUTCOME (PSO) FOR B.Sc.,DEGREE PROGRAMMES

PSO No.	Program Specific Outcomes (B.Sc., Microbiology)
PSO1	**Placement :** Prepare the students in all disciplines like agriculture, industry-medical, pharma, dairy, hotel, food and food processing, immunologicals, cosmetics, vermitechnology and water treatment for effective and respectful placement.
PSO2	**Entrepreneur :** To create effective entrepreneur by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.
PSO3	**Research and Development :** Design and implement HR systems that comply with good laboratory practices, following ethical values, leading the organization towards growth and development.
PSO4	**Contribution to society:** To contribute to the development of society and produce microbiological products, by collaborating with stake holders, related to the betterment of environment and mankind at the national and global level.

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CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS – LOCF)
(For the candidates admitted in the academic year 2023 – 2024)

ELIGIBILITY: A Pass in 10+2 with Biology as one of the core subjects

Sem	Part	Course	Course Code	Title of the Paper	Ins. Hours/ Week	L	T	P	S	Credit	Exam Hours	Marks		Total
												CIA	ESE	
I	I	Language Course-I	U23LC101	Pothu Tamil-1	6	5	1	-	-	3	3	25	75	100
	II	English Language Course-I	U23ELC101	General English – I	6	5	1	-	-	3	3	25	75	100
	III	Core Course-I	U23MB101	Fundamentals of Microbiology and Microbial Diversity	5	4	1	-	-	5	3	25	75	100
		Core Practical-I	U23MB102P	Fundamentals of Microbiology and Microbial Diversity	4	1	-	3	-	4	3	25	75	100
		Allied Course-I	U23ABC101	Basic and Clinical Biochemistry	3	2	1	-	-	2	3	25	75	100
		Allied Practical-I	U23ABC102P	Basic and Clinical Biochemistry	2	-	-	2	-	--	--	---	--	--
	IV	Non Major Elective -I	U23NMEMB11		2	2	-	-	-	2	3	25	75	100
		Foundation Course	U23FCMB11	Introduction to Microbial World	2	2	-	-	-	2	3	25	75	100
				TOTAL	**30**	**21**	**4**	**5**		**21**	-	-	-	**700**
II	I	Language Course-II	U23LC202	Pothu Tamil-II	6	5	1	-	-	3	3	25	75	100
	II	English Language Course-II	U23ELC202	General English –II	6	5	1	-	-	3	3	25	75	100
	III	Core Course-II	U23MB203	Microbial Physiology and Metabolism	5	4	1	-	-	5	3	25	75	100
		Core Practical –II	U23MB204P	Microbial Physiology and Metabolism	4	1	-	3	-	4	3	25	75	100
		Allied Course-II	U23AMB201	Bioinstrumentation	3	2	1	-	-	2	3	25	75	100
		Allied Practical I	U23ABC102P	Basic and Clinical Biochemistry	2	-	-	2	-	2	3	25	75	100
	IV	Non Major Elective -II	U23NMEMB22		2	2	-	-	-	2	3	25	75	100
		Skill Enhancement Course-I	23SECMB21	Sericulture	2	2	-	-	-	2	a3	25	75	100
				Total	**30**	**21**	**4**	**5**	**-**	**23**	-	-	-	**800**

Sem	Part	Course	Course Code	Title of the Paper	Ins. Hours/ Week	L	T	P	S	Credit	Exam Hours	Marks		Total
												CIA	ESE	
III	I	Language Course-III	U23LC303	Pothu Tamil-III	6	5	1	-	-	3	3	25	75	100
	II	English Language Course-III	U23ELC303	General English –III	6	5	1	-	-	3	3	25	75	100
	III	Core Course-III	U23MB305	Bacteriology and Mycology	5	4	1	-	-	5	3	25	75	100
		Core Practical –III	U23MB306P	Bacteriology and Mycology	4	1	-	3	-	4	3	25	75	100
		Allied Course-III	U23AMB302	Medical Laboratory Technology	3	2	1	-	-	2	3	25	75	100
		Allied Practical –II	U23AB303P	Medical Laboratory Technology	2	-	-	2	-	--	--	--	--	--
	IV	Skill Enhancement Course –II	U23SEMB32	Organic farming Practices	2	2	-	-	-	2	3	25	75	100
		Skill Enhancement Course –III	U23SEMB33	Algal Technology	2	2	-	-	-	2	3	25	75	100
				TOTAL	**30**	**21**	**4**	**5**	**-**	**21**		-	-	**700**
IV	I	Language Course-IV	U23LC404	Pothu Tamil-IV	6	5	1	-	-	3	3	25	75	100
	II	English Language Course-IV	U23ELC404	General English –IV	6	5	1	-	-	3	3	25	75	100
	III	Core Course- IV	U23MB407	Immunology	5	4	1	-	-	5	3	25	75	100
		Core Practical - IV	U23MB408P	Immunology	4	1	-	3	-	4	3	25	75	100
		Allied Practical- II	U23AMB303P	Medical Laboratory Technology	2	-	-	2	-	2	3	25	75	100
		Allied Course- IV	U23AMB404	Food Processing Technology	3	2	1	-	-	2	3	25	75	100
	IV	Skill Enhancement Course –IV	U23SEMB44	Biopesticides	2	2	-	-	-	2	3	25	75	100
		Skill Enhancement Course –V	U23SEMB45	Vermitechnology	2	2	-	-	-	2	3	25	75	100
				TOTAL	**30**	**21**	**4**	**5**	**-**	**23**	-	-	-	**800**
V	III	Core Course –V		Virology and Parasitology	6	5	1	-	-	5	3	25	75	100
		Core Course –VI		Environmental and Agriculture Microbiology	5	4	1	-	-	4	3	25	75	100
		Core Course-VII		Molecular Biology and Microbial Genetics	5	4	1	-	-	5	3	25	75	100
		Core Practical- V		Practical CC V and CC-VI	4	-	-	4	-	4	3	25	75	100
		Elective Course -I		Recombinant DNA Technology/ Biostatistics/Veterinary Microbiology	4	3	1	-	-	3	3	25	75	100
		Elective Course -II		Biosafety and Bioethics/	4	3	1	-	-	3	3	25	75	100

