V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Reaccredited with 'A++' Grade (4th Cycle) by NAAC
VIRUDHUNAGAR
Quality Education with Wisdom and Values

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS
(with effect from Academic Year 2023 - 2024)

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 13 UG Programmes (Aided), 15 UG Programmes (SF), 15 PG Programmes and 6 Ph.D. Programmes. The curricula for all these Programmes, except Ph.D. Programmes, have been framed as per the guidelines given by the University Grants Commission (UGC) &Tamil Nadu State Council for Higher Education (TANSCHE) under Choice Based Credit System (CBCS) and the guidelines for Outcome Based Education (OBE).

The Departments of Commerce, English, History, Mathematics, Biochemistry and Tamil upgraded as Research Centres offer Ph.D. Programmes as per the norms and regulations of Madurai Kamaraj University, Madurai and do not come under the purview of CBCS.

A. CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose Courses from the prescribed Courses. The CBCS is followed as per the guidelines formulated by the UGC. The performance of students is evaluated based on the uniform grading system. Computation of the Cumulative Grade Point Average (CGPA) is made to ensure uniformity in evaluation system.

List of Programmes in which CBCS/Elective Course System is implemented

UG PROGRAMMES

Arts & Humanities	:	History (E.M. & T.M.), English, Tamil
Physical & Life Sciences	:	Mathematics, Zoology, Chemistry, Physics, Biochemistry, Home Science - Nutrition and Dietetics, Costume Design and Fashion, Microbiology, Biotechnology, Computer Science, Information Technology, Data Science, Computer Applications and Computer Applications - Graphic Design
Commerce & Management	:	Commerce, Commerce (Computer Applications), Commerce (Professional Accounting), Business Administration

PG PROGRAMMES

Arts & Humanities	:	History, English, Tamil
Physical & Life Sciences	:	Mathematics, Physics, Chemistry, Zoology, Biochemistry, Home Science - Nutrition and Dietetics, Biotechnology, Computer Science, Computer Science (Data Science) Computer Applications (MCA) *
Commerce & Management	:	Commerce, Business Administration (MBA) *

* AICTE approved Programmes

OUTLINE OF CHOICE BASED CREDIT SYSTEM – UG

1. Core Courses
2. Elective Courses
   - Generic Elective Courses
   - Discipline Specific Elective Courses (DSEC)
   - Non Major Elective Courses (NMEC)
3. Skill Enhancement Courses (SEC)
4. Environmental Studies (EVS)
5. Value Education
6. Self Study Courses (Online)
7. Extra Credit Courses (Self Study Courses) (Optional)

List of Non Major Elective Courses (NME)
(2023-2024 onwards)

UG PROGRAMMES

Name of the Course	Course Code	Semester	Department
Introduction to Tourism	23UHIN11	I	History(EM)
Indian Constitution	23UHIN21	II	History(EM)
சுற்றுலா ஓர் அறிமுகம்	23UHIN11	I	History (TM)
இந்திய அரசியலமைப்பு	23UHIN21	II	History(TM)
Popular Literature and Culture	23UENN11	I	English
English for Professions	23UENN21	II	
பேச்சுக்கலைத்திறன்	23UTAN11	I	Tamil
பயன்முறைத் தமிழ்	23UTAN21	II	
Practical Banking Basic Accounting Principles	23UCON11 23UCON22	I II	Commerce (Aided)
Financial Literacy-I Financial Literacy -II	23UCON12 23UCON21	I II	Commerce (SF)
Self-Employment and Startup Business Fundamentals of Marketing	23UCCN11 23UCCN21	I II	Commerce CA (SF)

Women Protection Laws	23UCPN11	I	Commerce (Professional Accounting)
Basic Labour Laws	23UCPN21	II	
Basics of Event Management	23UBAN11	I	Business Administration
Business Management	23UBAN21	II	
Quantitative Aptitude I	23UMTN11	I	Mathematics
Quantitative Aptitude II	23UMTN21	II	
Physics for Everyday life -I	23UPHN11	I	Physics
Physics for Everyday life -II	23UPHN21	II	
Food Chemistry	23UCHN11	I	Chemistry
Drugs and Natural Products	23UCHN21	II	
Ornamental fish farming and Management	23UZYN11	I	Zoology
Biocomposting for Entrepreneurship	23UZYN21	II	
Foundations of Baking and Confectionery	23UHSN11	I	Home Science – Nutrition and Dietetics
Basic Nutrition and Dietetics	23UHSN21	II	
Nutrition and Health	23UBCN11	I	Biochemistry
Life Style Diseases	23UBCN21	II	
Social and Preventive Medicine	23UMBN11	I	Microbiology
Nutrition & Health Hygiene	23UMBN21	II	
Herbal Medicine	23UBON11	I	Biotechnology
Organic farming and Health Management	23UBON21	II	
Basics of Fashion	23UCFN11	I	Costume Design And Fashion
Interior Designing	23UCFN21	II	
Office Automation	23UCSN11	I	Computer Science
Introduction to Internet and HTML 5	23UCSN21	II	
Office Automation	23UITN11	I	Information Technology
Introduction to HTML	23UITN21	II	
Introduction to HTML	23UCAN11	I	Computer Applications
Fundamentals of Computers	23UCAN21	II	
Introduction to HTML	23UGDN11	I	Computer Applications - Graphic Design
Fundamentals of Computers	23UGDN21	II	
Organic Farming	23UBYN11	I	Botany
Nursery and Landscaping	23UBYN12		
Mushroom Cultivation	23UBYN21	II	
Medicinal Botany	23UBYN22		
Cadet Corps for Career Development I	23UNCN11	I	National Cadet Corps
Cadet Corps for Career Development II	23UNCN21	II	

B. OUTCOME BASED EDUCATION (OBE) FRAMEWORK

The core philosophy of Outcome Based Education rests in employing a student - centric learning approach to measure the performance of students based on a set of pre-determined outcomes. The significant advantage of OBE is that it enables a revamp of the curriculum based on the learning outcomes, upgrade of academic resources, quality enhancement in research and integration of technology in the teaching –learning process.

It also helps in bringing clarity among students as to what is expected of them after completion of the Programme in general and the Course in particular. The OBE directs the teachers to channelize their teaching methodologies and evaluation strategies to attain the PEOs and fulfill the Vision and Mission of the Institution.

Vision of the Institution

The founding vision of the Institution is to impart Quality Education to the rural womenfolk and to empower them with knowledge and leadership quality.

Mission of the Institution

The mission of the Institution is to impart liberal education committed to quality and excellence. Its quest is to mould learners into globally competent individuals instilling in them life-oriented skills, personal integrity, leadership qualities and service mindedness.

B.1 Programme Educational Objectives, Programme Outcomes and Programme Specific Outcomes

It is imperative for the institution to set the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs), consistent with its Vision and Mission statements. The PEOs and the POs should be driven by the mission of the institution and should provide distinctive paths to achieve the stated goals. The PEOs for each Programme have to fulfill the Vision and Mission of the Department offering the Programme.

Vision of the Department of Microbiology

Our vision is to produce highly qualified and competent students in all areas of the Microbiology. To empower students by developing human capabilities through quality education, making them responsible citizens who can work for the advancement of the society.

Mission of the Department of Microbiology

To produce skilled graduates to be lifelong learner by offering solid theoretical and practical foundations in various disciplines of microbiology and educating them about their professional and ethical responsibilities.

B.1.1 Programme Educational Objectives (PEOs)

PEOs are broad statements that describe the career and professional achievements that the Programme is preparing the graduates to achieve within the first few years after graduation. PEOs are framed for each Programme and should be consistent with the mission of the Institution.

Programme Educational Objectives (PEOs) of B.Sc., Microbiology Programme

The Programme Educational Objectives of B.Sc. Microbiology Programme are to prepare the students

PEO1: To undertake the concept of Microbiology for pursuing higher studies, successful career in medical laboratories, Medical coding sectors, pharmaceutical industries, Food industries and as successful teachers in schools and colleges.

PEO2: To employ their practical skills in Genetics, Molecular Biology, Immunology, Bioinformatics, Industrial, Food, Agricultural and Clinical Microbiology.

PEO3: To excel their capabilities through the use of new technologies to meet societal demands in research and effectively function as an entity in an environment with ethical values

Key Components of the Mission Statement	PEO1	PEO2	PEO3
Skilled graduates	✓	✓	-
theoretical and practical foundations	✓	✓	-
professional and ethical responsibilities.	-	-	✓

B.1.2 Programme Outcomes (POs)

POs shall be based on Graduate Attributes (GAs) of the Programme. The GAs are the attributes expected of a graduate from a Programme in terms of knowledge, skills, attitude and values. The Graduate Attributes include Disciplinary Knowledge, Communication Skills, Critical Thinking, Problem Solving, Analytical Reasoning, Research Related Skills, Co-operation/Team Work, Scientific Reasoning, Reflective Thinking, Information/Digital Literacy, Multicultural Competence, Moral and Ethical Awareness/Reasoning, Leadership Qualities and Lifelong Learning.

On successful completion of the Programme, the students will be able to

1 apply effectively the acquired knowledge and skill in the field of Arts, Physical Science, Life Science, Computer Science, Commerce and Management for higher studies and employment. (*Disciplinary Knowledge*)

2 articulate innovative thoughts and ideas proficiently in both in spoken and written forms. (*Communication Skills)*

3 identify, formulate and solve problems in real life situations scientifically /

systematically by adapting updated skills in using modern tools and techniques. (*Scientific Reasoning and Problem Solving)*

4 critically analyse, synthesize and evaluate data, theories and ideas to provide valid suggestions through assignments, case studies, Internship and projects for the fullfillment of the local, national and global developmental needs. (*Critical Thinking and Analytical Reasoning)*

5 use ICT in a variety of self-directed lifelong learning activities to face career challenges in the changing environment. (*Digital Literacy, Self - directed and Lifelong Learning)*

6 self-manage and function efficiently as a member or a leader in diverse teams in a multicultural society for nation building. (*Co-operation/Team Work and Multicultural Competence)*

7 uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment. (*Moral and Ethical Awareness)*

B.1.3 Programme Specific Outcomes (PSOs)

Based on the Programme Outcomes, Programme Specific Outcomes are framed for each UG Programme**.** Programme Specific Outcomes denote what the students would be able to do at the time of graduation. They are Programme specific. It is mandatory that each PO should be mapped to the respective PSO.

On completion of B.Sc. Microbiology Programme, the students will be able to

PO1 - *Disciplinary Knowledge*

PSO 1.a: apply the acquired knowledge about the basic concepts in various disciplines of Microbiology incorporated with knowledge in related courses for higher studies and employment.

PSO 1.b: demonstrate the techniques, tools and scientific procedures, follow safety measures and interpret the results in the field of Microbiology / chemistry and biology.

PO2 – *Communication Skills*

PSO 2: communicate the strategies in Microbiology effectively to upgrade their career as academicians, lab technicians, medical coders and quality control experts in various organizations.

PO3 – *Scientific Reasoning and Problem Solving*

PSO 3.a: explain and elaborate the sustainable development of microbes, their classification, metabolic processes and their molecular mechanisms in a systematic way.

PSO 3.b: make use of the knowledge and skill to handle various basic and analytical instruments used in microbiology laboratories for analyzing microbial diversity and molecular mechanisms.

PO4 – *Critical Thinking and Analytical Reasoning*

PSO 4.a: interpret the applications of biological sciences with molecular techniques to manipulate biological systems and produce novel products to meet the societal needs.

PSO 4.b: evaluate various diseases and their transmission, treatment, control and preventive methods with the help of modern techniques and involve in research activities in the field of medical laboratory and pharmaceutical industries.

PO5 – *Digital Literacy, Self - Directed and Lifelong Learning*

PSO 5: make use of ICT in their career for self-directed and lifelong learning in newly emerging disciplines of Microbiology and their area of interest.

PO6 – *Co-operation/Team Work and Multicultural Competence*

PSO 6: work in a team with team spirit or lead with entrepreneurial aspects and recent updates in course contents.

PO7 –*Moral and Ethical Awareness*

PSO 7: uphold and develop scientific responsibility towards social and ethical in the laboratory works of Microbiology.

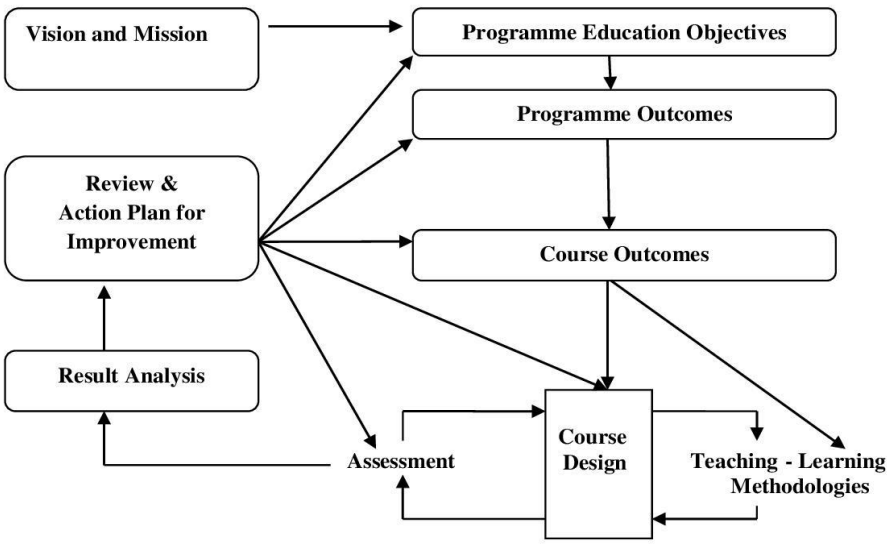
PO-PEO Mapping Matrix

Attainment of PEOs can be measured by a PO-PEO matrix. PEOs should evolve through constant feedback from alumnae, students, industry, management, *etc*. It is mandatory that each PEO should be mapped to at least one of the POs.

