



V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

(Belonging to Virudhunagar Hindu Nadars)

An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai

Re-accredited with 'A' Grade (3rd Cycle) by NAAC

VIRUDHUNAGAR - 626 001

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS (with effect from Academic Year 2020 - 2021)

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 20 UG Programmes, 14 PG Programmes, 6 M.Phil. 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 (TANSICHE) under Choice Based Credit System (CBCS) and the guidelines for Outcome Based Education (OBE).

The Departments of Commerce, English, History, Mathematics and Biochemistry, 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 and Computer Applications.
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, Computer Science, Information Technology, Computer Applications (MCA*)
Commerce & Management	:	Commerce, Business Administration (MBA*)

* AICTE approved Programmes

PRE-DOCTORAL PROGRAMMES (M.Phil.)

Arts & Humanities	:	History, English, Tamil
Physical & Life Sciences	:	Mathematics, Biochemistry
Commerce & Management	:	Commerce

OUTLINE OF CHOICE BASED CREDIT SYSTEM - UG

1. Core Courses
2. Discipline Specific Elective Courses (DSEC)
3. Allied Courses
4. Skill Enhancement Courses (SEC)
5. Non Major Elective Courses (NMEC)
6. Ability Enhancement Compulsory Courses (AECC)
7. Generic Elective Courses (GEC)
8. Internship / Field Project
9. Self Study Courses
10. Extra Credit Courses (optional)

List of Non Major Elective Courses (NMEC) Offered

UG PROGRAMMES

Name of the Course	Semester	Department
History of India upto A.D.1858	III	History(EM)
இந்திய வரலாறு கி.பி. 1858 வரை	III	History (TM)
Indian National Movement (A.D 1885-1947)	IV	History(EM)
இந்திய தேசிய இயக்கம் (கி.பி. 1885 – 1947)	IV	History(TM)
English for Professions I	III	English
English for Professions II	IV	
இக்கால நீதி இலக்கியம்	III	Tamil
உரைநடை இலக்கியம்	IV	
Basic Hindi – I	III	Hindi
Basic Hindi – II	IV	
Practical Banking	III	Commerce
Basic Accounting Principles	IV	
Business Management	III	Business Administration
Entrepreneurship	IV	
Quantitative Aptitude – I	III	Mathematics
Statistics and Operation Research	IV	
Physics in Everyday life	III	Physics
Fundamentals of Electronics	IV	
Industrial Chemistry	III	Chemistry
Drugs and Natural Products	IV	
Applied Zoology	III	Zoology
Animal Science	IV	
Basic Food Science	III	Home Science – Nutrition and Dietetics
Basic Nutrition and Dietetics	IV	
Women and Health	III	Biochemistry
Lifestyle associated disorders	IV	
Medical Lab Technology	III	Microbiology
Applied Microbiology	IV	
Infectious Diseases	III	Biotechnology
Organic Farming	IV	
Basics of Fashion	III	Costume Design And Fashion
Interior Designing	IV	
Introduction to Computers and Office Automation	III	Computer Science
Introduction to Internet and HTML 5	IV	
Spreadsheet	III	Information Technology
Introduction to HTML	IV	
Fundamentals of Computers	III	Computer Applications
Web Design with HTML	IV	
Horticulture – I	III	Botany
Horticulture – II	IV	
மருத்துவ தாவரவியல் - I	III	
மருத்துவ தாவரவியல் - II	IV	
Library and Information Science – I	III	Library Science
Library and Information Science - II	IV	

மேல்நிலை கல்வி வரை தமிழை முதன்மை பாடமாக எடுத்து படிக்காத மாணவிகள் கீழ்க்கண்ட பாடங்களை கட்டாயம் படிக்க வேண்டும்

1. அடிப்படைத் தமிழ் - எழுத்தறிதல்
2. அடிப்படைத் தமிழ் - மொழித்திறனறிதல்

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

UG PROGRAMMES

Name of the Course	Semester	Department
History of India upto A.D.1858	III	History(EM)
இந்திய வரலாறு கி.பி. 1858 வரை	III	History (TM)
Indian National Movement (A.D 1885-1947)	IV	History(EM)
இந்திய தேசிய இயக்கம் (கி.பி. 1885 – 1947)	IV	History(TM)
English for Professions I	III	English
English for Professions II	IV	
இக்கால நீதி இலக்கியம்	III	Tamil
உரைநடை இலக்கியம்	IV	
Basic Hindi – I	III	Hindi
Basic Hindi – II	IV	
Fundamental Hindi – I	III	Hindi
Fundamental Hindi – II	IV	
Practical Banking	III	Commerce
Basic Accounting Principles	IV	
Financial Literacy I	III	
Financial Literacy II	IV	
Self-Employment And Start-Up Business	III	Commerce CA
Fundamentals Of Marketing	IV	
Women Protection Laws	III	Commerce (Professional Accounting)
Basic Labour Laws	IV	
Business Management	III	Business Administration
Entrepreneurship	IV	
Quantitative Aptitude I	III	Mathematics
Basic Statistics		
Quantitative Aptitude II		
Operations Research	IV	
Physics in Everyday life -I	III	Physics
Physics in Everyday life -II	IV	
Industrial Chemistry	III	Chemistry
Drugs and Natural Products	IV	
Applied Zoology	III	Zoology
Animal Science	IV	
Basic Food Science	III	Home Science – Nutrition and Dietetics
Basic Nutrition and Dietetics	IV	
Women and Health	III	Biochemistry
Lifestyle Associated Disorders	IV	
Medical Lab Technology	III	Microbiology