Sem	Part	Course	Course Code	Title of the Paper	Ins. Hours/ Week	L	T	P	S	Credit	Exam Hours	Marks		Total
												CIA	ESE	
				Research Methodology/ Bioinformatics										
		Internship/ Industrial visit/ Field visit		Internship/ Industrial visit/ Field visit	-	-	-	-	-	2	-	-	-	-
		EVS		Environmental Studies	2	2	-	-	-	2	3	25	75	100
				TOTAL	**30**	**21**	**5**	**4**	**-**	**28**		-	-	**700**
VI	III	Core Course -VIII		Food, Dairy and Probiotic Microbiology	6	5	1	-	-	4	3	25	75	100
		Core Practical –VI		Environmental and Agriculture Microbiology, Food, Dairy and Probiotic Microbiology	6	5	1	-	-	4	3	25	75	100
		Core Project		Project with viva- voce/ Group Project	5	-	1	4	-	5	3	25	75	100
		Elective Course-III		Pharmaceutical Microbiology/ Bioinoculants/Cell Biology	4	3	1	-	-	3	3	25	75	100
		Elective Course-IV		Entrepreneurship And Bio-Business/ Antimicrobial Agents/ Fermentation Technology	4	3	1	-	-	3	3	25	75	100
	IV	Value Education		Value Education	2	2	-	-	-	2	3	25	75	100
		Professional competency Course		Microbial Quality Control and Testing	2	2	-	-	-	2	3	25	75	100
	V	Gender Studies		Gender Studies	1	1	-	-	-	1	3	25	75	100
		Extension activity		Extension activity	-	-	-	-	-	1	-	-	-	-
		TOTAL			**30**	**21**	**5**	**4**	**-**	**25**	-	-	-	**800**
		GRAND TOTAL			**180**	**127**	**25**	**28**		**141**	-	-	-	**4500**
		Extra Credit		MOOC/SWAYAM/NPTEL	-	-	-	-	-	**2**	-	-	-	**-**
				Value added Courses (At least one per Year)	-	-	-	-	-	**2**	-	-	-	**-**

L-Lecture T-Tutorial P-Practical S-Seminar

NON MAJOR ELECTIVE OFFERED BY THE DEPARTMENT

Semester	Part	Course	Course Code	Title of the Course
I	IV	NME -I	U23NMEMB11	Social and Preventive Medicine
II		NME -II	U23NMEMB22	Nutrition and Health Hygiene

Credit Distribution for B.Sc., Microbiology

S.No	Part	Subject	No. of Courses	Total Credits
1.	I	Language Course	4	12
2.	II	English Language Course	4	12
3.	III	Core Course –Theory	8	38
4.		Core Practical	6	24
5.		Core-Project	1	5
6.		Allied Course- Theory	4	08
7.		Allied Course Practical	2	4
8.		Elective Course	4	12
9.	IV	Non-Major Elective	2	04
10		Foundation Course	1	02
11		Skill Enhancement Course	5	10
12		Internship/ Industrial visit/ Field Visit	1	02
13		Environmental Studies	1	02
14		Value Education	1	02
15		Professional Competency Course	1	02
16	V	Gender Studies	1	01
17		Extension Activity	1	01
Total			**47**	**141**

SEMESTER - III

Semester: III- CC-III: Bacteriology and Mycology

Ins. Hours / Week: 6 **Course Credit: 5** **Course Code: U23MB305**

UNIT- I **(12 Hours)**

Classification of Medically Important Bacteria, Normal flora of human body, Koch's and River's postulates. Collection, transport, storage and processing of clinical specimens. 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.

UNIT-II: **(12 Hours)**

Medically important Gram Positive bacterial infections **-** Causative agent, clinical symptoms, pathogenesis, mode of transmission, prevention and treatment of the following bacterial diseases (a) Streptococcal infections (*Streptococcus pyogenes*,), (b) Staphylococcal infections (*Staphylococcus aureus*), (c) Tetanus (*Clostridium tetani*) (d) Diphtheria (*Corynebacterium diphtheriae*) (e) Anthrax (*Bacillus anthracis*) (f) Tuberculosis (*Mycobacterium tuberculosis*), (g) Leprosy (*Mycobacterium leprae*).

UNIT-III: **(12 Hours)**

Medically important Gram-Negative bacterial infections - Causative agent, clinical symptoms, pathogenesis, mode of transmission, prevention, and treatment of the following bacterial diseases (a) Meningitis (*Neisseria meningitidis*) (b) Typhoid (*Salmonella typhi*) (c) Cholera (*Vibrio cholerae*) (d) Bcillary dysentery (*Shigella dysenteriae*); Sexually Transmitted disease (Syphilis–*Treponema pallidum*. Gonorrhoea - *Neisseria gonorrhoeae*); Nosocomial infections – definition, importance and their control. Mode of action of Antibacterial agents.

UNIT-IV: **(12 Hours)**

Medically important Fungi - Classification of medically important fungi; Superficial mycoses: Pityriasis versicolor; Tinea Nigra; Piedra. Cutaneous mycoses: *Microsporum* sp., *Trichophyton* sp., and *Epidermophyton floccosum*. Subcutaneous mycoses: Chromoblastomycosis; Sporotrichosis.

UNIT-V: **(12 Hours)**

Systemic Mycoses **-** Blastomycosis; Histoplasmosis*;* Opportunistic Infections **-** Candidiasis;Cryptococcosis; Zygomycosis; Mycotoxins: Aflatoxin. Antifungal agents: Mechanism of actionof Amphotericin B and Griseofulvin.

Total Lecture Hours – 60

COURSE OUTCOME

After the completion of the course, students should be able to,

1. Explain the bacterial pathogenesis and processing of specimen for diagnosis
2. Compile a list of disease-causing Gram Positive bacteria and compare their modes of infection, symptoms, diagnosis and treatment.
3. Describe the Gram Negative bacterial disease and its control
4. Comprehend human fungal infection and mechanism behind the disease process.
5. Explain the types of mycoses caused in humans and categorize the modes of infection, pathogenesis, and treatment

TEXT BOOKS

1. Tom Parker, M. Leslie H. Collier. (1990). Topley & Wilson's Principles of Bacteriology, Virology and Immunity,8th Edition. Edward Arnold, London
2. Greenwood, D., Slack, R.B. and Peutherer, J.F. (2012) Medical Microbiology, 18thEdition. Churchill Livingstone, London.
3. Finegold, S.M. (2000) Diagnostic Microbiology, 10th Edition. C.V. Mosby Company, St. Louis.
4. Ananthanarayanan, R. and JayaramPanicker C.K. (2020) Text book of Microbiology. Orient Longman, Hyderabad.
5. JagdishChander (2018). Textbook of Medical Mycology, 4th edition, Jaypeebrothers medical publishers.