PEOs / POs/PSOs	PEO1	PEO2	PEO3
PO1/PSO1.a	-	✓	✓
PO1/PSO1.b	✓	✓	✓
PO2/PSO2.a	✓	✓	-
PO2/PSO2.b	✓	✓	-
PO3/PSO3	-	✓	✓
PO4/PSO4.a	-	✓	✓
PO4/PSO4.b	✓	✓	-
PO5/PSO5	✓	✓	-
PO6/PSO6	-	✓	✓
PO7/PSO7	-	-	✓

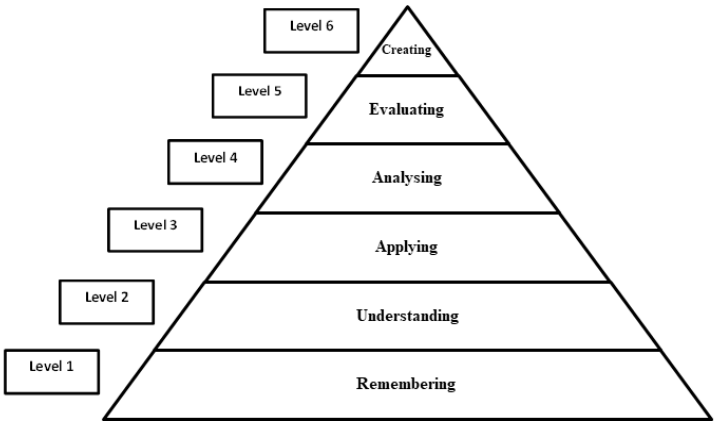
B.1.4 Course Outcomes (COs)

Course Outcomes are narrow statements restricted to the Course contents given in five units. Course Outcomes describe what students would be capable of, after learning the contents of the Course. They reflect the level of knowledge gained, skills acquired and attributes developed by the students after learning of Course contents. COs are measurable, attainable and manageable in number. COs contribute to attain POs in such a way that each CO addresses at least one of the POs and also each PO is reasonably addressed by adequate number of COs.



It is important to determine the methods of assessment. A comprehensive assessment strategy may be outlined using the revised Bloom's Taxonomy levels.

BLOOM'S TAXONOMY



CO – PO Mapping of Courses

After framing the CO statements, the COs framed for each Course is mapped with POs based on the relationship that exists between them. The COs which are not related to any of the POs is indicated with (-), signifying Nil. Measurement Mapping is based on Four Points Scale [High (H), Medium (M), Low (L) and Nil (-)]. For calculating weighted percentage of contribution of each Course in the attainment of the respective POs, the weights assigned for H, M and L are 3, 2and 1 respectively.

CO-PO/PSO Mapping Table (Course Articulation Matrix)

PO/PSOs / COs	PO1/ PSO1	PO2/ PSO2	PO3/ PSO3	PO4/ PSO4	PO5/ PSO5	PO6/ PSO6	PO7/ PSO7
CO1							
CO2							
CO3							
CO4							
CO5							

ELIGIBILITY FOR ADMISSION

The candidate should have passed the Higher Secondary Examination conducted by the Board of Higher Secondary Education, Tamil Nadu or any other equivalent examination accepted by the Academic Council with Biology as one of the subjects in Higher Secondary Course.

DURATION OF THE PROGRAMME

The candidates shall undergo the prescribed Programme of study for a period of three academic years (six semesters).

MEDIUM OF INSTRUCTION

English

COURSES OFFERED

Part I	:	Tamil/Hindi Course
Part II	:	English
Part III	:	Core Courses
		Elective Courses • Generic Elective Courses • Discipline Specific Elective Courses
		Self Study Course - online
Part IV	:	Skill Enhancement Courses (SEC)
		Elective Courses (NMEC)
		Environmental Studies Value Education
		Field Project/Internship
		Self Study Course - online
Part V	:	National Service Scheme/ Physical Education/ Youth Red Cross Society/ Red Ribbon Club/ Science Forum/ Eco Club/ Library and Information Science/ Consumer Club/ Health and Fitness Club/ National Cadet Corps/ Rotaract Club

B.2 EVALUATION SCHEME

B.2.1.PART II

Components	Internal Assessment Marks	Summative Examination Marks	Total Marks
Theory	15	60	100
Practical	5	15	
Assignment	5	-	

Three Periodic Tests - Average of the best two will be considered

B.2.2.Part I & PART III - Core Courses, Elective Courses (Generic, DSEC)

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory	25	75	**100**

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K3 Level	:	5
Quiz	K1 Level	:	5
Total		**:**	**25**

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Practical

Mode of Evaluation		**Marks**
Practical Test*	:	30
Record & Performance	:	10
Total	**:**	**40**

*Average of the two Practical Tests will be considered

Question Pattern for Internal Tests **Duration: 2 Hours**

Section	**Questions No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 4	Multiple Choice	4	4	1	4
B	5 -6	Internal Choice - Either … or Type	3	3	7	21
C	8 -9	Internal Choice - Either… or Type	2	2	10	20
					Total	**45***

*The total marks obtained in the Periodic Test will be calculated for 15 marks

SUMMATIVE EXAMINATION

Question Pattern **Duration: 3 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 -10	Multiple Choice	10	10	1	10
B	11 - 15	Internal Choice – Either …or Type	5	5	7	35
C	16 - 18	Internal Choice – Either… or Type	3	3	10	30
					Total	**75**

PROJECT

Assessment by Internal Examiner Only

Internal Assessment

Distribution of Marks

Mode of Evaluation	:	Marks
Project work and Report	:	60
Presentation and Viva –Voce	:	40
Total	:	100

B.2.3 PART IV - Skill Enhancement Courses, Non Major Elective Courses and Foundation Course

B.2.3.1 FOUNDATATION COURSE

INTERNAL ASSESSMENT
Distribution of Marks
Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K2 Level	:	5
Quiz	K1 Level	:	5
Total		**:**	**25**

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 3	Internal Choice - Either …or Type	3	3	5	15
B	4	Internal Choice – Either …or Type	1	1	10	10
	Total					**25***

*The total marks obtained in the Periodic Test will be calculated for 15 marks

SUMMATIVE EXAMINATION

Mode of Evaluation		Marks
Summative Examination	:	50
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Total	**:**	**75**

Question Pattern **Duration: 2 Hours**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 7	Internal Choice – Either… or Type	2	2	10	20
	Total					**50**

B.2.3.2 Skill Enhancement Course - Entrepreneurial skills

INTERNAL ASSESSMENT ONLY
Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	15
Assignment	:	5
Quiz	:	5
Model Examinations	:	60
Online Quiz(Multiple Choice Questions - K2 Level)	:	15
Total	**:**	**100**

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1- 3)	Internal Choice – Either Or Type	3	3	6	18
B Q. No.(4)	Internal Choice – Either Or Type	1	1	12	12
Total					**30**

Two Periodic Tests - Better of the two will be considered

Two Assignments - Better of the two will be considered

Two Quiz Tests - Better of the two will be considered

Question Pattern for Model Examination **Duration: 2 Hours**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1-5)	Internal Choice – Either Or Type	5	5	6	30
B Q. No.(6- 8)	Internal Choice – Either Or Type	3	3	10	30
Total					**60**

B.2.3.3 Skill Enhancement Courses/ Non Major Elective Courses

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K3 Level	:	5
Quiz	K2 Level	:	5
Total		**:**	**25**

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 3	Internal Choice - Either …or Type	3	3	5	15
B	4	Internal Choice – Either …or Type	1	1	10	10
	Total					**25***

*The total marks obtained in the Periodic Test will be calculated for 15 marks

SUMMATIVE EXAMINATION

Mode of Evaluation		Marks
Summative Examination	:	50
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Total	**:**	**75**

Question Pattern **Duration: 2 Hours**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 7	Internal Choice – Either… or Type	2	2	10	20
	Total					**50**

B.2.4 PART IV- ENVIRONMENTAL STUDIES / VALUE EDUCATION

INTERNAL ASSESSMENT ONLY

Evaluation Pattern

Mode of Evaluation		Marks
Periodic Test	:	15
Assignment (Based on the listed activities) - K3 Level	:	10
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Poster Presentation - K3 Level		10
Report on student's Awareness creation on Environmental Protection /Ethical Values - K3 Level		10
Model Examination	:	30
Total	**:**	**100**

Three Assignment - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1- 3)	Internal Choice – Either Or Type	3	3	6	18
B Q. No.(4)	Internal Choice – Either Or Type	1	1	12	12
Total					**30***

Two Periodic tests - Better of the two will be considered

The total marks obtained in the Periodic test will be calculated for 15 marks

Question Pattern for Model Examination **Duration: 2 ½ Hours**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 8	Internal Choice – Either… or Type	3	3	10	30
	Total					**60***

*The total marks obtained in the Model Examination will be calculated for 30 marks

B.2.5 PART IV- Internship/ Field Project

Internship / Field Project is compulsory for II year UG Science Students

- **Internship:** A designated activity that carries one credit involving not less than 15 days of working in an organization under the guidance of an identified mentor
- **Field Project:** Students comprising of maximum 5 members in a team need to undertake project that involve conducting surveys inside/outside the college premises and collection of data from designated communities or natural places.
- Assessment by Internal Examiner only

Mode of Evaluation		Marks
Onsite Learning/Survey	:	50
Report	:	25
Viva-Voce	:	25

Total		**100**

B.2.6 SELF STUDY COURSE

B.2.6 .1 PART III - Core & Elective Courses Quiz – Online

- Assessment by Internal Examiner only
- Question Bank is prepared by the Faculty Members of the Departments for all the Core and Elective Courses offered in all the Semesters.
- No. of Questions to be taken 700.
- Multiple Choice Question pattern is followed.
- Online Test will be conducted in VI Semester for 100 Marks.
- Model Examination is conducted after two periodic tests.

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	25
Model Examination	:	75
	:	**100**

Two Periodic Tests - Better of the two will be considered

B.2.6 .2 PART IV - Practice for Competitive Examinations – Online

Assessment by Internal Examiner only

- Question Bank prepared by the Faculty Members of the respective Departments will be followed.
- Multiple Choice Question pattern is followed.
- Online Test will be conducted in V Semester for 100 Marks.
- Model Examination is conducted after two periodic tests.

Subject wise Allotment of Marks

Subject		Marks
Tamil	:	10
English	:	10
History	:	10
Mathematics	:	10
Current affairs	:	10
Commerce, Law & Economics	:	10
Physical Sciences	:	10
Life Sciences	:	15
Computer Science	:	5
Food and Nutrition	:	5
Sports and Games	:	5

Total	**:**	**100**

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	25
Model Examination	:	75
Total	**:**	**100**

Two Periodic Tests - Better of the two will be considered

B.2.7. Part V – Extension Activities

INTERNAL ASSESSMENT ONLY

Distribution of Marks

Mode of Evaluation		Marks
Attendance	:	5
Performance	:	10
Report/Assignment/Project/Camp/Practical	:	10
Total	**:**	**25***

*The marks obtained will be calculated for 100 marks

B.2.8 EXTRA CREDIT COURSES (OPTIONAL)

2.8.1 Extra Credit Course offered by the Department.

Assessment by Internal Examiner Only (To be conducted along with the III Periodic Test)

Distribution of Marks

Mode of Evaluation		Marks
Quiz (Multiple Choice Questions)	:	25
Model Examination	:	75
Total	**:**	**100**

Question Pattern for Model Examination

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q.No.(1-5)	Internal Choice-Either or Type	5	5	7	35
B Q.No.(6-9)	Internal Choice-Either or Type	4	4	10	40
				Total	**75**

2.8.2 Extra credit Course offered by MOOC (Massive Open Online Course)

- The Courses shall be completed within the first V Semesters of the Programme.
- The allotment of credits is as follows **(Maximum of 10 credits)**

4weeks Course	- 1 credit
8 weeks Course	- 2 credits
12 weeks Course	- 3 credits

ELIGIBILITY FOR THE DEGREE

- The candidate will not be eligible for the Degree without completing the prescribed Courses of study, lab work, *etc.*, and a minimum Pass marks in all the Courses.
  - No Pass minimum for Internal Assessment.
  - Pass minimum for External Examination is 27 marks out of 75 marks for Core Courses, Elective Courses (Generic Elective, DSEC Courses)
  - Pass minimum for External Examination is 18 marks out of 50 marks for Skill Enhancement Courses and Non Major Elective Courses (NMEC).
  - The aggregate minimum pass percentage is 40.
  - Pass minimum for External Practical Examination is 21 marks out of 60 marks.
  - Pass minimum for Ability Enhancement Compulsory Courses and Generic Elective Courses is 40 marks.
  - Pass minimum for Self Study Courses is 40 marks.
- Attendance
  - For UG, PG Programmes,
    a) The students who have attended the classes for 76 days (85%) and above are permitted to appear for the Summative Examinations without any condition.
    b) The students who have only 60-75 days (66% - 84%) of attendance are permitted to appear for the Summative Examinations after paying the required fine amount and fulfilling other conditions according to the respective cases.
    c) The students who have attended the classes for 59 days and less – upto 45 days (50% - 65%) can appear for the Summative Examinations only after getting special permission from the Principal.
    d) The students who have attended the classes for 44 days or less (<50%) cannot appear for the Summative Examinations and have to repeat the whole semester.