Applied Microbiology	IV	
Infectious Diseases	III	Biotechnology
Organic Farming	IV	
Basics of Fashion	III	Costume Design And Fashion
Interior Designing	IV	
Introduction to Computers and Office Automation	III	Computer Science
Introduction to Internet and HTML 5	IV	
MS Office	III	Information Technology
Introduction to HTML	IV	
Fundamentals of Computers	III	Computer Applications
Web Design with HTML	IV	
Horticulture – I	III	Botany
Horticulture – II	IV	
மருத்துவ தாவரவியல் - I	III	
மருத்துவ தாவரவியல் - II	IV	
Library and Information Science – I	III	Library Science
Library and Information Science - II	IV	
Cadet Corps for Career Development I	III	National Cadet Corps
Cadet Corps for Career Development II	IV	

மேல்நிலைக் கல்வி வரை தமிழை முதன்மைப் பாடமாக எடுத்துப் படிக்காத மாணவிகள் கீழ்க்கண்ட பாடங்களைக் கட்டாயம் படிக்க வேண்டும்

1. அடிப்படைத் தமிழ் - எழுத்தறிதல்
2. அடிப்படைத் தமிழ் - மொழித்திறனறிதல்

**List of Ability Enhancement Compulsory Courses (AECC) &
Generic Elective Courses (GEC) Offered**

ABILITY ENHANCEMENT COMPULSORY COURSES (AECC)

1. Value Education
2. Environmental Studies

GENERIC ELECTIVE COURSES 1

1. Human Rights
2. Women Studies

GENERIC ELECTIVE COURSES 2

1. Constitution of India
2. Modern Economics
3. Adolescent Psychology
4. Disaster Management

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

PO1: 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*)

PO2: communicate proficiently and confidently with the ability to express original/complex ideas effectively in different situations. (*Communication Skills*)

PO3: 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*)

PO4: critically analyse, synthesize and evaluate data, theories and ideas to provide valid suggestions for the betterment of the society. (*Critical Thinking and Analytical Reasoning*)

PO5: 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*)

PO6: 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*)

PO7: 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: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 strategies in Microbiology for effectively 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 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

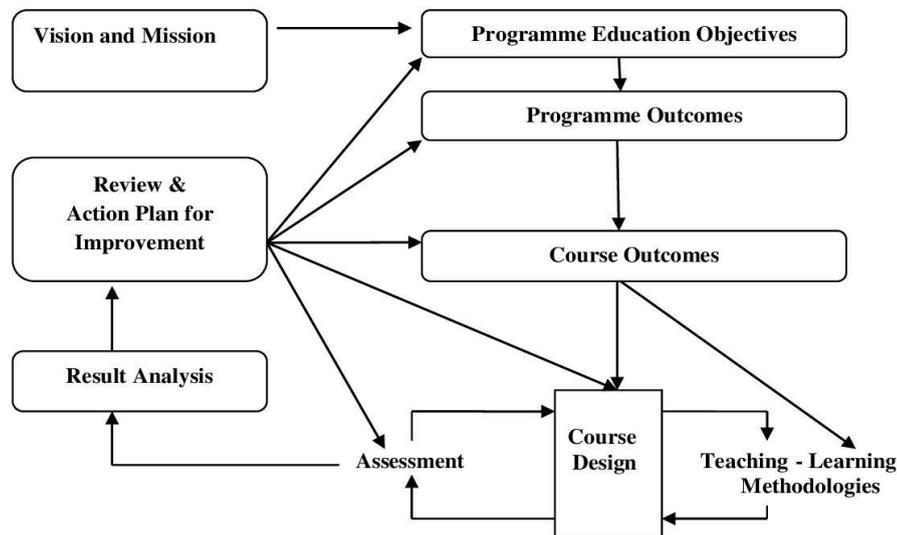
Attainment of PEOs can be measured by a PO-PEO matrix. PEOs should evolve through constant feedback from alumnae, students, industry, management, *etc.* It is mandatory that each PEO should be mapped to at least one of the POs.