6. Chhaya Singh (2022), Principles of Bacteriology and Virology, 1st Edition, Pinakin Publishing, Mumbai.

REFERENCE BOOK(S)

1. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Editions) (1994) Methods for General and Molecular Bacteriology. ASM Press, Washington, DC.
2. Kevin Kavanagh, (2018). Fungi Biology and Applications 3rd Edition. Wiley Blackwell publishers.
3. C.J. Alexopoulos, C.W. Mims, M. Blackwell, (2007). Introductory Mycology, 4th edition. Wiley publishers, Hoboken, New Jersey, U.S.
4. A.J. Salle (2007). Fundamental principles of bacteriology, 4th edition, Tata McGraw-Hill Publications, *New York, U.S*
5. 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, New York, NY, United States

E-RESOURCES

1. http://textbookofbacteriology.net/nd
2. https://microbiologysociety.org/members-outreach-resources/links.html
3. http://mycology.cornell.edu/fteach.html
4. https://www.adelaide.edu.au/mycology/
5. https://www.isham.org/mycology-resources/mycological-links

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	3		2	3						3			3	
CO2	3	2	3	3						3	3	3	2	
CO3	3	2	3	3						3	3	3	2	
CO4		3	3	3		2	3		3	2	2		3	3
CO5	3	3	2	3						3			3	3

Strong -3; Medium -2; Low - 1

Semester: III- CP-III: Bacteriology and Mycology

Ins. Hours / Week: 4 **Course Credit: 4** **Course Code: U23MB306P**

- Collection of clinical specimens (Throat swab, pus sample, sputum, urine and stool sample).
- Preparation of Stains for bacterial – Simple, Gram, Capsular and Spore Staining
- Preparation of Stains for Fungi- Flagella – Silver staining, Nuclear Staining
- Isolation of pure cultures of bacteria by streak plate method.
- Motility of bacteria - hanging drop method.
- Biochemical test for identification of pathogenic bacteria (*S.aureus, E.coli, K.pneumoniae, S.typhi and V.cholerae*) – Indole, Methyl Red, Voges proskauer, Citrate Utilization, Catalase, Oxidase and Urease test
- Antimicrobial susceptibility testing by disc-diffusion method.
- Isolation and identification of Endophytic microbes
- Microscopic identification of medically important Fungi – KOH mount and Lactophenol cotton Blue staining.
- LPCB Preparation of skin/hair/nail for fungal observation
- Cultivation of Yeast
- Biochemical identification of *Candida* spp

COURSE OUTCOME

After the completion of the course, students should be able to,

1. Demonstrate methods to observe and measure microorganisms by standard microbiological techniques
2. Identify pathogenic microorganisms and its sensitivity towards antibiotics.
3. Understand experimental tools used to cultivate and characterize clinically important viruses and bacteriophages

4. Elucidate clinically important fungi.
5. Investigate the medically important fungi from clinical specimens.

TEXT BOOKS

1. Dubey, R.C. and Maheswari, D.K. (2020). S. Chand Publishers. ISBN-13: 978-8121921534, ISBN-10: 8121921538., New Delhi.
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, New Delhi.
3. Collee, J.G., Fraser, A.G., Marnion, B.P. and Simmons, A. (1996). Mackie & McCartney Practical Medical Microbiology. 14th Edition. Elsevier. ISBN-10: 813120393X, ISBN-13: 978-8131203934, US.
4. Prince CP (2009). Practical Manual of Medical Microbiology, Ist edition, Jaypee digital publishing, New Delhi.
5. 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, New Delhi
6. Saha R (2022), Microbiology Practical Manual, 2nd Edition, CBS Publishers & Distributors Pvt. Ltd. New Delhi

REFERENCE BOOK(S)

1. Patricia M. Tille (2021). Bailey & Scott's Diagnostic Microbiology, 15th Edition. Elsevier. ISBN-10: 0323681050, ISBN-13: 978-0323681056, New Delhi.
2. Monica Cheesbrough (2006). District Laboratory Practice in Tropical Countries. Part 1. 2nd Edition. Cambridge University Press. ISBN-10: 0521171571, ISBN-13: 978-0521171571, London.
3. Michael A. Pfaller (ed.) (2015). Manual of Clinical Microbiology. Vol. 1 and 2. 11th Edition. ASM Press. ISBN-10: 9781555817374, ISBN-13: 978-1555817374, New Delhi.
4. Josephine A. Morello, Paul A. Granato and Helen EckelMizer (2002). Laboratory Manual and Workbook in Microbiology. 7th Edition. The McGraw Hill Company. ISBN: 0-07-246354-6, Hyderabad.

5. Rowland, S.S., Walsh, S.R., Teel, L.D. and Carnahan, A.M. (1994). Pathogenic and Clinical Microbiology: A Laboratory Manual. Lippincott Williams & Wilkins. ISBN-10: 0316760498, ISBN-13: 9780316760492, US.

E-RESOURCES

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
4. https://cmr.asm.org/content/31/3/e00062-17.full.pdf
5. https://microbiologyinfo.com/techniques-of-virus-cultivation/

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	3		3	2						3	3		3	
CO2	3	2	3	3		3	3		2	3	3		2	
CO3	3		3	2						3			3	2
CO4	1		3	2					3	3			3	3
CO5	2	3	3	2			3		3	3			3	3

Strong -3; Medium -2; Low - 1

Semester: III- AC-III: Medical Laboratory Technology

Ins. Hours / Week: 3 **Course Credit: 2** **Course Code: U23AMB302**

UNIT-I: **(9 Hours)**

Introduction to Clinical Laboratory Science: Basic laboratory principles - Code of conduct for medical laboratory personnel -Organization of clinical laboratory and role of medical laboratory technician - Safety measures.

UNIT-II: **(9 Hours)**

Specimen collection and processing - Blood, urine, stool, sputum, CSF, amniotic fluid and bile. Separation of serum and plasma, Handling of specimens for testing, preservation of specimens, transport of specimens and factors affecting the clinical results.

UNIT-III: **(9 Hours)**

Introduction to Haematology- Laboratory methods used in the investigation of coagulation disorders - coagulation tests , Routine coagulation tests, (Prothrombin time , plasma recalcification time, partial thromboplastin time , activated partial thromboplastin time, thrombin time), Laboratory diagnosis of bleeding disorders. Estimation of fibrinogen, Assay of coagulation factors.

UNIT-IV: **(9 Hours)**

Introduction to histopathology-Methods of examination of tissues and cells, Fixation of tissues: Classification and properties of fixatives. Tissue processing - Collection of specimens, Labeling and fixation, Dehydration, Clearing, Impregnation, Embedding - Paraffin block making, Section Cutting, Microtomes – types and mounting of sections.

UNIT-V: **(9 Hours)**

Quality Standards in Health Laboratories – Development and implementation of standards, Accreditation Boards –NABL, ISO, CAP, COLA, Performing quality assessment - pre-analytical, analytical and post-analytical phases of testing.

Total Lecture Hours - 45

COURSE OUTCOME

After the completion of the course, students should be able to,

1. Demonstrate ethical and professional conduct with medical professionals
2. Explain the procedure for collection, storage and handling of laboratory specimens.
3. Develop scientific knowledge on haematological techniques.
4. Perform laboratory tests with accuracy and precision.
5. Establish quality assurance to ensure the accuracy and reliability of laboratory information.