- For Part V in UG Programmes, the students require 75 % of attendance to get a credit.
- For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

These rules come into effect from 2023-2024 onwards.

B.3 ASSESSMENT MANAGEMENT PLAN

An Assessment Management Plan that details the assessment strategy both at the Programme and the Course levels is prepared. The continuous assessment is implemented using an assessment rubric to interpret and grade students.

B.3.1 Assessment Process for CO Attainment

Assessment is one or more processes carried out by the institution that identify, collect and prepare data to evaluate the achievement of Course Outcomes and Programme Outcomes. Course Outcome is evaluated based on the performance of students in the Continuous Internal Assessments and in End Semester Examination of a Course. Target levels of attainment shall be fixed by the Course teacher and Heads of the respective departments.

Direct Assessment (Rubric based) - Conventional assessment tools such as Term Test, Assignment, Quiz and End Semester Summative Examination are used.

Indirect Assessment – Done through Course Exit Survey.

CO Assessment Rubrics

For the evaluation and assessment of COs and POs, rubrics are used. Internal assessment contributes 40% and End Semester assessment contributes 60% to the total attainment of a CO for the theory Courses. For the practical Courses, internal assessment contributes 50% and Semester assessment contributes 50% to the total attainment of a CO. Once the Course Outcome is measured, the PO can be measured using a CO-PO matrix.

CO Attainment

Direct CO Attainment

Course Outcomes of all Courses are assessed and the CO – wise marks obtained by all the students are recorded for all the assessment tools. The respective CO attainment level is evaluated based on set attainment rubrics.

Target Setting for Assessment Method

For setting up the target of internal assessment tools, 55% of the maximum mark is fixed as target. For setting up the target of End Semester Examination, the average mark of the class shall be set as target.

Formula for Attainment for each CO

Attainment = Percentage of students who have scored more than the target marks

$$\text{Percentage of Attainment} = \frac{\text{Number of Students who scored more than the Target}}{\text{Total Number of Students}} \times 100$$

Attainment Levels of COs

Assessment Methods	**Attainment Levels**	
Internal Assessment	Level 1	50% of students scoring more than set target marks in Internal Assessment tools
	Level 2	55% of students scoring more than set target marks in Internal Assessment tools
	Level 3	60% of students scoring more than set target marks in internal Assessment tools
End Semester Summative Examination	Level 1	50% of students scoring more than average marks in End Semester Summative Examination
	Level 2	55% of students scoring more than average marks in End Semester Summative Examination
	Level 3	60% of students scoring more than average marks in End Semester Summative Examination

Indirect CO Attainment

At the end of each Course, an exit survey is conducted to collect the opinion of the students on attainment of Course Outcomes. A questionnaire is designed to reflect the views of the students about the Course Outcomes.

Overall CO Attainment= 75% of Direct CO Attainment + 25 % of Indirect CO Attainment

In each course, the level of attainment of each CO is compared with the predefined targets. If the target is not reached, the Course teacher takes necessary steps for the improvement to reach the target.

For continuous improvement, if the target is reached, the Course teacher can set the target as a value greater than the CO attainment of the previous year.

B.3.2 Assessment Process for Overall PO Attainment

With the help of CO - PO mapping, the PO attainment is calculated. PO assessment is done by giving 75% weightage to direct assessment and 25% weightage to indirect assessment. Direct assessment is based on CO attainment, where 75% weightage is given to attainment through End Semester Examination and 25% weightage is given to attainment through Internal assessments. Indirect assessment is done through Graduate Exit Survey and participation of students in Co-curricular/ Extra curricular activities.

PO Assessment Tools

Mode of Assessment	Assessment Tool	Description
Direct Attainment (Weightage -75%)	CO Assessment	This is computed from the calculated CO Attainment value for each Course
Indirect Attainment (Weightage - 25%)	Graduate Exit Survey 10%	At the end of the Programme, Graduate Exit Survey is collected from the graduates and it gives the opinion of the graduates on attainment of Programme Outcomes
	Co-curricular/ Extra-curricular	For participation in Co-curricular/Extra-curricular activities during the period of their study.

Programme Articulation Matrix (PAM)

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7
Average Direct PO Attainment								
Direct PO Attainment in percentage								

Indirect Attainment of POs for all Courses

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
Graduate Exit Survey							
Indirect PO Attainment							

Attainments of POs for all Courses

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
Direct Attainment (Weightage - 75%)							
Indirect Attainment (Weightage - 25%)							
Overall PO Attainment							

Overall PO Attainment= 75% of Direct PO Attainment +
25% of Indirect PO Attainment (Graduate Exit Survey & Participation in Co- curricular and Extra curricular Activities)

Expected Level of Attainment for each of the Programme Outcomes

POs	Level of Attainment
Attainment Value ≥70%	Excellent
60% ≤ Attainment Value < 70%	Very Good
50% ≤ Attainment Value < 60%	Good
40% ≤ Attainment Value < 50%	Satisfactory
Attainment Value <40%	Not Satisfactory

Level of PO Attainment

Graduation Batch	Overall PO Attainment (in percentage)	Whether Expected Level of PO is Achieved? (Yes/No)

B.3.3 Assessment Process for PEOs

The curriculum is designed so that all the Courses contribute to the achievement of PEOs. The attainment of PEOs is measured after 5 years of completion of the Programme only through indirect methods.

Target for PEO Attainment

Assessment Criteria	Target (UG)	Target (PG)
Record of Employment	15% of the class strength	30% of the class
Progression to Higher Education	50% of the class strength	5% of the class
Record of Entrepreneurship	2% of the class strength	5% of the class

Attainment of PEOs

Assessment Criteria & Tool	Weightage
Record of Employment	10
Progression to Higher Education	20
Record of Entrepreneurship	10
Feedback from Alumnae	30
Feedback from Parents	10
Feedback from Employers	20
Total Attainment	**100**

$$\text{Percentage of PEO Attainment from Employment} = \frac{\text{Number of Students who have got Employment}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Higher Education} = \frac{\text{Number of Students who pursue Higher Education}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Entrepreneurship} = \frac{\text{Number of Students who have become Entrepreneurs}}{\text{Target}} \times 100$$

Expected Level of Attainment for each of the Programme Educational Objectives

POs	Level of Attainment
Attainment Value ≥70%	Excellent
60% ≤ Attainment Value < 70%	Very Good
50% ≤ Attainment Value < 60%	Good
40% ≤ Attainment Value < 50%	Satisfactory
Attainment Value <40%	Not Satisfactory

Level of PEO Attainment

Graduation Batch	Overall PEO Attainment (in percentage)	Whether Expected Level of PEO is Achieved? (Yes/No)

C. PROCESS OF REDEFINING THE PROGRMME EDUCATIONAL OBJECTIVES

The College has always been involving the key stakeholders in collecting information and suggestions with regard to curriculum development and curriculum revision. Based on the information collected the objectives of the Programme are defined, refined and are inscribed in the form of PEOs. The level of attainment of PEOs defined earlier will be analyzed and will identify the need for redefining PEOs. Based on identified changes in terms of curriculum, regulations and PEOs, the administrative system like Board of Studies, Academic Council and Governing Body may recommend appropriate actions. As per the Outcome Based Education Framework implemented from the Academic Year 2020 -2021, the following are the Programme Structure, the Programme Contents and the Course Contents of B.Sc. Microbiology Programme.

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BACHELOR OF SCIENCE MICROBIOLOGY (2024)

Programme Structure - Allotment of Hours and Credits
For those who join in the Academic Year 2023-2024

Components	Semester						Total Number of Hours (Credits)
	I	II	III	IV	V	VI	
Part I : Tamil /Hindi	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24 (12)
Part II : English	6 (3)	6(3)	6 (3)	6 (3)	-	-	24 (12)
Part III : Core Courses, Elective Courses & Self Study Course							
Core Course	5 (5)	5 (5)	5 (5)	5 (5)	6(5)	6 (5)	32 (30)
Core Course	-	-	-	-	6 (5)	6 (5)	12 (10)
Core Course Practical	5(3)	5(3)	5 (3)	4 (3)	5 (4)	6(4)	30(20)
Core Course Project	-	-	-	-	1 (3)	-	1 (3)
Elective Course (DSEC)	-	-	-	-	5(3)	5 (3)	10 (6)
Elective Course (DSEC Practical)	-	-	-	-	5(3)	5(3)	10(6)
Elective Course I (Allied)	4(4)	4(4)	4(4)	4(4)	-	-	16(16)
Elective Course I Practical I(Allied)	-	-	-	-	-	-	-
Elective Course II(Allied)	-	-	-	-	-	-	-
Elective Course II Practical II(Allied)	-	-	-	-	-	-	-
Self Study Course	-	-	-	-	-	0 (1)	0 (1)
Part IV : Skill Enhancement Courses, Elective Courses, Environmental Studies, Value Education, Self Study Course &Internship/ Field Project							
SEC	2 (2)	-	1 (1)	2 (2)	-	-	5(5)
SEC	-	2 (2)	2 (2)	2 (2)	-	2 (2)	8 (8)
Elective Course(NME)	2 (2)	2 (2)	-	-	-	-	4 (4)
Value Education	-	-	-	-	2 (2)	-	2 (2)
Environmental Studies	-	-	1 (0)	1 (2)	-	-	2 (2)
Self Study Course	-	-	-	-	0 (1)	-	0 (1)
Internship/ Field Project	-	-	-	-	0 (1)	-	0 (1)
Part V : Extension Activities	-	-	-	-	-	0(1)	0 (1)
Total	**30 (22)**	**30 (22)**	**30 (21)**	**30 (24)**	**30 (27)**	**30 (24)**	**180 (140)**
Extra Credit Course (Self Study Course)	-	-	-	-	0(2)	-	0(2)

DSEC: Discipline Specific elective Course; SEC-Skill Enhancement Course

NMEC: Non Major Elective Course

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B.Sc., MICROBIOLOGY-2024
PROGRAMME CONTENT
SEMESTER I

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil – I/ Hindi - I	23UTAG11/ 23UHDG11	6	3	3	25	75	100
2.	**Part II**		English-I	23UENG11	6	3	3	25	75	100
3.	**Part III**	Core Course -1	Fundamentals of Microbiology and Microbial Diversity	23UMBC11	5	5	3	25	75	100
4.		Core Course -2 Practical - I	Fundamentals of Microbiology and Microbial Diversity Practical	23UMBC11P	5	3	3	40	60	100
5.		Elective Course –1	Basic and Clinical Biochemistry	23UMBA11	4	4	3	25	75	100
6.	**Part IV**	NME -1	Social and Preventive medicine	23UMBN11	2	2	2	25	75	100
7		SEC- 1 Foundation Course	Microbial Taxonomy	23UMBF11	2	2	2	25	75	100
				Total	**30**	**22**				**700**

B.Sc., MICROBIOLOGY-2024
PROGRAMME CONTENT
SEMESTER II

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil – II/ Hindi - II	23UTAG21/ 23UHDG21	6	3	3	25	75	100
2.	**Part II**		English-II	23UENG21	6	3	3	25	75	100
3.	**Part III**	Core Course -3	Microbial Physiology and Metabolism	23UMBC21	5	5	3	25	75	100
4.		Core Course -4 Practical - II	Microbial Physiology and Metabolism Practical	23UMBC21P	5	3	3	40	60	100
5.		Elective Course -2	Bio Instrumentation	23UMBA21	4	4	3	25	75	100
6.	**Part IV**	NME- 2	Nutrition & Health Hygiene	23UMBN21	2	2	2	25	75	100
7		SEC-2	Sericulture	23UMBS21	2	2	2	25	75	100
				Total	**30**	**22**				**700**

B.Sc., MICROBIOLOGY-2024
PROGRAMME CONTENT
SEMESTER III

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil – III/ Hindi - III	23UTAG31/ 23UHDG31	6	3	3	25	75	100
2.	**Part II**		English-III	23UENG31	6	3	3	25	75	100
3.	**Part III**	Core Course -5	Molecular Biology and Microbial Genetics	23UMBC31	5	5	3	25	75	100
4.		Core Course -6 Practical -III	Molecular Biology and Microbial Genetics Practical	23UMBC31P	5	3	3	40	60	100
5.		Elective Course –3	Clinical Laboratory Technology	23UMBA31	4	4	3	25	75	100
6.	**Part IV**	SEC –3	Organic Farming and Biofertilizer Technology	23UMBS31	1	1	2	100	-	100
7		SEC- 4	Aquaculture	23UMBS32	2	2	3	25	75	100
8			Environmental Studies	23UGES41	1	-	-	-	-	-
				Total	**30**	**21**				**700**

B.Sc., MICROBIOLOGY-2024
PROGRAMME CONTENT
SEMESTER IV

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil – IV/ Hindi – IV	23UTAG41/ 23UHDG41	6	3	3	25	75	100
2.	**Part II**		English-IV	23UENG41	6	3	3	25	75	100
3.	**Part III**	Core Course -7	Immunology and Immunotechnology	23UMBC41	5	5	3	25	75	100
		Core Course -8 Practical -IV	Immunology and Immunotechnology Practical	23UMBC41P	4	3	3	40	60	100
5.		Elective Course -4	Food Processing Technology	23UMBA41	4	4	3	25	75	100
6.	**Part IV**	SEC – 5	Vaccine Technology	23UMBS41	2	2	2	25	75	100
7		SEC-6	Apiculture	23UMBS42	2	2	2	25	75	100
8			Environmental Studies	23UGES41	1	2	2	100	-	100
				Total	**30**	**24**				**800**