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

B.1.4 Course Outcomes (COs)

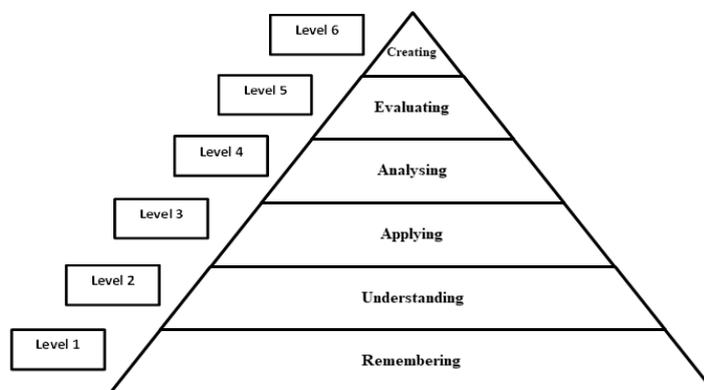
Course Outcomes are narrow statements restricted to the Course contents given in five units. Course Outcomes describe what students would be capable of, after learning the contents of the Course. They reflect the level of knowledge gained, skills acquired and attributes developed by the students after 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, 2 and 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/Alternate Course
Part II	:	English
Part III	:	Core Courses
	:	Allied Courses
	:	Elective Courses: Discipline Specific Elective Courses
	:	Self Study Course
Part IV	:	Skill Enhancement Courses (SEC)
	:	Field Project/Internship
	:	Non-Major Elective Courses (NMEC)
	:	Ability Enhancement Compulsory Courses (AECC)
	:	Generic Elective Courses (GEC)
Part V	:	Self Study Course
	:	National Service Scheme/ Physical Education/ Youth Red Cross Society/ Red Ribbon Club/ Science Forum/ Eco Club/ Library and Information Science/ Consumer Forum/ Health and Fitness Club and National Cadet Corps/ Rotaract club

B.2. EVALUATION SCHEME**B.2.1 PART II**

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory	15	75	100
Practical	5+5		

INTERNAL ASSESSMENT**Distribution of Marks**

Mode of Evaluation	Marks
Periodic Test	: 15
Practical	: 10
Total	: 25

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

B.2.1.1 PART II (II UG – 2023-2024 onwards)

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Test	15	60	100
Practical	10	15	

INTERNAL ASSESSMENT**Distribution of Marks**

Mode of Evaluation	Marks
Periodic Test	: 15
Practical	: 10
Total	: 25

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

EXTERNAL ASSESSMENT**Distribution of Marks**

Mode of Evaluation	Marks
Theory	: 60
Practical	: 15
Total	: 75

B.2.1 PART I PART III - Core Courses, Discipline Specific Elective Courses & Allied Courses

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory	25	75	100
Practical	40	60	100
Project	100	-	100

INTERNAL ASSESSMENT**Distribution of Marks****Theory**

Mode of Evaluation			Marks
Periodic Test		:	15
Assignment	Core:I UG-K4 Level, II & III UG – K5 Level	:	5
	Part I & Allied: K4 Level		
	DSEC:K5 Level		
Quiz	K2:Level	:	5
Total		:	25

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

Two Assignments - Best of the two will be considered

Three Quiz Tests - Best of the three will be considered

Practical

Mode of Evaluation		Marks
Continuous Assessment	:	15
Model Examination		15
Performance	:	10
Total	:	40

Model Examination - Average of the best two will be considered

Performance - Attendance and Record

Question Pattern for Periodic Tests**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- 4)	Multiple Choice	4	4	1	4
B Q.No.(5- 7)	Internal Choice - Either Or Type	3	3	7	21
C Q.No.(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

EXTERNAL EXAMINATION**Question Pattern****Duration: 3 Hours**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1- 10)	Multiple Choice	10	10	1	10
B Q. No.(11 -15)	Internal Choice – Either Or Type	5	5	7	35
C Q. No.(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.2.2 SELF STUDY COURSE**Core Courses Quiz – Online**

Assessment by Internal Examiner only

- Question Bank is prepared by the Faculty Members of the Departments.
- 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		:	40
Model Examination		:	60
Total		:	100

Two Periodic Tests - Better of the two will be considered

B.2.3 PART IV - Skill Enhancement Courses & Non Major Elective Courses**INTERNAL ASSESSMENT****Distribution of Marks****Theory**

Mode of Evaluation			Marks
Periodic Test		:	25
Assignment	SEC:K4 Level	:	10
	NMEC:K3 Level		
Quiz	K2 Level	:	5
Total		:	40

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

Two Assignments - Best of the two will be considered

Three Quiz Tests - Best of the three will be considered

Question Pattern**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	5	15
B Q. No.(4)	Internal Choice - Either Or Type	1	1	10	10
Total					25

EXTERNAL EXAMINATION**Question Pattern****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- 6)	Internal Choice - Either Or Type	6	6	5	30
B Q. No.(7- 9)	Internal Choice - Either Or Type	3	3	10	30
Total					60

B.2.4 PART IV- Ability Enhancement Compulsory Courses (AECC) & Generic Elective Courses (GEC)

Assessment by Internal Examiner only

- Model Examination is conducted after two periodic tests.
- Book and Study Material prepared by the Faculty Members of the respective departments will be prescribed.