TEXT BOOKS

1. Mukharji,K.L. (2000).Medical Laboratory Techniques, Vol - I, II & III, 5th Edition. Tata McGrawHill, New Delhi.
2. Ochei,A., Kolhatkar. A. (2000).Medical Laboratory Science: Theory and Practice, McGraw Hill Education, Delhi.
3. RamnikSood (2015).Concise Book of Medical Laboratory Technology:Methods and Interpretation, 2ndEdition, Jaypee Brothers Medical Publishers, New Delhi.
4. S. Ramakrishnan, KN Sulochana (2012). Manual of Medical Laboratory Techniques,Jaypee Brothers Medical Publishers Pvt. Ltd, Dharmatala, Kolkata
5. Talib V.H. (2019).Handbook Medical Laboratory Technology, 2ndEdition, Directorate of health services, Government of India. Goa.

REFERENCES BOOKS

1. Rutherford, B.H. Gradwohl , A.C. Sonnenwirth L. Jarett. Gradwohls. (2000). Clinical Laboratory Methods and Diagnosis, Vol-I, 8th edition, Mosby.
2. Baker, F.J., Silverton, R.E., and Pallister,.J. (1998). An Introduction to Medical Laboratory Technology, 7thEdition, CBS Publishers and Distributors Pvt. Ltd. New Delhi
3. Godkar (2021).Textbook of Medical Laboratory Technology, 3rdEdition, Bhalani Publishing House. Darya Ganj
4. M.N.Chatterjee and RanaShinde. (2008). Textbook of Medical Biochemistry, 7thEdition, Jaypee Brothers Medical Publishers Pvt. Limited, Delhi
5. James G Cappucino. and Natalie Sherman. (2016). Microbiology – A laboratory manual.(5th Edition).The Benjamin publishing company. New York.

6. Darshan P. Godkar Praful B and Godkar (2024), A Text Book of Medical Laboratory Technology Clinical Laboratory Sciences and Molecular Diagnosis, Bhalani Publishing House, Delhi

E-RESOURCES

1. https://www.jaypeedigital.com › book
2. https://www.pdfdrive.com › wintrobes-clinical-hematology
3. https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5.https://vlab.amrita.edu/index.php?sub=3&brch=272 5. https://nptel.ac.in/courses/102105087

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	3	3	2	3		3	3	3	3	3			3	3
CO2	2	3	3	3		3	3	2	3	3			3	3
CO3			3	3	3	3			2	3			2	3
CO4			3	3		3		2	3	3			3	3
CO5			3	3		2				3	2		3	3

Strong -3; Medium -2; Low - 1

Semester: III- AP-II: Medical Laboratory Technology

Ins. Hours / Week: 2 **Course Credit: 2** **Course Code: U23AMB303P**

- Collection of biological samples – Blood, Urine, Faeces, CSF, Sputum, Intestinal fluid,Semen.
- Handling of common laboratory equipment's
- Simple staining and Gram staining method
- Tests for motility bacteria.
- Biochemical testing – Catalase, Oxidase, Citrate utilization, Urease, TSI, Carbohydrate fermentation, MR VP, Indole
- Blood Grouping test
- Enumeration of RBC and Platelet
- Bleeding time and Clotting time
- Microscopic analysis of urine

COURSE OUTCOME

After the completion of the course, students should be able to,

1. Demonstrate the collection and transport of biological sample
2. Acquire skills for handling the laboratory equipment's
3. Identify the pathogenic bacteria using staining and biochemical tes
4. Understand the Haematological examinations of samples
5. Interpret the clinical conditions of urine samples

TEXT BOOKS

1. Teitz, (2018). Clinical Chemistry. W.B. Saunders Company Harcourt (India) Private Ltd, New Delhi.
2. Kaplan (2003). Clinical Chemistry, Mosby Company, St. Louis Washington, D.C. Toronto.
3. U. Satyanarayan (2013). Biochemistry Books and Allied (P) Ltd. Kolkata-India

4. Ramanic Sood (2023). Laboratory Technology (Methods and interpretation) 4th Ed. J.P. Bros,New Delhi
5. Mukharji (2022). Medical Laboratory Techniques, Vol - I, II & III, 5th Edn. Tata McGraw Hill,Delhi.

REFERENCE (BOOKS)

1. Fischbach, (2005). Manual of lab and diagnostic tests, Lippincott Williams Wilkins, NewYork.
2. Gradwohls, (2000). Clinical laboratory methods and diagnosis. (ed) Ales C. Sonnenwirthand leonard jarret, M.D.B.I., New Delhi.
3. J Ochei and Kolhatkar, (2002). Medical laboratory science theory and practice, TataMcGraw- Hill, New Delhi.
6. Kanai L. Mukherjee, (2007), Medical laboratory technology Vol.1.Tata McGraw Hill, Delhi.

E-RESOURCES

1. https://www.jaypeedigital.com › book
2. https://www.pdfdrive.com › wintrobes-clinical-hematology
3. https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5.https://vlab.amrita.edu/index.php?sub=3&brch=272 5. https://nptel.ac.in/courses/102105087

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	3	2	3			3	2	3	3	3	3	3		3
CO2	3	3	2	3		3		2	3	3			3	3
CO3			3	3		2				3		2	3	3
CO4	2			3		3				3		2	3	3
CO5				3		3	2	3	3	3		3	2	3

Strong -3; Medium -2; Low - 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI–614016.
(For the Candidates admitted in the academic year 2023-2024)
DEPARTMENT OF MICROBIOLOGY
B.Sc., MICROBIOLOGY

Semester: III- SEC- II -Organic Farming Practices

Ins. Hours / Week: 2 **Course Credit: 2** **Course Code: U23SEMB32**

UNIT- I: **(6 Hours)**

Organic farming – definition – need – scope – principles – characteristics - relevance to modern agriculture. Different eco friendly farming systems- biological farming, natural farming, regenerative agriculture – permaculture - biodynamic farming.

UNIT- II: **(6Hours)**

Initiatives taken by the Central and State Governments. Organic nutrient sources and their fortification – organic manures- methods of composting. Green manures. Bio fertilizers – types, methods of application – benefits and limitations.

UNIT III **(6 Hours)**

Scope and limitations. Nutrient management in organic farming. Organic ecosystem and their concepts. Choice of crops and varieties in organic farming – crop rotations – need and benefits – multiple cropping.

UNIT- IV **(6 Hours)**

Fundamentals of insect, disease and weed management under organic mode of production-cultural-biological methods-non chemical pest & disease management. Botanicals- pyrethrum, Neem seed kernel extract, Neem seed powder, soluble Neem formulations, Neem oil.