B.Sc., MICROBIOLOGY-2024
PROGRAMME CONTENT
SEMESTER V

S. No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1	**Part III**	Core Course -9	Bacteriology and Mycology	23UMBC51	6	5	3	25	75	100
2		Core Course -10	Virology and Parasitology	23UMBC52	6	5	3	25	75	100
3		Core Course- 11 Practical - V	Medical Microbiology Practical	23UMBC51P	5	4	3	40	60	100
4		Core Course– 12 Project	Project with Viva Voce	23UMBC54PR	1	3	-	100	-	100
5		Elective Course (DSEC -1)	Recombinant DNA Technology	23UMBE51	5	3	3	25	75	100
6		Elective Course (DSEC -2)	Biosafety and Bioethics	23UMBE52	5	3	3	25	75	100
	Part IV	Self-Study Course	Practice for Competitive Examinations - Online	23UGCE51	-	1	-	100	-	100
7			Value Education	23UGVE51	2	2	2	100	-	100
9		Internship/Field Project	Internship	23UMBI51G	-	1	-	100	-	100
				Total	**30**	**27**				**900**

10.	Extra Credit Course (Self study course)	Industrial Microbiology	23UMBO51	-	2	3	**100**	-	**100**

B.Sc., MICROBIOLOGY-2024
PROGRAMME CONTENT
SEMESTER VI

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1	**Part III**	Core Course -13	Environmental and Agriculture Microbiology	23UMBC61	6	5	3	25	75	100
2		Core Course -14	Food, Dairy and Probiotic Microbiology	23UMBC62	6	5	3	25	75	100
3		Core Course- 15 Practical - VI	Environmental, Agriculture and Food Microbiology Practical	23UMBC61P	6	4	3	40	60	100
5		Elective Course (DSEC -3)	Pharmaceutical Microbiology	23UMBE61	5	3	3	25	75	100
6		Elective Course (DSEC -4)	Entrepreneurship and Bio-business	23UMBE62	5	3	3	25	75	100
		Self-Study Course	Core Courses Quiz-online	23UMBQ61	-	1	-	100	-	100
7	**Part IV**	Professional Competency SEC-7	Microbial Quality Control and Testing	23UMBS61	2	2	2	25	75	100
	Part V	Extension Activities	Extension Activities		-	1	-	100	-	100
				Total	**30**	**24**				**800**

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B.Sc. Microbiology
(2023-2024 onwards)

Semester I	**FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY**	Hours/Week: 5	
Core Course – 1		Credits: 5	
Course Code 23UMBC11		Internal 25	External 75

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1: Recall the historical events to understand the fundamentals of Microbiology. (K1)

CO2: Discuss the detailed structure, functions and growth of microorganisms. (K2)

CO3: Explain the various microbiological techniques and growth medium involved in culturing microorganisms. (K2)

CO4: Interpret the working mechanism of different microscopes to study the organelle features and diversity of microorganisms. (K3)

CO5: Apply the concept of Culture techniques, Modes of sterilization and Microscopes to learn the microbial diversity**.** (K3)

UNIT I

History and Evolution of Microbiology, Classification – Three kingdom, five kingdom, six kingdom and eight kingdom. Microbial biodiversity: Introduction to microbial biodiversity-ecological niche. Basic concepts of Eubacteria, Archaebacteria and Eucarya. Conservation of Biodiversity. (15 Hours)

UNIT II

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. Differences between prokaryotic and eukaryotic microorganisms**.**

(15 Hours)

UNIT III

Bacterial culture media and pure culture techniques. Mode of cell division, Quantitative measurement of growth. Anaerobic culture techniques.

(15 Hours)

UNIT IV

Microscopy – Simple, bright field, dark field, phase contrast, fluorescent, electron microscope – TEM & SEM. Stains and staining methods. (15 Hours)

UNIT V

Sterilization–moist heat - autoclaving, dry heat – Hot air oven, radiation – UV, Ionization, filtration – membrane filter and disinfection, antiseptic; Antimicrobial agents.

(15 Hours)

Text Books

1. Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7th Edition.,McGraw –Hill, New York.
2. Willey J., Sherwood L., and Woolverton C. J., (2017). Prescott's Microbiology. 10th Edition., McGraw-Hill International edition.
3. Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11th Edition., A La Carte Pearson.
4. Salle. A.J (1992). Fundamental Principles of Bacteriology. 7th Edition., McGraw Hill Inc.New York.
5. Boyd, R.F. (1998). General Microbiology,2nd Edition., Times Mirror, Mosby CollegePublishing, St Louis.

References Books

1. Jeffrey C. Pommerville., Alcamo's Fundamentals of Microbiology (9th Edition). Jones &Bartlett learning 2010.
2. Stanier R.Y, Ingraham J. L., Wheelis M. L., and Painter R. R. (2010). General Microbiology, 5th Edition., MacMillan Press Ltd
3. Tortora, G.J., Funke, B.R. and, Case, C.L (2013). Microbiology-An Introduction, 11th Edition., Benjamin Cummings.
4. Nester E., Anderson D., Roberts C. E., and Nester M. (2006). Microbiology-A Human Perspective, 5th Edition., McGraw Hill Publications.
5. Madigan M.T., Martinko J.M., Stahl D.A, and Clark D. P. (2010). Brock - Biology of Microorganisms, 13th Edition Benjamin-Cummings Pub Co.

Web Resources

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/#

4 https://bio.libretexts.org/@go/page/9188

5 https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/

Course Code 23UMBC11	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	3	3	1	2	-	1	1	-	2
CO2	2	-	1	2	-	1	-	-	-	1
CO3	3	3	2	-	2	2	-	1	-	2
CO4	1	2	-	1	-	-	-	2	-	1
CO5	1	3	2	2	1		1	-	-	2

Mrs. J.Jeya
Head of the Department

Mrs.M.M.Fatima mansoora
Course Designer

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B.Sc. Microbiology
(2023-2024 onwards)

Semester I	**FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY PRACTICAL**	Hours/Week: 5	
Core Course – 2 Practical-I		Credits: 3	
Course Code **23UMBC11P**		Internal 40	External 60

Course Outcomes:

CO1 Practice sterilization methods; learn to prepare media and their quality control. (K2)

CO2 Learn streak plate, pour plate and serial dilution and pigment production of microbes. (K2)

CO3 Understand Microscopy methods, different Staining techniques and motility test. (K3)

CO4 Observe culture characteristics of microorganisms. (K3)

CO5 Study on Microbial Diversity using Hay Infusion Broth-Wet mount (K3)

UNIT I

Cleaning of glass wares, Microbiological good laboratory practice and safety. Sterilization and assessment of sterility– Autoclave, hot air oven, and membrane filtration.

. (15 Hours)

UNIT II

Media preparation: liquid media, solid media, semi-solid media, agar slants, agar deeps, agar plates. (15 Hours)

UNIT III

Preparation of basal, differential, enriched, enrichment, transport, and selective media preparation- quality control of media, growth supporting properties, sterility check of media. Pure culture techniques: streak plate, pour plate, decimal dilution. (15 Hours)

UNIT IV

Culture characteristics of microorganisms: growth on different media, growth characteristics, and description. Demonstration of pigment production. Microscopy: light microscopy and bright field microscopy. (15 Hours)

UNIT V

Staining techniques: smear preparation, simple staining, Gram's staining and endospore staining. Study on Microbial Diversity using Hay Infusion Broth-Wet mount to show different types of microbes, hanging drop. (15 Hours)

Text Books

1. James G Cappucino and N. Sherman MB(1996). A lab manual Benjamin Cummins, New York 1996.
2. Kannan. N (1996). Laboratory manual in General Microbiology. Palani Publications.
3. Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications.
4. Gunasekaran, P. (1996). Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi.
5. R C Dubey and D K Maheswari (2002). Practical Microbiology. S. Chand Publishing.

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1. Atlas.R (1997). Principles of Microbiology, 2nd Edition, Wm.C.Brown publishers.
2. Amita J, Jyotsna A and Vimala V (2018). Microbiology Practical Manual. (1st Edition). Elsevier India
3. Talib VH (2019). Handbook Medical Laboratory Technology. (2nd Edition). CBS
4. Wheelis M, (2010). Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.
5. Lim D. (1998). Microbiology, 2nd Edition, WCB McGraw Hill Publications.

Web Resources

1. http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection-methods-and-principles-microbiology/24403.
2. https://www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635
3. https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf

4 https://microbiologyinfo.com/top-and-best-microbiology-books/

5 https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology

Course Code 23UMBC11P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	1	3	1	2	1	-	-	2	1
CO2	1	-	2	2	-	2	1	1	-	-
CO3	2	2	2	1	1	-	1	-	2	-
CO4	1	1	3	-	-	1	2	1	2	1
CO5	1	1	-	2	1	-	-	1	1	-

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VIRUDHUNAGAR - 626 001

B.Sc. Microbiology
(2023-2024 onwards)

Semester I	**BASIC AND CLINICAL BIOCHEMISTRY**	Hours/Week: 4	
Elective Course		Credits: 4	
Course Code 23UMBA11		Internal 25	External 75

Course Outcomes:

CO1 Recall the structure, classification , significance and metabolic disorders of biomolecules (K1)

CO2 Explain the physicochemical properties and functions of biomolecules and its metabolism. (K2)

CO3 Illustrate the structural organisation of macromolecules and diseases related to inborn errors of metabolism. (K2)

CO4 Develop the biochemical basis and metabolic abnormalities of macromolecules. (K3)

CO5 Identify the imbalances of enzymes in organ function and relate the role of Clinical Biochemistry in screening and diagnosis. (K3)

UNIT I

Biomolecules -Carbohydrate – General properties, function, structure, classification– monosaccharides (Glucose, Fructose, Galactose), Oligosaccharides (Sucrose, Maltose, Lactose) and polysaccharides (Starch, Glycogen,) and biological significance. Lipids – General properties, functions, structure, classification (Simple, Derived and Complex), Cholesterol, LDL, HDL – biological significance. (12 Hours)

UNIT II

Biomolecules - Amino acids – General properties, functions, structure, classification and biological significance. Proteins– General structure, Properties, functions, classification and biological significance.) (12 Hours)

UNIT III

Disorders of Metabolism: Disorders of carbohydrate metabolism: diabetes mellitus, ketoacidosis, hypoglycemia, glycogen storage diseases, galactosemia and lactose intolerance. Disorders of lipid metabolism: hyperlipidemia, hyperlipoproteinemia, hypercholesterolemia, hypertriglyceridemia, sphingolipidosis.. (12 Hours)

UNIT IV

Disorders of Metabolism: Disorders of amino acid metabolism: alkaptonuria, phenylketonuria, phenylalaninemia, homocystineuria, tyrosinemia, aminoacidurias. (12 Hours)

UNIT V

Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase. (12 Hours)

Text Books

1. Satyanarayana, U. and Chakrapani, U(2014).Biochemistry,4th Edition, Made Simple Publisher.
2. Jain J L, Sunjay Jain and Nitin Jain (2016).Fundamentals of Biochemistry, 7th Edition, S Chand Company.
3. AmbikaShanmugam's (2016). Fundamentals of Biochemistry for Medical Students, 8th Edition. Wolters Kluwer India Pvt Ltd.
4. Vasudevan. D.M.Sreekumari.S, Kannan Vaidyanathan (2019). Textbook Of Biochemistry For Medical Students. Kindle edition, Jaypee Brothers Medical Publishers
5. Jeremy M. Berg,LubertStryer, John L. Tymoczko, Gregory J. Gatto (2015). Biochemistry, 8th edition. WH Freeman publisher.

References Books

1. AmitKessel&Nir Ben-Tal (2018). Introduction to Proteins: structure, function and motion. 2nd Edition, Chapman and Hall.
2. David L. Nelson and Michael M. Cox (2017).Lehninger Principles of Biochemistry, 7th Edition W.H. Freeman and Co., NY.
3. LupertStyrer, Jeremy M. Berg, John L. Tymaczko, Gatto Jr., Gregory J (2019). Biochemistry. 9th Edition ,W.H.Freeman& Co. New York.
4. Donald Voet, Judith Voet, Charlotte Pratt (2016). Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, Wiley.
5. Joy PP, Surya S. and AswathyC (2015). Laboratory Manual of Biochemistry, Edition 1.,Publisher:Kerala agricultural university.

Web Resources

1 https://www.abebooks.com › plp

2 https://kau.in/document/laboratory-manual-biochemistry

3 https://metacyc.org

4 https://www.medicalnewstoday.com

5 https://journals.indexcopernicus.com

Course Code 23UMBA11	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	2	3	-	-	2	1	-	1	1
CO2	2	2	2	1	1	-	2	1	-	2
CO3	2	2	2	1	1	1	2	1	-	1
CO4	1	2	1	-	-	1	2	-	1	2
CO5	1	1	2	2	1	2	2	-	1	-

Mrs. J.Jeya
Head of the Department

Mrs. J.Jeya
Course Designer

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B.Sc. Microbiology
(2023-2024 onwards)

Semester I	**SOCIAL AND PREVENTIVE MEDICINE**	Hours/Week: 2	
NME-1		Credits: 2	
Course Code **23UMBN11**		Internal 25	External 75

Course Outcomes:

CO1 Identify the health information system (K1)

CO2 Associate various factors with health management system(K2)

CO3 Choose the appropriate health care services (K2)

CO4 Appraise the role of preventive medicine in community setting (K3)

CO5 Recommend the usage of alternate medicine during outbreaks (K3)

UNIT 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.. (6 Hours)

UNIT II

Health management:

Applications of behavioral 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. (6 Hours)

UNIT III

Health care and services:

Health care of the community-information, education, communication and training in health-maternal & child health-school health services- Geriatrics-care and welfare of the aged-mental health-health services through general practitioners. (6 Hours)

UNIT 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. (6 Hours)

UNIT 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.