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	30
Assignment	K2 Level	:
		10
Model Examination	:	60
Total		100

Two Periodic tests - Better of the two will be considered

Two Assignments - Better of the two will be considered

Question Pattern for Periodic Test**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

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.2.5 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

SELF STUDY COURSE

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	:	40
Model Examination	:	60
Total	:	100

Two Periodic Tests - Better of the two will be considered

B.2.6 PART – V Extension Activities**Assessment by Internal Examiner only**

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

EXTRA CREDIT COURSES (OPTIONAL)**Assessment by Internal Examiner only****Distribution of Marks****Question Pattern****Duration:3 Hours**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q.No.(1- 10)	Multiple Choice	10	10	1	10
B Q.No.(11- 15)	Internal Choice - Either Or Type	5	5	9	45
C Q.No.(16-20)	Open Choice	5	3	15	45
Total					100

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 for Core Courses, Discipline Specific Elective Courses and Allied Courses.
- Pass minimum for External Examination is 21 marks out of 60 for Skill Enhancement Courses and Non Major Elective Courses.
- Pass minimum for Internal Practical is 19 marks out of 40 marks.
- 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 Course and Generic Elective Course is 40.
- Pass minimum for Self Study Courses is 40.

ATTENDANCE

- (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.
 - These rules are applicable to UG, PG and M.Phil. Programmes and come into effect from 2020-2021 onwards.
 - For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

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.

Attainment Levels of COs

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

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

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

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 attainment of 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 against 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/ Extracurricular activities 15%	For participation in Co-curricular / Extracurricular activities during the period of their study.

Programme Articulation Matrix (PAM)

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Average Direct PO Attainment									
Direct PO Attainment in percentage									

Indirect Attainment of POs for all Courses

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Graduate Exit Survey								
Indirect PO Attainment								

Attainments of POs for all Courses

POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
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
Extracurricular Activities)]**

Expected Level of Attainment for each of the Programme Outcomes

POs	Level of Attainment
Value > 70% =	Excellent
Value > 60 % and Value < 70% =	Very Good
Value > 50 % and Value < 60% =	Good
Value > 40% and Value < 50% =	Satisfactory
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	25% of the class strength	30% of the class strength
Progression to Higher Education	40% of the class strength	5% of the class strength
Record of Entrepreneurship	2% of the class strength	5% of the class strength

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
Value	>	70%	Excellent
	=		
Value	>	60 % and Value < 70%	Very Good
	=		
Value	>	50 % and Value < 60%	Good
	=		
Value	>	40% and Value < 50%	Satisfactory
	=		
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 PROGRAMME EDUCATIONAL OBJECTIVES

The college has always been involving the key stake holders 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 2020-2021

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, Discipline Specific Elective Courses and Allied Courses							
Core Course	4 (4)	4 (4)	5 (5)	5 (5)	4 (4)	5 (4)	27 (26)
Core Course	4 (4)	4 (4)	-	-	4 (4)	5 (4)	17(16)
Core Course	-	-	-	-	4 (4)	5 (4)	9 (8)
Core Course Practical	2 (0)	2 (2)	2 (0)	2 (2)	3 (0)	3 (3)	14 (7)
					3 (0)	3 (3)	6 (3)
					2 (0)	2 (2)	4 (2)
DSEC	-	-	-	-	4 (4)	5 (4)	9 (8)
Project					0(1)	-	0(1)
Allied Course I	4 (4)	4 (4)	-	-	-	-	8 (8)
Allied Course Practical	2 (0)	2 (2)			-	-	4(2)
Allied Course II	-	-	4 (4)	4 (4)	-	-	8 (8)
Allied Course Practical			2 (0)	2(2)	-	-	4 (2)
Self Study Courses	-	-	-	-		0 (1)	0 (1)
Part IV : Skill Enhancement Courses, Non Major Elective Courses, Ability Enhancement Compulsory Courses, Generic Elective Courses and Internship/ Field Project							
SEC	-	2 (2)	2 (2)	2 (2)	2 (2)	2 (2)	10 (10)
SEC	-	-	-	-	2 (2)	-	2 (2)
Non Major Elective Course	-	-	2(2)	2 (2)	-	-	4 (4)
AECC - Value Education	2 (2)	-	-	-	-	-	2 (2)
AECC - Environmental Studies	-	-	-	-	2 (1)	-	2 (1)
GEC	-	-	1 (1)	-	-	-	1 (1)
GEC	-	-	-	1 (1)	-	-	1 (1)
Self Study Course					0 (1)	-	0 (1)
Internship/ Field Project	-	-	-	0 (1)	-	-	0 (1)
Part V : Extension Activities	-	-	-	0 (1)	-	-	0 (1)
Total	30 (20)	30 (24)	30 (20)	30 (26)	30 (23)	30 (27)	180 (140)
Extra Credit Course					0(2)		0(2)