UNIT- V **(6 Hours)**

Inspection – certification - labelling and accreditation procedures for organic products. Processing, - economic consideration and viability. Marketing and export potential of organic products – national economy

Total Lecture Hours : 30

COURSE OUTCOME

After the completion of the course the students should be able to

1. Develop organic farms on their own
2. Explore the benefits of organic farming Practices
3. Formulate organic manure and compost
4. Implement the protective products for plants
5. Evaluate the procedure for certification of organic products

TEXT BOOK(S)

1. Reddy S R . (2017). Principles of Organic Farming, Kalyani Publisher,Chennai, Tamil Nadu.
2. Bansal M. (2020). Basics of Organic Farming, CBS publishers and Distributors Pvt.Ltd, Chennai,Tamil Nadu.
3. Debabrata Biswas, Shirley A. Micallef. (2019) .Safety and Practice for Organic Food, Academic press, Elsevier Science, India.
4. P L Maliwal.(2022). Principles Of Organic Farming: Textbook, Scientific Publishers,New Delhi.
5. Hariom Mishra. (2022). A Text Book Of Modern Organic Farming, Book Rivers Publishers, Denmark.

REFERENCE BOOK(S)

1. Joanne M Willey,Kathleen MSandman and Dorothy H Wood Prescotts (2019) Microbiology McGraw-Hill Education, New York.
2. Unni M R and SabuThomas (2018). Organic Farming Global Perspectives and Methods Wood head publishing, Delhi.
3. Amitava Rakshit and H B Singh (2018). ABC of Organic Farming Jain Brothers, Bangalore.
4. Rhonda Sherman (2018).The Worm Farmer's Handbook Chelsea Green Publishing Company, US.
5. Vinaya Kumar Sethi (2018). Organic farming and biofertilizers Discovery publishing house Pvt. Ltd. Delhi.

E- LEARNING RESOURCES

1. http://ecoursesonline.iasri.res.in/course/view.php?id=163
2. https://eorganic.info/
3. https://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Compilation_techniques_organic_agriculture_rev.pdf
4. https://libguides.lib.msu.edu/c.php?g=95605&p=624373
5. https://ncof.dacnet.nic.in/30dayscertificatecourseonOrganicFarming

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	1	3	2				3		3	3	2	3	3	3
CO2	3	3	2	2		2	3	2	3	3	3	3	3	3
CO3	3	3	2	3		3	3	3	3	3	2	3	3	3
CO4	2	3	2	3		3	3	2	3	3	3	3	3	3
CO5	3	3	2	3	3	2	3	2	3	3	2	3	3	3

Strong -3; Medium -2; Low - 1

Semester: III- SEC- III -Algal Technology

Ins. Hours / Week: 2 **Course Credit: 2** **Course Code: U23SEMB33**

UNIT- I: **(6 Hours)**

Algae: General characteristics: Ecology and distribution; structure of algal thallus; Classification (Fritsch's system of classification) Cell structure and components; cell wall, pigment system, reserve food, flagella, methods of reproduction-Role of algae in the environment, agriculture and industries.

UNIT- II: **(6 Hours)**

Photobioreactor technology for microalgae cultivation and their components – Light system, Optical transmission system, Air handling and gas exchange systems, Mixing system, Nutrient system, Instrumentation system and Electrical system.

UNIT III **(6 Hours)**

Cultivation of micro algae: Algae for biodiesel, Process, strains, Sources of contamination. Bio-pond –Production in Open Ponds –Harvesting and Oil Extraction: principles and methods. Cyanobacterial inoculants (BGA): Azolla-*Anabaena azollae*. Isolation, mass multiplication-role in rice cultivation-crop response-field application.

UNIT- IV **(6 Hours)**

Single Cell Proteins (SCP): *Spirulina* as single cell protein-Production of *Spirulina*-small scale commercial production and mass cultivation (tank construction, culture medium, strain selection, scaling up of the process)- Growth requirements in *Spirulina* cultivation (light and pH), harvesting, drying and packing**.**

UNIT- V **(6 Hours)**

Algae as food and fodder, use of algae in agriculture and space research, commercial products of algae: Pigments - Astaxanthin, β-Carotenoids, Agar Agar, Alginates, Carrageenan, diatomite, mucilage, minerals and elements - Algae in medicine and biofuels.

Total Lecture Hours: 30

COURSE OUTCOME

On completion of this course, students will

1. Understand the structure and functions of algae.
2. Discuss the advanced algal cultivation technology.
3. Explain about the production of algae in bioenergy and agriculture sector.
4. Learn the importance of Single cell proteins and its harvesting methodology.
5. Evaluate the economical value of algae.

TEXT BOOKS

1. H Stein (1973) Handbook of Phycological methods. Culture methods and growth measurements, Cambridge University Press, London.
2. Selvendran D. (2015) Large Scale Algal Biomass (*Spirulina*) Production in India. In: D. Das (Ed.) Algal Biorefinery: An Integrated Approach, Springer, New York.
3. O.P. Sharma.(2011), Text Book of Algae. 4th edn.. TATA McGraw Hill Publishers, New Delhi.
4. Ozcan Konur, (2020) Handbook of Algal Science, Technology and medicine. Academic Press, Elsevier. USA.
5. Ashfaq Ahamed, Fawzi Banat, Hanifa Alblooshi, (2022). Algal Biotechnology. Elsevier.Amsterdam.

REFERENCE BOOK(S)

1. B.R.Vashista (2010) Algae. 8th Edn.. S. Chand and company Publishing.
2. Johri RM, Snehlatha, Sandhya Shrama (2010). A Textbook of Algae. Wisdom Press, New Delhi.
3. S K Singh and Seema Srivastava (2008) A Textbook of Algae. Campus Books
4. Vashishta B.R., Sinha A.K and Singh V.P. 2008. Botany for Degree Students. Algae. S Chand and Co, New Delhi.
5. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
6. Sambamurty, A.V.S.S. (2015). A Textbook of Algae. S Chand. New Delhi.
7. Sharma, O.P. (2011). Diversity of Microbes and Cryptogams/Algae. Tata Mc Graw Hill Education Private Ltd, New Delhi.
8. Dinabandhu Sahoo and B.D. Kaushik. (2012). Algal Biotechnology and Environment. I.K. International, New Delhi.
9. Mihir Kumar Das. (2010). Algal Biotechnology. Daya Publishing House, New Delhi.
10. Vashishta, P.C. (2014). S.Chand & Company Ltd, New Delhi.
11. Ian Morris. (1977). An introduction to the algae. Hutchinson & Co (Publishers) Ltd. Cambridge University Press, London.