(6 Hours)

Text Books

1. Park.K (2021). Textbook of preventive and social medicine, 26th edition. Banarsidas Bhanot publishers.
2. Mahajan& Gupta (2013). Text book of preventive and social medicine, 4th edition. Jaypeebrothers medical publishers.
3. Chun-Su Yuan, Eric J. Bieber, Brent Bauer (2006). Textbook of Complementary and Alternative Medicine. Second Edition. Routledge publishers.
4. Vivek Jain (2020). Review of Preventive and Social Medicine: Including Biostatics. 12th edition, Jaypee Brothers Medical Publishers.
5. Lal Adarsh Pankaj Sunder (2011). Textbook of Community Medicine: Preventive and Social Medicine, CBS publisher.

References Books

1 Howard Waitzkin, Alina Pérez, Matt Anderson (2021). Social Medicine and the coming Transformation. First Edition. Routledge 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 BehavioralMedicine.Guilford Press.

4 Marie Eloïse Muller, Marie Muller, MarthieBezuidenhout, KarienJooste (2006).Health Care Service Management. Juta and Company Ltd.

5 Geoffrey Rose (2008).Rose's Strategy of Preventive Medicine: The Complete.OUP Oxford.

Web Resources

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.futurelearn.com

4 https://www.healthcare-management-degree.net

5 https://www.conestogac.on.health-care-administration-and-service-management

Course Code 23UMBN11	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	1	-	-	1	-	-	-	-
CO2	2	-	1	-	1	-	-	2	1	1
CO3	2	2	-	1	-	2	1	-	-	-
CO4	2	2	1	-	2	1	-	1	-	1
CO5	2	2	1	-	1	-	-	-	1	-

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B.Sc. MICROBIOLOGY

(2023 -2024 onwards)

Semester I	**MICROBIAL TAXONOMY**	Hours/Week: 2	
SEC-1 Foundation Course		Credits: 2	
Course Code **23UMBF11**		Internal 25	External 75

COURSE OUTCOMS

On Completion of the course, the students will be able to

CO1: describe the standard rules governing diverse taxonomy with current classification of different microbial groups. [K1]

CO2: outline the classification system and taxonomic strategies to arrange microorganisms from kingdom to species. [K1]

CO3: explain the kingdom concepts to learn major characteristic features of microscopic community in different ecosystems. [K2]

CO4: Relate the nature of microorganisms according to the Various classification system of different microbes.. [K2]

CO5: classify the Structural, genomic and nomenclature features of microorganisms. [K2]

UNIT I

Introduction to Microbial diversity –Binomial nomenclature – species concept – Kingdom, Division, Class, Order, Family, and Genus. Principles of Classification – Morphological, Physiological , Biochemical & Molecular basis of classification. **(**6 Hours)

UNIT II

Bacteria: Salient Features of Bacteria, Archea & Actinomycetes - Classification of bacteria – Bergey's Manual (upto family level)- General characteristics of *Escherichia coli, Staphylococcus , Methanogens & Streptomyces*.. (6 Hours)

UNIT – III

Algae : Salient features- Classification of algae by Fritsch – Structure and Reproduction of *Chlamydomonas & Chlorella.* (6 Hours)

UNIT – IV

Fungi : Salient features - Classification of fungi by Alexopoulos & Mims – Structure and Reproduction of *Penicillium.* Protozoa- Salient features -Classification of Protozoa – Life cycle of *Plasmodium* (6 Hours)

UNIT V

Viruses: Nomenclature and classification of viruses. Salient Features of Bacteriophages - T4, Plant viruses - TMV and animal viruses – HIV. (6 Hours)

TEXT BOOK

Prescott, Harley & Klein, (2008). *Microbiology*, 6th Edition. New York: The McGraw-Hill companies.

REFERENCE BOOKS

1. Maigan, M.T., Martinko J.M., & Parker, J., (2000). *Brock Biology of Microorganisms*, 9th edition. New Jersey: Prentice – Hall.
2. Alexopoulos, C.J., & Mims, C.W., (1979). *Introductory Mycology*, 3rd edition, New York: Wiley publishers.
3. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L.,&Paintor, P.R.,(1999). *General Microbiology*, London: McMillan Educational Ltd.
4. Bergey, D.H., John.G.,Holt, (1994). *Bergey's Manual ofDeterminative Bacteriology*, 9th edition. New York: Bergey's Manual Trust Publications.

Course Code 23UMBF11	PO 1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	1	2	3	1	1	2	2	-	1
CO2	1	-	1	2	-	1	-	1	-	-
CO3	1	-	1	3	-	-	1	2	-	-
CO4	1	-	2	2	-	1	-	1	-	-
CO5	1	1	1	2	1	-	1	1	-	2

Mrs. J.Jeya
Head of the Department

Mrs.A.Hemalatha
Course Designer

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B.Sc., Microbiology
(2023-2024 onwards)

Semester II	**MICROBIAL PHYSIOLOGY AND METABOLISM**	Hours/Week: 5	
Core Course - 3		Credits: 5	
Course Code 23UMBC21		Internal 25	External 75

Course Outcomes:

CO1 Describe microorganisms based on nutrition. (K1)

CO2 Explain the concept of microbial growth and identify the factors affecting bacterial growth. (K2)

CO3 Explain the methods of nutrient uptake. (K2)

CO4 Develop anaerobic and aerobic energy production. (K3)

CO5 Apply the process of bacterial photosynthesis and reproduction. (K3)

UNIT I

Physiology of microbial growth: Batch – continuous - synchronous cultures; Growth Curve and measurement method (turbidity, biomass, and cell count). Control of microbial growth. (15 Hours)

UNIT 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. (15 Hours)

UNIT 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. (15 Hours)

UNIT IV

Photosynthesis - An Overview of chloroplast structure. Photosynthetic Pigments, Light Reaction-Cyclic and non-cyclic Photophosphorylation. Dark Reaction - Calvin Cycle.

(15 Hours)

UNIT 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. (15 Hours)

Text Books

1 Schlegal, H.G. (1993). General Microbiology., 7th Edition, Press syndicate of the University of Cambridge.

2 RajapandianK.(2010). Microbial Physiology, Chennai: PBS Book Enterprises India.

3 MeenaKumari. S. Microbial Physiology, Chennai 1st Edition MJP Publishers 2006.

4 Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand & Co.

5 S. Ram Reddy, S.M. Reddy (2008). Microbial Physiology. Anmol Publications Pvt Ltd.

References Books

1 Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49.

2 Kim B.H., Gadd G.M. (2008). Bacterial Physiology and Metabolism. Cambridge University Press, Cambridge.

3 Daniel R. Caldwell. (1995). Microbial Physiology & Metabolism Wm.C. Brown Communications, Inc. USA.

4 Moat, A.G and J.W Foaster (1995). Microbial Physiology, 3rd edition. Wiley – LISS, A John Wiley & Sons. Inc. Publications.

5 BhanuShrivastava. (2011). Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism. Lambert academic Publication.

Web Resources

1 https://sites.google.com/site/microbial physiologyoddsem/teaching-contents

2 https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition

3 https://onlinecourses.swayam2.ac.in/cec20_bt14/preview

4 http://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf

5 https://www..frontiersin.org.microbial-physiology-and-metabolism

Course Code 23UMBC21	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	2	2	2	1	2	2	-	1	2
CO2	3	2	2	2	-	2	2	-	2	1
CO3	2	2	1	1	-	2	2	-	1	-
CO4	2	1	-	1	1	1	1	1	-	-
CO5	1	1	1	1	-	-	1	-	-	-

Mrs. J.Jeya
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Mrs. J.Jeya
Course Designer

B.Sc. Microbiology
(2023-2024 onwards)

Semester II	**MICROBIAL PHYSIOLOGY AND METABOLISM PRACTICAL**	Hours/Week: 5	
Core Course – 4 Practical-II		Credits: 3	
Course Code 23UMBC21P		Internal 40	External 60

Course Outcomes:

CO1 Discuss hanging drop, wet mount preparation, semi-solid agar, Craigie's tube method for motility observation. (K2)

CO2 Explain Smear preparation, permanent specimen preparation, Capsular, and Acid-fast staining for the identification of bacteria.(K2)

CO3 Determine the antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains. (K3)

CO4 Demonstrate Micrometry to measure the size of yeast, fungal filaments and protozoa. (K3)

CO5 Apply morphological, physiological, and biochemical methods for bacterial identification. (K3)

UNIT I

Motility demonstration: hanging drop, wet mount preparation, semi-solid agar, Craigie's tube method. Staining techniques: Smear preparation, permanent specimen preparation, Capsular, and Acid-fast staining. (15 Hours)

UNIT II

Direct counts – Direct cell count (Petroff-Hausser counting chamber), Turbidometry. Viable count - pour plate, spread plate. Bacterial growth curve. (15 Hours)

UNIT III

Anaerobic culture methods. Antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains. (15 Hours)

UNIT IV

Morphological variations in algae, fungi and protozoa. Micrometry: Demonstration of the size of yeast, fungal filaments and protozoa. (15 Hours)

UNIT V

Methods of bacterial identification- morphological, physiological, and biochemical methods - IMViC test, H_2S, TSI, Oxidase, catalase, urease test, and Carbohydrate fermentation test. Maintenance of pure culture, paraffin method, stab culture, maintenance of mold culture. (15 Hours)

Text Books

1. James G Cappucino and N. Sherman MB (1996). A lab manual Benjamin Cummins, New York.
2. Kannan. N (1996).Laboratory manual in General Microbiology. Palani Publications.
3. Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications.
4. Gunasekaran. P (2007). Laboratory manual in Microbiology. New age international publisher.
5. Elsa Cooper (2018). Microbial Physiology: A Practical Approach. Callisto Reference publisher.

References Books

1. DavidWhite., James Drummond., Clay Fuqua (2012) Physiology and Biochemistry of Prokaryotes. 4th Ed. Oxford University Press, New York.
2. Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49.
3. Kim B.H., Gadd G.M. (2008). Bacterial Physiology and Metabolism. Cambridge University Press, Cambridge.
4. Dawes, I.W and Sutherland L.W (1992). Microbial Physiology (2nd edition), Oxford Blackwell Scientific Publications.
5. Moat, A.G and J.W Foaster, (1995). Microbial Physiology, 3rd edition. Wiley – LISS, A John Wiley & Sons. Inc. Publications.

Web Resources

1. https://sites.google.com/site/microbial physiologyoddsem/teaching-contents
2. https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition

3 https://onlinecourses.swayam2.ac.in/cec20_bt14/preview

4 https://www.studocu.com/microbial-physiology-practicals

5 https://www.agr.hokudai.ac.jp/microbial-physiology

Course Code 23UMBC21P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	2	1	2	1	2	2
CO2	2	2	3	2	2	2	1	2	2	1
CO3	3	2	3	1	1	2	2	1	1	2
CO4	3	2	2	2	1	2	2	2	-	2
CO5	2	2	2	2	2	2	2	2	1	2

Mrs. J.Jeya
Head of the Department

Mrs.M.M.Fatima mansoora
Course Designer

B.Sc., Microbiology
(2023-2024 onwards)

Semester II	**BIO** **INSTRUMENTATION**	Hours/Week: 4	
Elective Course		Credits: 4	
Course Code **23UMBA21**		Internal 25	External 75

Course Outcomes:

CO1 Relate the facts, ideas and need of equipment's in the field of molecular analysis (K1)

CO2 Explain the theoretical skills behind the usage of biomedical instruments (K2)

CO3 Understand the basic principles and types of analytical techniques in medical diagnosis

(K2)

CO4 Apply the knowledge about the applications of radioactivity and its measurements in biomolecules identification, separation as well as imaging techniques (K3)

CO5 Compare the efficacy and make use of modern techniques to rectify the problem in an efficient way (K3)

UNIT I

Basic instruments: pH meter, Centrifuge- Preparative, Analytical and Ultra, Laminar Air Flow, Autoclave**,** Hot Air Oven and Incubator. Buffers- Phosphate, Acetate, TE, TAE. Biological importance of buffers. (12 Hours)

UNIT II

Spectroscopic Techniques: Colorimeter, Ultraviolet and visible, Infrared and Mass Spectroscopy. (12 Hours)

UNIT III

Chromatographic and Electrophoresis Techniques: Chromatographic Techniques: Paper, Thin Layer and Column. Electrophoresis Techniques: AGE, PAGE

(12 Hours)

UNIT IV

Imaging techniques: Principle, Instrumentation and application of ECG, EEG, EMG, MRI, CT and PET scan radioisotopes. (12 Hours)

UNIT V

Fluorescence and radiation based techniques: Spectrofluorimeter, Flame photometer, Scintillation counter, Geiger Muller counter, Autoradiography. (12 Hours)

Text Books

1. Palanivelu, P., (2004). Analytical Biochemistry & Separation Techniques, 4th edition – Madurai: 21st Century Publication.
2. Jayaraman J (2011). Laboratory Manual in Biochemistry, 2nd Edition. Wiley Eastern Ltd., New Delhi.
3. Veerakumari, L (2009).Bioinstrumentation- 5 th Edition -.MJP publishers.
4. Upadhyay, Upadhyay and Nath (2002). Biophysical chemistry – Principles and techniques 3rd Edition. Himalaya publishing home.
5. Chatwal G and Anand (1989). Instrumental Methods of Chemical Analysis. S.Himalaya Publishing House, Mumbai.