DSEC:Discipline Specific elective Course; SEC-Skill Enhancement Course; AECC-Ability Enhancement Compulsory Courses; GEC-Generic Elective Courses



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PART I - TAMIL

S. No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UTAG11	பொதுத்தமிழ் தாள் I	3	100
2.	II	20UTAG21	பொதுத்தமிழ் தாள் II	3	100
3.	III	20UTAG31	பொதுத்தமிழ் தாள் III	3	100
4.	IV	20UTAG41	பொதுத்தமிழ் தாள் IV	3	100
TOTAL				12	400

PART I - HINDI

S. No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UHDG11 22UHDG11	Hindi - Paper I Prose – I & II, Ancient Stories - I, General Essays, Functional Hindi – I & Grammar General Hindi – I	3	100
2.	II	20UHDG21 22UHDG21	Hindi - Paper II Drama, One Act Play, Letter, Correspondence, Functional Hindi – II & Grammar General Hindi – II	3	100
3.	III	20UHDG31 22UHDG31	Hindi - Paper III Ancient Poetry, Drama, Indian History, Hindi Grammar & Functional Hindi III Advanced Hindi – I	3	100
4.	IV	20UHDG41 22UHDG41	Hindi - Paper IV Modern Poetry, Hindi Literary Essays, Letter Correspondence, Conversation & Functional Hindi IV Advanced Hindi - II	3	100
TOTAL				12	400

PART II - ENGLISH

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UENG11A 20UENG11B 20UENG11C	English – Paper I English for Advanced Learners I English for Career Guidance - I English for Communicative Competence-I	3	100
2.	II	20UENG21A 20UENG21B 20UENG21C	English – Paper II English for Advanced Learners II English for Career Guidance - II English for Communicative Competence - II	3	100

3.	III	20UENG31A 20UENG31B 20UENG31C 22UENG31	English – Paper III English for Advanced Learners III English for Career Guidance – III English for Communicative Competence – III Communicative English – I	3	100
4.	IV	20UENG41A 20UENG41B 20UENG41C 22UENG41	English – Paper IV English for Advanced Learners IV English for Career Guidance – IV English for Communicative Competence – IV Communicative English – II	3	100
TOTAL				12	400

PART III – CORE, DISCIPLINE SPECIFIC ELECTIVE COURSES

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1	I	20UMBC11	General Microbiology	4	100
2	I	20UMBC12	Biochemistry	4	100
3	II	20UMBC21/ 20UMBC21N	Microbial Taxonomy	4	100
4	II	20UMBC22/ 20UMBC22N	Microbial physiology and Metabolism	4	100
5	II	20UMBC21P	Major Practical- I	2	100
6	III	20UMBC31	Molecular Biology	5	100
7	IV	20UMBC41	Microbial Genetics	5	100
8	IV	20UMBC41P	Major Practical –II	2	100
9	V	20UMBC51	Clinical Microbiology	4	100
10	V	20UMBC52	Immunology	4	100
11	V	20UMBC53	Bioinformatics	4	100
12	V	20UBOE51/ 20UMBE52/ 20UMBE53	Discipline Specific Elective 1 1. Genomics and Proteomics 2. Virology 3. Nanobiotechnology	4	100
13	V	20UMBC5PR	Project	1	100
14	VI	20UMBC61	Soil& Agricultural Microbiology	4	100
15	VI	20UMBC62	Industrial Microbiology	4	100
16	VI	20UMBC63	Recombinant DNA Technology	4	100
17	VI	20UMBE61/ 20UMBE62/ 20UBOE63	Discipline Specific Elective 2 1. Pharmaceutical Microbiology 2. Environmental Microbiology 3. IPR, Bioethics and Biosafety	4	100
18	VI	20UMBQ61	Self study Course-Core courses Quiz – online	1	100
19	VI	20UMBC61P	Major Practical –III	3	100
20	VI	20UMBC62P	Major Practical –IV	3	100
21	VI	20UMBC63P	Major Practical –V	2	100
Total				72	2100

PART III – ALLIED COURSE I- CHEMISTRY

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UCHA11	Chemistry –I	4	100
2.	II	20UCHA21	Chemistry –II	4	100
		20UCHA21P	Allied Chemistry Practical	2	100
Total				10	300

PART III - ALLIED COURSE II- CONCEPTS IN BIOLOGY

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	III	20UBIA31	Biology-I(Cell biology)	4	100
2	IV	20UBIA41	Biology-II (Applied biology)	4	100
3	III&IV	20UBIA41P	Biology Practical (Cell Biology, Applied Biology Practical)	2	100
Total				10	300