12. Lee, R.D. (2008).Phycology 4th Edition, Cambridge University Press, New York

E-RESOURCES

1. https://www.slideshare.net/slideshow/algae-notes-1/64903042
2. https://ro.scribd.com/document/169056704/Cultivation-of-Algae-in-Photobioreactor
3. https://annamalaiuniversity.ac.in/affcl/download/syllabus_ug_2022-23/Science/212.B.Sc_Microbiology_C.doc
4. https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-ofAlgae/Pereira/p/book/9781498755382
5. https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-SecondEdition/Barsanti-Gualtieri/p/book/9781439867327
6. https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-EnvironmentalAssessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	1	3	2	3					3	3		2	3	3
CO2	2	3	2	3		3		3	3	3	3	3	2	3
CO3	3	2	3	2		3	2	3	3	3	2	3	3	3
CO4	3	2	3	2		3		3	3	3	3	3	2	3
CO5	3	2	3	2		3		3	3	3	3	3	2	3

Strong -3; Medium -2; Low - 1

SEMESTER - IV

Semester: IV- CC-IV: Immunology

Ins. Hours / Week: 5 **Course Credit: 5** **Course Code:U23MB407**

UNIT- I **(12 Hours)**

Organs and Cells in Immune System and Immune Response: Primary lymphoid organs, Secondary lymphoid organs and lymphoid tissues; T – cell and B –cell membrane bound receptors – apoptosis; T - cell processing, presentation and regulation; T –cell subpopulation, properties, functions and T – cell suppression; Physiology of immune response- Innate, Humoral and Cell Mediated Immunity; Immunohematology.

UNIT-II: **(12 Hours)**

Antigen and Antibody: Antigens - Properties of haptens, epitopes, adjuvants, and cross reactivity. Antibodies- Structure, Properties, Classes. Antigen and Antibody Reactions: Precipitation, Agglutination, Complement Fixation, Opsonization, Neutralization; Vaccines – Active and Passive immunization; Classification of vaccines; Other approaches to new vaccines; Types of vaccine – antibacterial and antiviral Vaccines. Vaccination schedule.

UNIT-III: **(12 Hours)**

Immunoassay and Immunotechniques **-** Preparation and standardization of bacterial antigens; Raising of monoclonal and polyclonal antibodies; Purification of antibodies. Immunotechniques - RIA, RAST, ELISA, Immuno fluorescence techniques and Flow cytometry

UNIT-IV: **(12 Hours)**

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.

UNIT-V: **(12 Hours)**

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.

Total Lecture Hours – 60

COURSE OUTCOME

After the completion of the course, students should be able to,

1. Recall the fundamental concepts of immunity, contributions of the organs and cells in immune responses
2. Investigate the structure and functions of Antigen and Antibody.
3. Evaluate the Immunoassay and Immunotechniques
4. Explain about the immunologic processes governing graft rejection and therapeutic modalities for immunosuppression in transplantation
5. Analyze the overreaction by our immune system leading to hypersensitive conditions and its consequences.

TEXT BOOKS

1. Richard Coico, Geoffrey Sunshine, Eli Benjamini. (2003). Immunology – A Short Course. 5thEdition., Wiley-Blackwell, New York.
2. Judith A.Owen, Jenni Punt, Sharon A. Stranford, Janis Kuby. (2013). Immunology, 7th Edition., W. H. Freeman and Company, New York.
3. Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai. (2021). Cellular and Molecular Immunology, 10thEdition.,Elsevier, Amsterdam.
4. 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, Amsterdam.
5. Pravash Sen. Gupta. (2003). Clinical Immunology. Oxford University Press, Oxford, England

REFERENCE BOOK(S)

1. Janeway Travers. (1997). Immunobiology- the immune system in health and disease. 3rd Edition. Current Biology Ltd. London, New York.
2. Peter J. Delves, Seamus Martin, Dennis R. Burton, Ivan M. Roitt. (2006). Roitt's Essential Immunology, 11thEdition.,Wiley-Blackwell, Hoboken, New Jersey , United States
3. William R Clark. (1991). The Experimental Foundations of Modern Immunology. 3rdEdition. John Wiley and Sons Inc. New York.Stanier
4. Frank C. Hay, Olwyn M. R. Westwood. (2002). Practical Immunology, 4thEdition., Wiley-Blackwell, Hoboken, New Jersey , United States
5. Noel R. Rose, Herman Friedman, John L. Fahey. (1986). Manual of Clinical Laboratory Immunology3rd Edition. ASM, Washington, DC, United States.

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1. https://www.ncbi.nlm.nih.gov/books/NBK279395/
2. https://med.stanford.edu/immunol/phd-program/ebook.html
3. https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall-2005/pages/lecture-notes/
4. Immunology Overview - Medical Microbiology - NCBI Bookshelf (nih.gov)
5. Immunology - an overview | ScienceDirect Topics

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	3	2	3	2						3			3	
CO2		2	3	2						3			3	2
CO3	3	2	3	2		3		3		3			3	2
CO4	3	2	3	2						3			3	2
CO5	3			2		3			3	3			3	2

Strong -3; Medium -2; Low - 1

Semester: IV- CP-IV: Immunology

Ins. Hours / Week: 4 **Course Credit: 4** **Course Code:**

- Separation of serum from blood
- ABO Blood grouping
- Rh typing
- While Blood Cell Count
- Red Blood Cell Count
- WIDAL tube and slide Test
- Rapid Plasma Reagin (RPR)
- Cross Reactive Protein (CRP)
- Anti Streptolysin 'O'(ASO)
- Visit to blood bank
- Double immunodiffusion
- Demonstration of ELISA

Course Outcome

1. Assess the blood groups and their types
2. Competently perform serological diagnostic tests such as ASO, CRP
3. Demonstrate the antigen antibody reactions in gel.
4. Differentiate the Blood cells using Haemocytometer
5. Examine the concept of ELISA.

TEXT BOOKS

1. Talwar. (2006). Hand Book of Practical and Clinical Immunology, Vol. I, 2nd edition, CBS, New Delhi.

2. Asim Kumar Roy. (2019). Immunology Theory and Practical**,** Kalyani Publications, New Delhi

3. Richard Coico, Geoffrey Sunshine, Eli Benjamini. (2003). Immunology – A Short Course. 5th Edition., Wiley-Blackwell, New York.

4. Judith A.Owen, Jenni Punt, Sharon A. Stranford, Janis Kuby. (2013). Immunology, 7th Edition., W. H. Freeman and Company, New York.