References Books

1. Ponmurugan. P and Gangathara PB (2012). Biotechniques.1st Edition. MJP publishers.
2. Rodney.F.Boyer (2000). Modern Experimental Biochemistry, 3rd Edition. Pearson Publication.
3. Skoog A.,WestM (2014). Principles of Instrumental Analysis – 14th Edition W.B.Saunders Co.,Philadephia.
4. N. Gurumani. (2006). Research Methodology for biological sciences- 1st Edition – MJP Publishers.
5. Wilson K, and Walker J (2010). Principles and Techniques of Biochemistry and Molecular Biology.7th Edition. Cambridge University Press.
6. Webster, J.G. (2004). Bioinstrumentation- 4th Edition - John Wiley & Sons (Asia) Pvt. Ltd, Singapore.

Web Resources

1 http://www.biologydiscussion.com/biochemistry/centrifugation/centrifugeintroduction-types- uses-and-other-details-with-diagram/12489

2 https://www.watelectrical.com/biosensors-types-its-working-andapplications/

3 http://www.wikiscales.com/articles/electronic-analytical-balance/ Page 24 of 75

4 https://study.com/academy/lesson/what-is-chromatography-definition-typesuses.html

5 http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction

Course Code 23UMBA21	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	2	1	2	1	2	-	1	3
CO2	1	2	1	-	2	-	1	-	2	3
CO3	1	2	1	-	1	2	-	2	-	3
CO4	2	1	2	1	-	3	3	-	-	3
CO5	2	2	2	-	-	-	1	1	2	3

Mrs. J.Jeya
Head of the Department

Ms.M.Vijayalakshmi
Course Designer

B.Sc.,Microbiology
(2023-2024 onwards)

Semester II	**Nutrition & Health Hygiene**	Hours/Week: 2	
NME-2		Credits: 2	
Course Code 23UMBN21		Internal 25	External 75

Course Outcomes:

CO1 Identify the importance of nutrition for a healthy life (K1)

CO2 Describe the nutrition for life cycle (K1)

CO3 Outline the health care programmes of India (K2)

CO4 Explain the importance of community and personal health (K2)

CO5 Build awareness on community health and hygiene (K3)

UNIT 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 (6 Hours)

UNIT 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.

(6 Hours)

UNIT III

Improper diets: Definition, Identification, Signs and Symptoms - malnutrition, under-nutrition, over-nutrition, Protein Energy Malnutrition, obesity; Nutritional Disease and Disorder - hypertension, diabetes, anemia, osteomalacia, cardiovascular disease. (6 Hours)

UNIT IV

Health - Determinants of health, Key Health Indicators, Environment health & Public health; Health-Education: Principles and Strategies. Health Policy & Health Organizations: Health Indicators and National Health Policy of Govt. of India; Functioning of various nutrition and health organizations in India. (6 Hours)

UNIT V

Hygiene – Definition; Personal, Community, Medical and Culinary hygiene; WASH (Water, Sanitation and Hygiene) programme. Rural Community Health: Village health sanitation & Nutritional committee. Community & Personal Hygiene: Environmental Sanitation and Sanitation in Public places. (6 Hours)

Text Books

1. Bamji, M.S., K. Krishnaswamy& G.N.V. Brahmam (2009) Textbook of Human Nutrition(3rd edition) Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
2. Swaminathan (1995)Food &Nutrition(Vol I, Second Edition) The Bangalore Printing &Publishing Co Ltd., , Bangalore
3. SK. Haldar(2022). Occupational Health and Hygiene in Industry. CBS Publishers.
4. Acharya, Sankar Kr, Rama Das, Minati Sen (2021). Health Hygiene and Nutrition Perception and Practices.Satish Serial Publishing House
5. Dass (2021).Public Health and Hygiene, Notion Press

References Books

1. VijayaKhader (2000)Food, nutrition & health, Kalyan Publishers, New Delhi
2. Srilakshmi, B., (2010)Food Science, (5th Edition) New Age International Ltd., New Delhi
3. Arvind Kumar Goel (2005). A College Textbook of Health & Hygiene,ABD Publishers
4. Sharma D. (2015).Textbook on Food Science and Human Nutrition. Daya Publishing House.
5. Revilla M. K. F., Titchenal A. and Draper J. (2020). Human Nutrition. University of Hawaii, Mānoa.

Web Resources

1 National Rural Health Scheme:
https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=969&lid=49

2 National Urban Health Scheme:
https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=970&lid=137

3 Village health sanitation & Nutritional committee
https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=149&lid=225

4 Health Impact Assessment - https://www.who.int/hia/about/faq/en/

5 Healthy Living https://www.nhp.gov.in/healthylivingViewall

Course Code 23UMBN21	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	2	2	-	3	2	2	2	1	3
CO2	2	1	2	2	3	2	2	2	-	3
CO3	2	1	1	1	3	2	2	2	-	3
CO4	2	2	2	-	3	3	1	-	1	3
CO5	3	1	2	-	3	3	2	-	-	3

Mrs. J.Jeya
Head of the Department

Mrs.A.Hemalatha
Course Designer

B.Sc.,Microbiology
(2023-2024 onwards)

Semester II	**SERICULTURE**	Hours/Week: 2	
SEC-2		Credits: 2	
Course Code 23UMBS21		Internal 25	External 75

Course Outcomes:

CO1 Discuss the overall aspects of Sericulture and the biology and varieties of mulberry plant. Creates awareness among students about the economic importance and suitability of Sericulture in Indian conditions. (K1)

CO2 Examine the lifecycle of silk worm and its important. (K1)

CO3 Explain common diseases of silkworm encountered during rearing, sources of infection, disease symptoms, pre-disposing factors and their management practices. (K2)

CO4 Describe the cultivation of mulberry, maintenance of the farm, seed technology, silkworm rearing, post cocoon techniques like stifling, reeling, and utilization of by-products. (K2)

CO5 Competent to transfer the knowledge and technical skills to the Seri-farmers. Analyze the importance of sericulture in entrepreneurship development and emerge as potential entrepreneur. (K3)

UNIT 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. (6 Hours)

UNIT II

Silkworm- biology-morphology of silkworm. Life cycle of silkworm- egg, larva, pupa, and moth. (6 Hours)

UNIT 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. (6 Hours)

UNIT IV

Rearing of silkworm. Cocoon assessment and processing technologies. Value added products of mulberry and silkworms. (6 Hours)

UNIT V

Entrepreneurship and rural development in sericulture:Planning for EDP, Project formulation, Marketing, Insectary facilities and equipments: Location, building specification, air conditioning and environmental control, furnishings and equipment, sanitation and equipment, subsidiary facilities . (6 Hours)

Text Books

1 Ganga, G. and Sulochana Chetty (2010). Introduction to Sericulture,, J., Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.

2 Dr. R. K. Rajan&Dr. M. T. Himantharaj(2005). Silkworm Rearing Technology, Central Silk Board, Bangalore.

3 Dandin S B, Jayant Jayaswal and Giridhar K (2010). Handbook of Sericulture technologies,Central Silk Board, Bangalore.

4 M. C. Devaiah, K. C. Narayanaswamy and V. G. Maribashetty(2010). Advances in Mulberry Sericulture,,CVG Publications, Bangalore

5 *T.V.SatheandJadhav.A.D.(2021). Sericulture and Pest Management,* Daya Publishing House.

References Books

1 S. Morohoshi (2001). Development Physiology of Silkworms 2nd **E**dition, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi

2 Hamamura, Y (2001). Silkworm rearing on Artificial Diet. Oxford & IBH publishing Co., Pvt. Ltd. NewDelhi.

3 **M.Johnson, M.Kesary (2019). Sericulture, 5th. Edition. Saras Publications.**

4 Manisha Bhattacharyya (2019). **Economics of Sericulture, Rajesh Publications.**

5 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.**

Web Resources

1 https://egyankosh.ac.in › bitstream

2 https://archive.org › details › SericultureHandbook

3 https://www.academic.oup.com

4 https://www.sericulture.karnataka.gov.in

5 https://www.silks.csb.gov.in

Course Code 23UMBS21	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	2	1	-	2	3	2	3	2	3
CO2	2	1	2	-	1	2	2	3	1	2
CO3	3	1	2	1	2	2	1	3	1	2
CO4	1	-	1	-	-	1	-	-	2	3
CO5	-	2	2	1	1	2	-	3	2	3

Mrs. J.Jeya
Head of the Department

Mrs.A.Hemalatha
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Quality Education with Wisdom and Values

B.Sc. Microbiology
(for those who join in 2023 - 2024)

Semester - III	**MOLECULAR BIOLOGY AND MICROBIAL GENETICS**	Hours/Week: 5	
Core Course – 5		Credits: 5	
Course Code 23UMBC31		Internal 25	External 75

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1: relate the basics of gene related terms, Structure, Role of enzymes and Gene transfer and its identification techniques.(K1)

CO2: describe the theoretical concepts of Molecular events and repair works in prokaryotic & eukaryotic cells. (K2)

CO3: explain the molecular underpinnings of various post processes, functional output of genes and its impact in genetics research. (K2)

CO4: apply the factors involved in molecular events of the microbial cells. (K3)

CO5: identify the sources for malfunctioning of genes due to environmental, biological factors and its effects in mutagenic cells. (K3)

UNIT I

DNA Structure - Salient features of double helix, forms of DNA. Denaturation and renaturation. DNA topology – Supercoiling, 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.

(15 Hours)

UNIT 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. (15 Hours)

UNIT 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 - Photoreactivation, Nucleotide Repair, Base Excision Repair, Methyl Directed Mismatch Repair and SOS Repair. (15 Hours)

UNIT 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. (15 Hours)

UNIT 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 elements – insertion sequences, composite, and non-composite transposons. Uses of transposons.

(15 Hours)

Text Books

1. Verma, P.S., & Agarwal, V.K., (2013). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology,2 nd edition. New Delhi: S.Chand and company (P) Ltd.
2. Ajoy Paul, (2011). The Text Book of Genetics – from genes to genomes, 2 nd edition. Kolkata: Books and Allied (P) Ltd,.
3. Malacinski G.M. (2008). Freifelder's Essentials of Molecular Biology. 4th Edition. Narosa Publishing House, New Delhi.

4 Jeyanthi, G.P., (2009). Molecular Biology, 1 st edition. New Delhi: MJP Publishers.

5 Watson, D., & Hopkins. H., (1988). Molecular Biology of the Gene, 4 th edition. California: The Benjamin/cummings Publishing Company, Inc.

6 Gardner E. J. Simmons M. J. and Snusted D.P.(2006). Principles of Genetics. 8th Edition. Wiley India Pvt. Ltd.

7 Brown T. A. (2016). Gene Cloning and DNA Analysis- An Introduction. (7th Edition). John Wiley and Sons, Ltd.

References Books

1 Glick B. R. and Patten C.L. (2018). Molecular Biotechnology – Principles and Applications of Recombinant DNA. 5th Edition. ASM Press.

2 Russell P.J. (2010). iGenetics - A Molecular Approach, 3rd Edition., Pearson New International edn.

3 Nelson, D.L. and Cox, M.M. Lehninger(2017). Principles of Biochemistry. 7th Edition, W.H. Freeman.

4 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.

5 Primrose S.B. and Twyman R. M. (2006). Principles of Gene Manipulation and Genomics. (7th Edition). Blackwell Publishing

Web Resources

1. [PDF] Lehninger Principles of Biochemistry (8th Edition) By David L. Nelson and Michael M. Cox Book Free Download - StudyMaterialz.in
2. https://microbenotes.com/gene-cloning-requirements-principle-steps-applications/
3. https://courses.lumenlearning.com/boundless-biology/chapter/dna-replication/
4. Molecular Biology Notes - Microbe Notes
5. Molecular Biology Lecture Notes & Study Materials | Easy Biology Class

Course Code 23UMBC31	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	3	2	3	1	3	-	1
CO2	2	2	3	1	3	3	1	3	-	1
CO3	1	2	1	1	3	2	2	3	-	2
CO4	3	2	2	1	3	3	1	3	-	1
CO5	1	2	3	2	3	2	2	3	1	1

Strong – 3 Medium – 2 Low – 1

Mrs.M.M.Fatima Mansoora
Head of the Department

Ms.M.Vijayalakshmi
Course Designer

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Semester - III	**MOLECULAR BIOLOGY AND MICROBIAL GENETICS PRACTICAL**	Hours/Week: 5	
Core Course - 6 Practical - III		Credits: 3	
Course Code **23UMBC31P**		Internal 40	External 60

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1 write the basic concepts and principles behind the techniques in the advanced lab practicals. (K2)

CO2 explain the methodologies involved in the isolation, estimation and mechanism of inheritance of genetic molecules.(K2)

CO3 make use of theoretical knowledge in an application oriented manner to carry out practicals in Molecular Biology. (K3)

CO4 find the results with the already given protocol and in order to correlate the amount of biomolecules using formula, graphs and calculation methods (K3)

CO5 apply the use of apparatus, chemicals and the importance of these things in molecular biology & microbial genetics experiments.(K3)

UNIT – I

Study of different types of DNA and RNA using micrographs and model / schematic representations.

Study of semi-conservative replication of DNA through micrographs / schematic representations. (15 Hours)

UNIT - II

Isolation of Genomic and Plasmid DNA from *E. coli* and Analysis by Agarose gel electrophoresis.

Estimation of DNA using colorimeter (diphenylamine reagent), UV spectrophotometer (A260 measurement). (15 Hours)

UNIT - III

Resolution and visualization of proteins by polyacrylamide gel electrophoresis (SDS-PAGE) – Demonstration.

UV induced auxotrophic mutant production and isolation of mutants by replica plating technique – Demonstration. (15 Hours)

UNIT – IV

Perform artificial Transformation in *E. coli*.