PART IV - SKILL ENHANCEMENT COURSES

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	II	20UMBS21/ 20UMBS21N	Microbiological and Analytical Techniques	2	100
2.	III	20UMBS31	Diagnostic Microbiology	2	100
3.	IV	20UMBS41/ 20UMBS41N	Mushroom Technology	2	100
4.	V	20UMBS51	Cosmetic Microbiology	2	100
5.	V	20UMBS52	Food Microbiology	2	100
6.	VI	20UMBS61	Vermitechnology	2	100
Total				12	600

PART IV – NON MAJOR ELECTIVE COURSES

S.No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UMBN31	Medical Lab Technology	2	100
2.	II	20UMBN41	Applied Microbiology	2	100
Total				4	200

PART IV- ABILITY ENHANCEMENT COMPULSORY COURSES, GENERIC ELECTIVE COURSES AND INTERNSHIP / FIELD PROJECT

S. No.	Sem.	Code	Title of the Course	Credits	Marks
1.	I	20UGVE11	Value Education	2	100
2.	V	20UGES51	Environmental Studies	1	100
3	III	20UGEH31 20UGEW32	Human Rights/ Women Studies	1	100
4.	IV	20UGEC41	Constitution of India/	1	100
		20UGEM42	Modern Economics/		
		20UGEA43	Adolescent Psychology/		
		20UGED44	Disaster Management		
		20UMBI41G	Internship/Field Project	1	100
5.	V	20UGCE51	Practice for Competitive Examinations - Online	1	100
Total				7	500

PART V - EXTENSION ACTIVITIES

S. No.	Sem.	Code	Title of the Course	Credit
1	I, II, III & IV	20UVNS1, 20UVNS2	National Service Scheme	1
2		20UVPE1	Physical Education	
3		20UVYR1, 20UVYR2	Youth Red Cross Society	
4		20UVR1	Red Ribbon Club	
5		20UVSF1	Science Forum	
6		20UVEC1	Eco Club	
7		20UVL1	Library and Information Science	
8		20UVCF1	Consumer Forum	
9		20UVHF1	Health and Fitness Club	
10		20UVNC1, 20UVNC2	National Cadet Corps	
11		20UVRO1	Rotaract Club	

EXTRA CREDIT COURSES (Optional)

S.No.	Sem.	Code	Title of the Course	Credits	Total Marks
1.	V	20UMB051	Biocontrol	2	100



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BACHELOR OF MICROBIOLOGY

PROGRAMME CONTENT

Programme Code – 2024

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int.	Ext.	
I	Part I	20UTAG11 20UHDG11	Tamil Paper - I Hindi Paper - I	6	3	25	75
	Part II	20UENG11	English Paper - I	6	3	25	75
	Part III	20UMBC11	Core Course -1 General Microbiology	4	4	25	75
		20UMBC12	Core Course - 2 Biochemistry	4	4	25	75
		20UMBC21P	Core Course Practical I Major Practical – I	2	-	-	-
		20UCHA11	Allied Course –I Chemistry - 1	4	4	25	75
		20UCHA21P	Allied Course Allied Chemistry Practical – I	2	-	-	-
	Part IV	20UGVE11	Value Education	2	2	40	60
	TOTAL			30	20	600	

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int.	Ext.	
II	Part I	20UTAG21 20UHDG11	Tamil Paper – II Hindi Paper - II	6	3	25	75
	Part II	20UENG21	English Paper – II	6	3	25	75
	Part III	20UMBC21	Core Course - 3 Microbial Taxonomy	4	4	25	75
		20UMBC22	Core Course -4 Microbial Physiology and Metabolism	4	4	25	75
		20UMBC21P	Core Course Practical - I Major Practical -I	2	2	40	60
		20UCHA21	Allied Course –I Chemistry – II	4	4	25	75
		20UCHA21P	Allied Course Allied Chemistry Practical	2	2	40	60
	Part IV	20UMBS21	Skill Enhancement Course - 1 (SEC-1) Microbiological and Analytical Techniques	2	2	40	60
		TOTAL			30	24	800

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int.	Ext.	
III	Part I	20UTAG31 20UH DG31	Tamil Paper - III Hindi Paper – III	6	3	25	75
	Part II	20UENG31	English Paper – III	6	3	25	75
	Part III	20UMBC31	Core Course -5 Molecular Biology	5	5	25	75
		20UMBC41P	Core Course Practical - II Major Practical – II	2	-	-	-
		20UBIA31 20UBIA41P	Allied-Course -II Cell Biology Cell Biology and Applied Biology Practical-1	4 2	4 -	25 -	75 -
	Part IV	20UMBS31	Skill Enhancement Course - 2 (SEC -2) Diagnostic Microbiology	2	2	40	60
		20UMBN31	Non Major Elective Course - 1 (NMEC-1) Medical Lab Technology	2	2	40	60
	Part IV	20UGEH31/ 20UGEW32	Generic Elective Course -1 (GEC - 1) 1.Human Rights/ 2. Women studies	1	1	40	60
		TOTAL			30	20	700