5. Pravash Sen. Gupta. (2003). Clinical Immunology. Oxford University Press, London.

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1. Frank C. Hay, Olwyn M. R. Westwood. (2008).Practical Immunology, 4th Edition, Wiley-Blackwell, US.
2. Wilmore Webley. (2016). Immunology Lab Manual, LAD Custom Publishing, US.
3. Rose. (1992). Manual of Clinical Lab Immunology, ASM, New Delhi.
4. Janeway Travers. (1997). Immunobiology- the immune system in health and disease. 3rd Edition, Current Biology Ltd. London, New York.
5. Peter J. Delves, Seamus Martin, Dennis R. Burton, Ivan M. Roitt. (2006). Roitt's Essential Immunology, 11th Edition., Wiley-Blackwell, US.

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1. https://www.researchgate.net/publication/275045725_Practical_Immunology-_A_Laboratory_Manual

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

4. Immunology Overview - Medical Microbiology - NCBI Bookshelf (nih.gov)

5. Immunology - an overview | ScienceDirect Topics

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	3		3	2		3				3	3	3	3	
CO2		2	3	2		2		3	3	3			3	2
CO3		3	3	2		2		3	3	3			3	2
CO4		2	3	2		2		3	3	3			3	2
CO5		2	3	2		2	3	3	3	3			3	2

Strong -3; Medium -2; Low - 1

Semester: IV- AC-VI: Food Processing Technology

Ins. Hours / Week: 3 **Course Credit: 2** **Course Code: U23AMB404**

UNIT- I **(9 Hours)**

Introduction to food preservation –objectives and techniques of food preservation - principles of high temperature, low temperature, radiation, chemical preservatives and bio preservatives.

UNIT-II **(9 Hours)**

Freshness criteria and quality assessment of meat and fish –spoilage and methods of preservation. Production of byproducts after processing waste and their utilization. Role of packaging material, types of packaging material.

UNIT-III **(9 Hours)**

Composition of milk; assessment of milk, thermal processing of fluid milk-Pasteurization (LTH, HTST & UHT techniques). Fermented milk products-Cheese, Butter milk, Yoghurt, Kumiss, Kefir and Acidophilus milk. Hygiene and sanitation requirement in food processing and fermentation industries.

UNIT-IV **(9 Hours)**

Importance of fats and oils in Food - Extraction of fats and Oils-Rendering, pressing, solvent extraction, pressing of oil- degumming, refining, bleaching, deodorization, fractionation, pyrolysis of fats, toxicity of frying oil.

UNIT-V **(9 Hours)**

Methods for the microbiological examination of foods. Food borne illness and diseases. Microbial cultures for food fermentation. Indian Factories Act on safety, HACCP, Safety from adulteration of food.

Total Lecture Hours - 45

COURSE OUTCOME

After the completion of the course, students should be able to,

1. Assess the fundamental concepts of food preservation
2. Investigate the quality assessment of meat and fish.
3. Design the processing of milk and milk product quality assessment.
4. Explore about the importance of fats and oils.
5. Examine the food safety and adulteration detection.

TEXT BOOKS

1. Avantina Sharma. (2006). Text Book of Food Science and Technology, International Book Distributing Co, Lucknow, UP.
2. Sivasankar. (2005). Food Processing and Preservation, 3rd Edition., Prentice Hall of India Pvt Ltd, New Delhi.
3. Ramaswamy H and Marcotte M. (2006). Food Processing: Principles & Applications. Taylor & Francis, Oxford shire. United Kingdom
4. NIIR Board of Food and Technologist. (2005). Modern Technology of Food Processing and Agrobased industries, National Institute of Industrial Research, Delhi.
5. Adams M.R. and Moss M. O (2007). Food Microbiology. New Age International Ltd, Darya Ganj

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1. Fellos PJ. (2005). Food Processing Technology: Principle &Practice 2nd Edition. CRC
2. Peter Zeuthen and Leif Bogh-Sorenson. (2005). Food Preservation Techniques, Wood land Publishing Ltd, Cambridge, England.
3. Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Pilar Cano. (2004). Novel Food Processing Technologies, CRC press, Boca Raton, Florida
4. Suman Bhatti, Uma Varma. (1995). Fruit and vegetable processing organizations and institutions, 1st Edition., CBS Publishing, New Delhi.
5. Mirdula Mirajkar, Sreelatha Menon. (2002). Food Science and Processing Technology Vol-2,Commercial processing and packaging, Kanishka publishers, New Delhi.
6. Foster W.M (2020). Food Microbiology, CBS Publishers, New Delhi

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1. https://sites.google.com/a/uasd.in/ecourse/food-processing-technology
2. https://nptel.ac.in/courses/126105015
3. https://engineeringinterviewquestions.com/biology-notes-on-food-adulteration/food processing | Definition, Purpose, Examples, & Facts | Britannica
4. Food Processing Technology | Food News & Views Updated Daily (foodprocessing-technology.com)

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	2		3	3		3			3	3			3	3
CO2	2		3	3		3			3	3			2	3
CO3	2		3	3		3	3		3	3			3	3
CO4	2		3	3		3	3		3	3			2	3
CO5	2		3	3		3		3	3	3			3	3

Strong -3; Medium -2; Low - 1

Semester: IV- SEC-IV: Biopesticides

Ins. Hours / Week: 2 **Course Credit: 2** **Course Code: U23SEMB44**

UNIT- I: **(6 Hours)**

Importance, scope and potential of bio-pesticide. Definitions, concepts and classification of biopesticides viz., pathogen, Mode of action of pesticides.

UNIT- II: **(6 Hours)**

Botanicals and their uses as biopesticides and biorationales. Role of Biopesticides in Organic farming and ecofriendly agriculture.

UNIT- III: **(6 Hours)**

Biochemical Pesticides- Plant extracts, Semiochemicals, Growth regulators. Plant Incorporated protectants.

UNIT- IV: **(6 Hours)**

Mass production of Microbial pesticides -Viral pesticides - *Baculovirus*. Fungal pesticides - *Trichoderma*. Bacterial pesticides - *Pseudomonas, Bacillus*.

UNIT- V: **(6 Hours)**

Methods of applications of Biopesticides. Precautionary approaches in application and usage of Biopesticides. Methods of quality control and Techniques of Biopesticides. Constraints & possible solutions in production and use of Biopesticides.

COURSE OUTCOME

After the completion of the course, students should be able to,

1. Discuss the importance and scope of Biopesticides
2. Understand the role of botanicals in pest control and organic farming.

3. Analyse the mechanism of action of biochemical compounds in Biopesticides
4. Gain knowledge on mass production of Microbial Pesticides.
5. Evaluate the application of Biopesticides and quality testing

TEXT BOOKS

1. Ramanathan N. (2023).Text Book of Biopesticieds Technology 2023. Deepika Book Agency, India.

2. Md. Arshad Anwer. (2017). Bio Pesticides and Bio Agents e book CRC Press Taylor & Francis group Newyork. 1-365 pp.

3. Dwijendra Singh (2014). Advances in Plant Bio Pesticides. Publisher Springer 1-401 pp.

4. Ghayur Alam. (2000). A Study of Bio Pesticides and Bio Fertilisers in Haryana, India. International Institute for Environment and Development 3 Endsleigh Street London 1-24 pp.