Isolation of antibiotic resistant mutants by gradient plate method. – Demonstration

(15 Hours)

UNIT - V

Screening and isolation of phages from sewage.

Perform RNA isolation.

Estimate RNA. (15 Hours)

Text Books

1. Palanivelu, P., (2004). Analytical Biochemistry & Separation Techniques, 4 th edition. Madurai: 21 st Century Publication
2. Gunasekaran P. (2007). Laboratory Manual in Microbiology. New Age International.
3. James G Cappucino. and Natalie Sherman. (2016). Microbiology – A laboratory manual. (5th Edition). The Benjamin publishing company. New York.
4. Murugalatha, N., (2012). Microbiological Techniques, 1 st edition. New Delhi: MJP publishers.
5. Crichton. M. (2014). Essentials of Biotechnology. Scientific International Pvt Ltd.New Delhi.
6. Sambrook J. and Russell D.W. (2001). Molecular Cloning - A Laboratory Manual – 7th Edition. Cold Spring Harbor, N.Y: Cold Spring Harbor Laboratory Press.
7. 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.

References Books

1. Glick B. R. and Patten C.L. Molecular Biotechnology – Principles and Applications of Recombinant DNA. 5th Edition. ASM Press. 2018.
2. Russell P.J. (2010). iGenetics - A Molecular Approach, 3rd Edition., Pearson New International edn.
3. Nelson, D.L. and Cox, M.M. Lehninger(2017). Principles of Biochemistry. 7th Edition, W.H. Freeman.
4. 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.
5. Brown T.A. (2016). Gene Cloning and DNA Analysis. (7th Edition). John Wiley and Jones, Ltd.

Web Resources

1. https://www.molbiotools.com/usefullinks.html
2. (PDF) Molecular Biology Laboratory manual (researchgate.net)
3. https://www.molbiotools.com/usefullinks.html
4. https://geneticgenie.org3.
5. https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5

Course Code 23UMBC31P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	3	2	3	2	2	1	2
CO2	3	3	2	3	3	2	2	1	-	1
CO3	3	3	2	3	3	2	2	1	1	1
CO4	2	2	3	2	2	2	1	1	1	1
CO5	2	3	3	3	3	2	2	1	1	2

Strong – 3 Medium – 2 Low – 1

Mrs.M.M.Fatima Mansoora
Head of the Department

Ms.M.Vijayalakshmi
Course Designer

V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
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VIRUDHUNAGAR
Quality Education with Wisdom and Values

B.Sc. Microbiology

(for those who join in 2023 - 2024)

Semester - III	**CLINICAL LABORATORY TECHNOLOGY**	Hours/Week: 4	
Elective Course - 3		Credits: 4	
Course Code 23UMBA31		Internal 25	External 75

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1: define ethical and professional conduct with patients, laboratory personnel, health- care professionals, and the public. (K1)

CO2: explain how accurate and reliable information might be obtained about proper procurement, storage, and *handling* of laboratory *specimens*. (K2)

CO3: develop a sound scientific knowledge foundation that prepares them to interpret, analyze and evaluate scientific knowledge in Clinical practice. (K2)

CO4: perform a full range of laboratory tests with accuracy and precision. (K3)

CO5: establish quality assurance principles and practices to ensure the accuracy and reliability of laboratory information. (K3)

UNIT I

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. Assessment of a patient and Brief history of Collection. Maintenance of Hygiene & Infection Control Practices. (12 Hours)

UNIT II

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. (12 Hours)

UNIT III

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. (12 Hours)

UNIT IV

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. (12 Hours)

UNIT V

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. (12 Hours)

Text Books

1 Mukharji,K.L. (2000).Medical Laboratory Techniques, Vol - I, II & III, 5th Edition. Tata McGrawHill, Delhi

2 Ochei,A., Kolhatkar.A. (2000).Medical Laboratory Science: Theory and Practice, McGraw Hill Education.

3 RamnikSood (2015).Concise Book of Medical Laboratory Technology:Methods and Interpretation, 2ndEdition, Jaypee Brothers Medical Publishers, NewDelhi.

4 *S. Ramakrishnan,* KN Sulochana(2012). Manual of Medical Laboratory Techniques,Jaypee Brothers Medical Publishers Pvt. Ltd

5 Talib V.H. (2019).*Handbook Medical Laboratory Technology, 2nd*Edition*, Directorate of health services, Government of India.*

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.

3 Godkar (2021).Textbook of Medical Laboratory Technology, 3rdEdition,Bhalani Publishing House.

4 M.N.Chatterjee and RanaShinde.(2008). Textbook of Medical Biochemistry, 7thEdition, Jaypee Brothers Medical Publishers Pvt. Limited..

5 James G Cappucino. and Natalie Sherman. (2016). Microbiology – A laboratory manual.(5th Edition).The Benjamin publishing company. New York.

Web 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
4. https://vlab.amrita.edu/index.php?sub=3&brch=272
5. https://nptel.ac.in/courses/102105087

Course Code 23UMBA31	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	3	2	1	3	2	2
CO2	2	2	3	1	3	3	1	3	-	1
CO3	3	2	1	1	3	2	2	3	-	2
CO4	3	2	2	1	3	3	1	3	-	1
CO5	2	2	3	2	3	2	2	3	2	3

Strong – 3 Medium – 2 Low – 1

Mrs. M.M.Fatima Mansoora Ms.S.Vaishnavi

Head of the Department **Course Designer**

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Semester - III	**ORGANIC FARMING & BIOFERTILIZER TECHNOLOGY**	Hours/Week: 1
SEC–3		Credits: 1
Course Code **23UMBS31**		Internal 100

COURSE OUTCOMES

On Completion of the course, the students will be able to

CO1 recall the significance of organic farming and strategies to increase the yield to conserve environment.(K1)

CO2 state the role of Entrepreneur with wide knowledge about farming and sustainable resources. (K1)

CO3 outline on organic farming in urban areas with knowledge on compost and Biofertilizers. (K2)

CO4 explain the structure, characteristic features, advantages and future perspectives of biofertilizers. (K2)

CO5 develop the knowledge, skill to produce quality of packaging, storage; assess the shelf life and bioefficacy of biofertilizers. (K3)

UNIT 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. (3 Hours)

UNIT II

Organic farming for Urban space; Create a Sustainable Organic Garden (Backyard-Square Foot Gardening, Small Space Gardening, Mini Farming) Composting, Vermicomposting. (3 Hours)

UNIT III

Biofertilizers: Introduction, Advantages and Future Perspective. Structure and Characteristic features of Bacterial Biofertilizers- *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia.* (3 Hours)

UNIT IV

Structure and Characteristic features of Cyanobacterial Biofertilizers- *Anabaena, Nostoc* ;Structure and Characteristic features of Fungal Biofertilizers- AM Mycorrhiza (3 Hours)

UNIT V

Production of *Rhizobium, Azotobacter, Anabena*; Biofertilizers -Storage, Shelf life, Quality control and Marketing. (3 Hours)

Text Books

1 A.K. Sharma (2006). Hand book of Organic Farming

2 A.C.Gaur (2017). Hand book of Organic Farming and Biofertilizers

3 N.S. Subbarao (2017). Bio-fertilizers in Agriculture and Forestry (4th Edition) Med tech publisher

4 SubbaRao, N. S. (2002). Soil Microbiology. Soil Microorganisms and Plant Growth. (4th Edition), Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

5 Dubey, R. C. (2008). A Textbook of Biotechnology. S. Chand & Co., New Delhi.

References Books

1 Masanobu Fukuoka, Frances Moore Lappe Wendell Berry (2009). The One-Straw Revolution: An Introduction to Natural Farming, 1st edition, YRB Classics.

2 SujitChakrabarty(2018). Organic Home Gardening Made Easy, 1st Edition,

3 Singh and Purohit (2008). Biofertilizer technology. Agrobios, India.

4. Bansal M (2019). Basics of Organic Farming CBS Publisher.

5. Hurst, C.J., Crawford R.L., Garland J.L., Lipson D.A., Mills A.L. and Stetzenbach L.D. (2007). Manual of Environmental Microbiology. (3rd Edition). American Society for Microbiology.

Web Resources

1 https://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html

2 https://www.fao.org/organicag/oa-faq/oa-faq6/en/

3 https://www.india.gov.in/topics/agriculture/organic-farming

4 https://agriculture.nagaland.gov.in/bio-fertilizer/

5 https://vlab.amrita.edu/index.php?sub=3&brch=272

Course Code 23UMBS31	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	2	1	3	-	3	-	-	3	2
CO2	3	1	1	3	1	3	2	1	3	1
CO3	3	2	2	3	-	3	-	1	3	1
CO4	3	2	2	3	1	3	-	1	3	1
CO5	3	1	1	3	-	3	-	1	3	-

Strong – 3 Medium – 2 Low – 1

Mrs.M.M.Fatima Mansoora
Head of the Department

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Semester - III	**AQUACULTURE**	Hours/Week: 2	
SEC- 4		Credits: 2	
Course Code 23UMBS32		Internal 25	External 75

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1: recall knowledge in aquaculture systems, methods and Scope of aquaculture. (K1)

CO2: state the significance and functions of design, types and construction of aquaculture ponds. (K1)

CO3: explain the biological characteristics of various aquaculture species and their pre-stocking and stocking management (K2)

CO4: outline the methods involved in post stocking management. (K2)

CO5: illustrate major cultivatable species for aquaculture and hatchery management. (K3)

UNIT I

Aquaculture Systems and Methods - Scope and Definition. Traditional, Extensive, Semi - intensive and Intensive culture. Monoculture, Polyculture, Composite culture, Mixed culture, Mono-sex culture, Cage culture, Pen culture, Raft culture, Race way culture. (6 Hours)

UNIT 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. (6 Hours)

UNIT 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. (6 Hours)

UNIT 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. (6 Hours)

UNIT 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.

(6 Hours)

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 Stickney, R.R. (2016). Aquaculture: An Introductory Text. 3rd Edition. Centre for Agriculture and Bioscience International Publishing.

3 Ackefors H., Huner J and Konikoff M. (2009). Introduction to the General Principles of Aquaculture. CRC Press.

4 Mushlisin Z. A. (2012). Aquaculture. In Tech.

5 Akpaniteaku R.C. (2018).Basic Handbook of Fisheries and Aquaculture.AkiNik Publications.

References 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.

4 Rath R.K.(2011). Fresh Water Aquaculture. 3rdEdition. Scientific Publishers.

5 Lucas J. S., Southgate P.C. and Tucker C.S. (2019). Aquaculture: Farming Aquatic Animals and Plants. Wiley Blackwell.

Web Resources

1. Aquaculture: Types, Benefits and Importance (Fish Farming) - Conserve Energy Future (conserve-energy-future.com)
2. Fisheries Department - Tamil Nadu (tn.gov.in)
3. Aquaculture - Google Books
4. aquaculture | Definition, Industry, Farming, Benefits, Types, Facts, & Methods | Britannica
5. Fisheries & Aquaculture (investindia.gov.in)

Course Code 23UMBS32	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	2	2	-	-	-	1	2	2	-	2
CO2	2	1	2	2	3	3	2	3	-	1
CO3	2	3	2	3	2	2	1	3	-	3
CO4	2	3	2	3	2	3	3	3	-	2
CO5	2	3	2	3	2	2	3	3	3	2

Strong – 3 Medium – 2 Low – 1

Mrs. M.M.Fatima Mansoora — **Head of the Department**

Mrs.K.Bervin — **Course Designer**

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B.Sc. Microbiology
(For those who join in 2023-2024)

Semester - IV	**IMMUNOLOGY AND IMMUNOTECHNOLOGY**	Hours/Week: 5	
Core Course –7		Credits: 5	
Course Code 23UMBC41		Internal 25	External 75

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1 relate the structure of the immune system, contributions of organs, fundamental concepts of immunity and cells involved in immune responses. (K1)

CO2 explain the basics of antigens and antibodies, types and their properties in immune system regulation (K2)

CO3 outline the role of MHC system in transplantation; leading to hypersensitivity conditions, functions of Tumor specific antigens, etc (K2)

CO4 make use of the concepts of immuno-techniques and immunologic processes governing graft rejection and therapeutic modalities for immunosuppression in transplantation. (K3)

CO5 apply the knowledge on immunological disorders, overreaction by our immune system and its consequences. (K3)

UNIT I

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. (15 Hours)

UNIT II

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, Antiviral; Vaccination Schedule.

(15 Hours)

UNIT III

Immunoassay and Immunotechniques - Preparation and Standardization of Bacterial antigens; Raising of Monoclonal and Polyclonal antibodies; Purification of antibodies. Immunotechniques - RIA, RAST, ELISA, Immunofluorescence techniques and Flow Cytometry. (15 Hours)

UNIT 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 Immunotherapy. (15 Hours)

UNIT V

Immunological Disorders and Diseases - Hypersensitivity Reactions (Type I, II, III and IV); Acquired Immunodeficiency Syndrome; Autoimmune Disorders and Diseases: Organ Specific and Non-organ Specific. (15 Hours)

Text Books

1 Kuby, J. (2018). Immunology, 8 th edition. New York: W.H. Freeman and company.

2 Roitt, I.M., (2017). Essential of immunology, 13 th edition.New Jersey: Blackwell scientific publication.

3 Tizard, R. (2007).Immunology, 4 th edition.United States: Thomson organization Ltd.

4 Robert Coleman, M. (1992). Fundamental Immunology,2 nd edition. New York:WCB Publishers.

5 HaleemKhan,A.A. (2011). Textbook of Immunology, 1 st edition. New Delhi:Ane Books Pvt. Ltd.

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

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

8 Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai. (2021). Cellular and Molecular Immunology, 10thEdition.,Elsevier.