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int.	Ext.	
IV	Part I	20UTAG41	Tamil Paper – IV Hindi Paper – IV	6	3	25	75
	Part II	20UENG41	English Paper – IV	6	3	25	75
	Part III	20UMBC41	Core Course - 6 Microbial Genetics	5	5	25	75
		20UMBC41P	Core Course Practical - II Major Practical –II	2	2	40	60
		20UBIA41 20UBIA41P	Allied Course – II Applied Biology Cell Biology and Applied Biology Practical-1	4 2	4 2	25 40	75 60
	Part IV	20UMBS41	Skill Enhancement Course - 3 (SEC -3) Mushroom Technology	2	2	40	60
		20UMBN41	Non Major Elective Course - 2 (NMEC-2) Applied Microbiology	2	2	40	60
		20UMBI41G	Internship/Field Project	0	1	100	-
		20UGEC41/ 20UGEM42/ 20UGEA43/ 20UGED44	Generic Elective Course – 2 (GEC-2) Constitution of India/ Modern Economics/ Adolescent Psychology/ Disaster Management	1	1	100	-
	Part V		Extension Activities	-	1	-	-
			TOTAL	30	26	1000	

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int	Ext	
V	Part - III	20UMBC51	Core Course – 7 Clinical Microbiology	4	4	25	75
		20UMBC52	Core Course – 8 Immunology	4	4	25	75
		20UMBC53	Core Course – 9 Bioinformatics	4	4	25	75
		20UMBC61P	Core Course Practical - III Major Practical - III	3	-	-	-
		20UMBC62P	Core Course Practical - IV Major Practical - IV	3	-	-	-
		20UMBC63P	Core Course Practical - V Major Practical - V	2	-	-	-
		20UBOE51	Discipline Specific Elective Course – 1 (DSEC – 1) 1. Genomics and Proteomics	4	4	25	75
		20UMBE52	2. Virology				
		20UMBE53	3. Nanobiotechnology				
	20UMBC5PR	Core Course – 10 Project	-	1	100		
	20UGCE51	Practice for Competitive Examinations - Online	-	1	100		
	Part - IV	20UMBS51	Skill Enhancement Course - 4 (SEC – 4) Cosmetic Microbiology	2	2	40	60
		20UMBS52	Skill Enhancement Course – 5 (SEC – 5) Food Microbiology	2	2	40	60
20UGES51		Environmental Studies	2	1	100		
		TOTAL	30	23	900		

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int	Ext	
VI	Part - III	20UMBC61	Core Course – 11 Soil & Agricultural Microbiology	5	4	25	75
		20UMBC62	Core Course – 12 Industrial Microbiology	5	4	25	75
		20UMBC63	Core Course – 13 Recombinant DNA Technology	5	4	25	75
		20UMBC61P	Core Course Practical - III Major Practical - III	3	3	40	60
		20UMBC62P	Core Course Practical - IV Major Practical - IV	3	3	40	60
		20UMBC63P	Core Course Practical - V Major Practical - V	2	2	40	60
		20UMBE61 20UMBE62 20UBOE63	Discipline Specific Elective Course - 2 (DSEC – 2) 1. Pharmaceutical Microbiology 2. Environmental Microbiology 3. IPR, Bioethics and Biosafety	5	4	25	75
	20UMBQ61	Core courses Quiz - Online	-	1	100		
Part - IV	20UMBS61	Skill Enhancement Course - 6 (SEC – 6) Vermitechnology	2	2	40	60	
TOTAL			30	27	900		



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BACHELOR OF MICROBIOLOGY

Programme Code – 2024

REVISED PROGRAMME CONTENT

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int.	Ext.	
I	Part I	20UTAG11 20UHDG11	Tamil Paper - I Hindi Paper - I	6	3	25	75
	Part II	20UENG11	English Paper - I	6	3	25	75
	Part III	20UMBC11	Core Course -1 General Microbiology	4	4	25	75
		20UMBC12	Core Course - 2 Biochemistry	4	4	25	75
		20UMBC21P	Core Course Practical I Major Practical – I	2	-	-	-
		20UCHA11	Allied Course –I Chemistry - 1	4	4	25	75
		20UCHA21P	Allied Course Allied Chemistry Practical – I	2	-	-	-
	Part IV	20UGVE11	Value Education	2	2	40	60
	TOTAL			30	20	600	