5. Vibrant Gujarath. (2017). Setting up a Bio-Fertilizers and Bio-Pesticides Unit Biotechnology Government of Gujarat. Gujarat State Biotechnology Mission. 1-23 pp. 199

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1. Salma Mazid, Ratul Ch. Rajkhowa, Jogen Ch. Kalita , (2011). A review on the use of Bio Pesticides in Insect Pest Management. *International Journal of Science and Advanced Technology*, Volume 1 No 7, 169-178 pp.
2. Muhammad Nawaz, Juma Ibrahim Mabubu and Hongxia Hua. (2016). Current status and advancement of Bio Pesticides: Microbial and Botanical Pesticides. *Journal of Entomology and Zoology Studies*, Volume 4(2): 241-246 pp.
3. S. Ezhil Vendan. (2016). Current Scenario of Bio pesticides and eco-friendly insect pest management in India. *South Indian Journal of Biological Sciences* 2(2); 268-271pp.
4. Opender Koul. (2011). Microbial Bio Pesticides: Opportunities and Challenges. CAB Reviews: Perspectives in Agriculture, Veterinary Science, *Nutrition and Natural Resources* Vol 6, No. 56. 1-26 pp.
5. Vaishali Kandpal (2014). Bio Pesticides. *International Journal of Environmental Research and Development*. 4(2), 191-196 pp
6. Awasthi L.P. Biopesticides in organic farming, (2021). CRC Press, Boca Raton

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1. https://agritech.tnau.ac.in/farm_enterprises/Farm%20enterprises_%20bio%20pesticides.
2. https://www.slideshare.net/slideshow/biopesticides-50835900/50835900

3. https://microbenotes-com.webpkgcache.com/doc/-/s/microbenotes.com/biopesticides/

4.https://www.slideshare.net/slideshow/biorational-insecticides-notes-ppt-for-bsc-agriculture-students/267137751

5.https://one.oecd.org/document/ENV/CBC/MONO(2023)10/en/pdf

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	3	2	3	3		3	2	2	3	3	2	3	3	3
CO2	3	2	3	3		3	3	3	3	3	2	3	2	3
CO3	3	2	3	3		3	2	2	3	3	2	3	3	3
CO4	3	2	3	3		3	3	3	3	3	2	3	2	3
CO5	3	2	3	3		3	3	2	3	3	2	3	3	3

Strong -3; Medium -2; Low - 1

Semester: IV- SEC -V : Vermitechnology

Ins. Hours / Week: 2 **Course Credit: 2** **Course Code: U23SEMB45**

UNIT – I: **(6 Hours)**

Vermitechnology: Definition and Scope of vermiculture and vermicomposting – difference between vermiculture and vermicomposting. Vermitech practices in India.

UNIT – II: **(6 Hours)**

Earthworm Diversity - Ecological groups of earthworms, biology of composting earthworms – *Eisenia foetida, Eudrilus eugeniae.*

UNIT – III: **(6 Hours)**

Soil and Organic waste residues. Soil – Physical, chemical and biological features, Organic waste sources – problems in traditional composting, Vermicomposting, Types, small and large scale - Pit method, Heap method.

UNIT – IV: **(6 Hours)**

Vermiculture process – site selection -collection of species mono and poly culture - Essential parameters for Vermiculture–bedding. Methods of harvesting worms- general manual methods, self-harvesting and mechanical method, Vermin wash, Natural enemies of earthworms, Pests, Parasites and Pathogen

UNIT – V: Vermicomposting **(6 Hours)**

Nutritive value of Vermicompost, storing and packing - Applications of vermicomposting in agricultural and horticultural practices - Economic value of Vermiculture, Nationalized bank, NABARD support for Vermiculture.

Total Lecture Hours -30

COURSE OUTCOME

After completion of the course the students should able to,

1. Acquire knowledge about the characteristics and role of earthworm in sustainable agriculture.
2. Describe the biology and significance of earthworms.
3. Understand the various method of Vermicomposting
4. Evaluate the benefits of Vermiculture and Vermiwash
5. Expertise in Vermicomposting techniques and Creating Opportunities for Entrepreneur

TEXT BOOKS

1. Arunk K Sharma, (2018). A hand book of Organic Farming, Agrobios, Jodhpur, India
2. Aravind Kumar, (2005).Verms & Vermitechnology, A.P.H. Publishing Corporation, New Delhi.
3. Arun K. Sharma. (2002). Vermiculture and Vermicomposting. Kalyani Publishers, New Delhi.
4. Bhatnagar and Patla, (2007). Earthworm vermiculture and vermin-composting, Kalyani Publishers, New Delhi.
5. Gupta P.K. (2008). Vermicomposting for Sustainable Agriculture. Agrobios. India
6. Sultan Ahmed Ismail, (2005). The Earthworm Book, Second Revised Edition. Other India Press, Goa, India.
7. Kumar Anand and Pritam Bala Sinha. (2020).Vermitechnology: A Solution for Agricultural Waste. Kalyani Publishers, New Delhi.

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1. Edwards, C.A J. R. Lofty (1977). Biology of earthworms London *:* Chapman *and* Hall, Wiley, New York.
2. Edwards, C.A., Arancon, N.Q. and Sherman, R. (eds) (2011). Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management. CRC Press, Boca Raton, Florida.
3. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use", Academic Press, Sydney
4. Satchel, J.E. (1983). "Earthworm Ecology", Chapman Hall, London
5. M.Moorthi and M.Govidarajan, (2021). Vermitechnology. Academic Publishing Company,US.

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1. https://www.slideshare.net/BirenDaftary88/vermiculture-44813996
2. https://www.earthwormsoc.org.uk/earthworm-ecology
3. https://www.slideshare.net/krishnaSethi1/vermicomposting-118274903
4. https://www.slideshare.net/sudharajput/vermicomposting-47669414
5. https://www.slideshare.net/hrfchennai/tamil-nadu-government-welfare-schemes-2017-80290561

MAPPING WITH PROGRAM OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	3	2	3	3		3	2	2	3	3	3	3	2	3
CO2	3	2	3	3		3	2	2	3	3	3	3	3	3
CO3	3	2	3	3		3	2	2	3	3	3	3	2	3
CO4	3	2	3	3		3	2	2	3	3	3	3	3	3
CO5	3	2	3	3		3	2	2	3	3	3	3	2	3

Strong -3; Medium -2; Low - 1