9 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.

10 Pravash Sen. Gupta. (2003). Clinical Immunology. Oxford University Press.

References Books

1 Janeway Travers. (1997). Immunobiology- the immune system in health and disease. Current Biology Ltd. London, New York. 3rd Edition.

2 Peter J. Delves, Seamus Martin, Dennis R. Burton, Ivan M. Roitt. (2006). Roitt's Essential Immunology, 11th Edition.,Wiley-Blackwell.

3 William R Clark. (1991). The Experimental Foundations of Modern Immunology. 3rd Edition. John Wiley and Sons Inc. New York.

4. Frank C. Hay, Olwyn M. R. Westwood. (2002). Practical Immunology, 4th Edition., Wiley-Blackwell.

5. Noel R. Rose, Herman Friedman, John L. Fahey. (1986). Manual of Clinical Laboratory Immunology. ASM.3rd Edition.

Web Resources

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

Course Code 23UMBC41	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	2	1	2	2	3	3	3	-	2
CO2	2	3	2	3	2	2	1	3	-	1
CO3	2	3	2	3	2	2	1	3	-	1
CO4	2	3	2	3	2	2	3	3	1	2
CO5	2	3	2	3	2	2	3	3	1	2

Strong – 3 Medium – 2 Low – 1

Mrs.M.M.Fatima Mansoora
Head of the Department

Ms.M.Vijayalakshmi
Course Designer

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Semester - IV	**IMMUNOLOGY AND IMMUNOTECHNOLOGY PRACTICAL**	Hours/Week: 4	
Core Course – 8 Practical- IV		Credits: 3	
Course Code **23UMBC41P**		Internal 40	External 60

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1 explain the basic concepts and practical knowledge on immunological reactions. (K2)

CO2 identify the principle behind antigen –antibody reactions. (K2)

CO3 illustrate the procedure to study immune complexes. (K3)

CO4 compare the structural basis of blood cells and their characteristics. (K3)

CO5 apply the methodology and techniques used in immunology. (K3)

UNIT I

Identification of Blood group and Rh Typing. Coomb's test. TPHA. (12 Hours)

UNIT II

T cell identification (Demonstration)

Latex Agglutination reactions- RF, ASO, CRP. (12 Hours)

UNIT III

Ouchterlony's Double Diffusion Method (antigen pattern).

Single Radial Immuno Diffusion Method

Widal test (12 Hours)

UNIT IV

Electrophoresis - Serum, Counter and Immuno. (12 Hours)

UNIT V

Separation of Lymphocytes by Gradient Centrifugation method.

Diagnosis of Human Viral diseases: Dot ELISA.

ELISA: Hepatitis/ HIV (12 Hours).

Text Books

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

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

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

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

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

References Books

1 Frank C. Hay, Olwyn M. R. Westwood. (2008).Practical Immunology, 4th Edition, Wiley-Blackwell.

2 Wilmore Webley. (2016). Immunology Lab Manual, LAD Custom Publishing.

3 Rose. (1992). Manual of Clinical Lab Immunology, ASM.

4 Janeway Travers. (1997). Immunobiology- the immune system in health and disease. Current Biology Ltd. London, New York. 3rd Edition.

5 Peter J. Delves, Seamus Martin, Dennis R. Burton, Ivan M. Roitt. (2006). Roitt's Essential Immunology, 11thEdition.,Wiley-Blackwell.

Web Resources

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

Course Code 23UMBC41P	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	2	2	2	2	3	3	3	21	2
CO2	3	3	2	3	2	2	1	3	1	2
CO3	3	3	2	3	1	2	2	3	-	1
CO4	2	3	2	3	2	2	3	3	-	2
CO5	2	3	2	3	2	2	3	2	2	2

Strong – 3 Medium – 2 Low – 1

Mrs. M.M.Fatima Mansoora Mrs. K.Bervin

Head of the Department **Course Designer**

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B.Sc. Microbiology
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Semester - IV	**FOOD PROCESSING TECHNOLOGY**	Hours/Week: 4	
Elective Course - 4		Credits: 4	
Course Code **23UMBA41**		Internal 25	External 75

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1 recall the basic concepts of Food Processing Technology. (K1)

CO2 understand the quality assessment of Meat, Milk and Fish. (K2)

CO3 explain the Processing methods, Hygiene and Sanitation requirements in Food industries. (K2)

CO4 find the methods for the Microbiological Examination of Foods and Safety Acts.(K3)

CO5 apply the Food Preservation, Quality Assessment and Adulteration detection Techniques. (K3)

UNIT I

Introduction to Food Preservation –Objectives and Techniques of Food Preservation. Preservation: Principles of High temperature, Low temperature, Radiation, Chemical Preservatives and Bio preservatives. (12 Hours)

UNIT II

Freshness criteria and Quality assessment of Meat and Fish –Spoilage and Methods of Preservation. Production of by-products after processing waste and their utilization. Role of Packaging material, Types of packaging material. (12 Hours)

UNIT III

Composition of Milk; Assessment of Milk, Thermal processing of fluid milk - Pasteurization (LTH, HTST&UHT techniques). Fermented Milk products-Cheese, Butter

milk, Yogurt, Kumis, Kefir and Acidophilus milk. Hygiene and Sanitation requirement in Food processing and Fermentation industries. (12 Hours)

UNIT IV

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. (12 Hours)

UNIT V

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. (12 Hours).

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, NewDelhi.

3 Ramaswamy H & Marcotte M. (2006). Food Processing: Principles & Applications. Taylor & Francis.

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.**

References Books

1 Fellos PJ. (2005). Food Processing Technology: Principle &Practice 2nd Edition. CRC.

2 Peter Zeuthen and Leif Bogh-Sorenson. (2005). Food Preservation Techniques, WoodlandPublishing Ltd, Cambridge, England.**1**

3 Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Pilar Cano. (2004). Novel Food Processing Technologies, CRC.

4 Suman Bhatti, Uma Varma. (1995). Fruit and vegetable processing organizations and institutions, 1st Edition., CBS Publishing, New Delhi.

5 MirdulaMirajkar, Sreelatha Menon. (2002). Food Science and Processing Technology Vol-2,Commercial processing and packaging, Kanishka publishers, New Delhi.

Web Resources

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/

4 food processing | Definition, Purpose, Examples, & Facts | Britannica

5 Food Processing Technology | Food News & Views Updated Daily (foodprocessing-technology.com)

Course Code 23UMBA41	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	2	3	2	3	2	2	1	2
CO2	3	3	2	3	3	2	2	1	-	1
CO3	3	3	2	3	3	2	2	1	1	1
CO4	2	2	3	2	2	2	1	1	1	1
CO5	2	3	3	3	3	2	2	1	1	2

Strong – 3 Medium – 2 Low – 1

Mrs. M.M.Fatima Mansoora — **Head of the Department**

Mrs. K.Bervin — **Course Designer**

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B.Sc. Microbiology

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Semester - IV	**VACCINE TECHNOLOGY**	Hours/Week: 2	
SEC - 5		Credits: 2	
Course Code **23UMBS41**		Internal 25	External 75

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1 recall knowledge on the basics of immunization and induction of immunity. (K1)

CO2 state the types of vaccines, its immunological effects and regulatory guidelines (K1)

CO3 interpret the role of Recombinant DNA in vaccine technology. (K2)

CO4 outline on conventional to recent technology of vaccine production (K2)

CO5 apply ethical issues and regulations in vaccine production and clinical trials.(K3)

UNIT 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. (6 Hours)

UNIT 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. (6 Hours)

UNIT 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 & HIV. (6 Hours)

UNIT 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. (6 Hours)

UNIT 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. (6 Hours)

Text Books

1 Ronald W. Ellis.(2001). New Vaccine Technologies.Landes Bioscience.

2 Cheryl Barton. (2009). Advances in Vaccine Technology and Delivery.Espicom Business Intelligence.

3 Male, David. Ed. (2007). Immunology. 7th Edition. Mosby Publication.

4 Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne. (2002). Immunology. 6th Edition, Freeman.

5 Brostoff J, Seaddin JK, Male D, Roitt IM. (2002). Clinical Immunology. 6th Edition, Gower Medical Publishing.

References Books

1 Stanley A. Plotkin, Walter Orenstein& Paul A. Offit.(2013). Vaccines, 6th Edition. BMA Medical Book Awards Highly Commended in Public Health. Elsevier Publication.

2 Coico, R. etal. (2003). Immunology: A Short Course. 5th Edition, Wiley – Liss.

3 Parham, Peter.(2005). The Immune System. 2nd Edition, Garland Science.

4 Abbas, A.K. etal. (2007). The Cellular and Molecular Immunology. 6th Edition, Sanders / Elsevier.

5 Weir, D.M. and Stewart, John (2000). Immunology. 8th Edition, Churchill Pvt. Ltd.

Web Resources

1 https://www.slideshare.net/adammbbs/pathogenesis-3-rd-internal-updated-43458567
2 https://www.bio.fiocruz.br/en/images/stories/pdfs/mpti/2013/selecao/vaccine-processtechnology.pdf
3 https://www.dcvmn.org/IMG/pdf/ge_healthcare_dcvmn_introduction_to_pd_for_vaccine_production_29256323aa_10mar2017.pdf
4 https://www.sciencedirect.com/science/article/pii/B9780128021743000059
5 https://www.researchgate.net/publication/313470959_Vaccine_Scaleup_and_Manufacturing

Course Code 23UMBS41	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	2	2	1	3	2	3	-	2
CO2	3	3	2	3	3	2	2	1	-	1
CO3	3	3	2	3	3	2	2	1	1	1
CO4	2	2	3	2	3	2	1	2	1	1
CO5	2	3	3	2	3	2	2	1	1	3

Strong – 3 Medium – 2 Low – 1

Mrs. M.M.Fatima Mansoora — Ms. S.Vaishnavi

Head of the Department — **Course Designer**

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Semester - IV	**APICULTURE**	Hours/Week: 2	
SEC –6		Credits: 2	
Course Code **23UMBS42**		Internal 25	External 75

COURSE OUTCOMES

On Completion of the Course, the students will be able to

CO1 recall Systematic position, Life history and Biology of honey bees. (K1)

CO2 state the different stages, types of bees and Management of Apiculture.(K1)

CO3 describe the practice of bee rearing process and analyze instruments employed in apiary.(K2)

CO4 explain the Diseases, Economy, Rearing and Entrepreneurship of Apiculture (K2)

CO5 apply the proposal for funding agencies and reveal the modern methods employed in artificial bee hives.(K3)

UNIT I

Biology of Bees: Honeybee – Systematic position – Species of Honey bees – Life history of Honey bee – behaviour – swarming – Pheromone. (6 Hours)

UNIT II

Social life in Bees:Bee colony – Castes – natural colonies and their yield – Types of bee hives – Structure – location, care and management. (6 Hours)

UNIT III

Bee Rearing:Apiary – Care and Management – Artificial bee hives – types – construction of spaceframes – Selection of sites – Handling – Maintenance – Instruments employed in Apiary – Extraction instruments. (6 Hours)

UNIT 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. (6 Hours)

UNIT V

Entrepreneurship: venture – Preparing proposals for financial assistance and funding agencies – Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens. (6 Hours)

Text Books

1. Dewey M. Caron. (2013). Honey Bee Biology and Beekeeping. Revised Edition. Wicwas Press, Kalamazoo. ISBN 10: 1878075292
2. R. A. Morse. (1993). Rearing queen honey bees. Wicwas press, NY. ISBN-10 : 1878075055
3. Ted Hooper. (2010). Guide to Bees & Honey: The World's Best Selling Guide to Beekeeping. Northern Bee Books. Oxford. ISBN 10: 1904846513
4. Jayashree K. V., Tharadevi C.S. and Arumugam N. (2014) Apiculture. Saras Publication
5. Raj H. (2020).Vinesh Text Book of Apiculture. S. Vinesh and Co.

References Books

1 Dewey M. Caron. (2020). The Complete Bee Handbook: History, Recipes, Beekeeping Basics, and More,Rockridge Press. ISBN-10 : **1646119878**

2 Joachim Petterson. (2016). Beekeeping: A Handbook on Honey, Hives & Helping the Bees, Weldon Owen.

3 Eva Crane. (1999). The World History of Beekeeping and Honey Hunting. Routledge. India.ISBN-10 : 0415924677

4 Pagar B. S. (2016). Textbook Of Apiculture. Sahitya Sagar.

5 Sehgal P.K. (2018). Text Book of Sericulture, Apiculture and Entomology.Kalayani.

Web Resources

1 Bee Keeping Basics. Retrieved from:https://denton.agrilife.org/files/2013/08/beekeeping-basics.pdf

2 Beekeeping as an Entrepreneurship, Retrieved from: https://lupinepublishers.com/agriculture-journal/pdf/CIACR.MS.ID.000270.pdf

3 Raising Bumble Bees at Home: A Guide to Getting Started. Retrieved from:

https://www.ars.usda.gov/ARSUserFiles/20800500/BumbleBeeRearingGuide.pdf

4 Apiculture – Biology for Everybody (homeomagnet.com)
5 Apiculture: Introduction to Apiculture (iasri.res.in)

Course Code 23UMBS42	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	2	2	-	-	-	1	2	2	-	2
CO2	2	1	2	2	3	3	2	3	-	1
CO3	2	3	2	3	2	2	1	3	-	3
CO4	2	3	2	3	2	3	3	3	1	2
CO5	2	3	2	3	2	2	3	3	3	2

Strong – 3 Medium – 2 Low – 1

Mrs. M.M.Fatima Mansoora
Head of the Department

Ms. S. Vaishnavi
Course Designer