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int.	Ext.	
II	Part I	20UTAG21 20UHDG11	Tamil Paper – II Hindi Paper - II	6	3	25	75
	Part II	20UENG21	English Paper – II	6	3	25	75
	Part III	20UMBC21N	Core Course - 3 Microbial Taxonomy	4	4	25	75
		20UMBC22N	Core Course -4 Microbial Physiology and Metabolism	4	4	25	75
		20UMBC21P	Core Course Practical - I Major Practical -I	2	2	40	60
		20UCHA21	Allied Course –I Chemistry – II	4	4	25	75
		20UCHA21P	Allied Course Allied Chemistry Practical	2	2	40	60
	Part IV	20UMBS21N	Skill Enhancement Course - 1 (SEC-1) Microbiological and Analytical Techniques	2	2	40	60
	TOTAL			30	24	800	

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int.	Ext.	
III	Part I	20UTAG31 20UH DG31	Tamil Paper - III Hindi Paper – III	6	3	25	75
	Part II	20UENG31	English Paper – III	6	3	25	75
	Part III	20UMBC31	Core Course -5 Molecular Biology	5	5	25	75
		20UMBC41P	Core Course Practical - II Major Practical – II	2	-	-	-
		20UBIA31 20UBIA41P	Allied-Course -II Cell Biology Cell Biology and Applied Biology Practical-1	4 2	4 -	25 -	75 -
	Part IV	20UMBS31	Skill Enhancement Course - 2 (SEC -2) Diagnostic Microbiology	2	2	40	60
		20UMBN31	Non Major Elective Course - 1 (NMEC-1) Medical Lab Technology	2	2	40	60
	Part IV	20UGEH31/ 20UGEW32	Generic Elective Course -1 (GEC - 1) 1.Human Rights/ 2. Women studies	1	1	40	60
		TOTAL			30	20	700

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int.	Ext.	
IV	Part I	20UTAG41	Tamil Paper – IV Hindi Paper – IV	6	3	25	75
	Part II	20UENG41	English Paper – IV	6	3	25	75
	Part III	20UMBC41	Core Course - 6 Microbial Genetics	5	5	25	75
		20UMBC41P	Core Course Practical - II Major Practical –II	2	2	40	60
		20UBIA41 20UBIA41P	Allied Course – II Applied Biology Cell Biology and Applied Biology Practical-1	4 2	4 2	25 40	75 60
	Part IV	20UMBS41N	Skill Enhancement Course - 3 (SEC -3) Mushroom Technology	2	2	40	60
		20UMBN41	Non Major Elective Course - 2 (NMEC-2) Applied Microbiology	2	2	40	60
		20UMBI41G	Internship/Field Project	0	1	100	-
		20UGEC41/ 20UGEM42/ 20UGEA43/ 20UGED44	Generic Elective Course – 2 (GEC-2) Constitution of India/ Modern Economics/ Adolescent Psychology/ Disaster Management	1	1	100	-
	Part V		Extension Activities	-	1	-	-
			TOTAL	30	26	1000	

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int	Ext	
V	Part - III	20UMBC51	Core Course – 7 Clinical Microbiology	4	4	25	75
		20UMBC52	Core Course – 8 Immunology	4	4	25	75
		20UMBC53	Core Course – 9 Bioinformatics	4	4	25	75
		20UMBC61P	Core Course Practical - III Major Practical - III	3	-	-	-
		20UMBC62P	Core Course Practical - IV Major Practical - IV	3	-	-	-
		20UMBC63P	Core Course Practical - V Major Practical - V	2	-	-	-
		20UBOE51 20UMBE52 20UMBE53	Discipline Specific Elective Course – 1 (DSEC – 1) 1. Genomics and Proteomics 2. Virology 3. Nanobiotechnology	4	4	25	75
		20UMBC5PR	Core Course – 10 Project	-	1	100	
		20UGCE51	Practice for Competitive Examinations - Online	-	1	100	
	Part - IV	20UMBS51	Skill Enhancement Course - 4 (SEC – 4) Cosmetic Microbiology	2	2	40	60
		20UMBS52	Skill Enhancement Course – 5 (SEC – 5) Food Microbiology	2	2	40	60
		20UGES51	Environmental Studies	2	1	100	
			TOTAL	30	23	900	

Semester	Course Code	Courses	Hours per week	Credits	Total Marks		
					Int	Ext	
VI	Part - III	20UMBC61	Core Course – 11 Soil & Agricultural Microbiology	5	4	25	75
		20UMBC62	Core Course – 12 Industrial Microbiology	5	4	25	75
		20UMBC63	Core Course – 13 Recombinant DNA Technology	5	4	25	75
		20UMBC61P	Core Course Practical - III Major Practical - III	3	3	40	60
		20UMBC62P	Core Course Practical - IV Major Practical - IV	3	3	40	60
		20UMBC63P	Core Course Practical - V Major Practical - V	2	2	40	60
		20UMBE61 20UMBE62 20UBOE63	Discipline Specific Elective Course - 2 (DSEC – 2) 1. Pharmaceutical Microbiology 2. Environmental Microbiology 3. IPR, Bioethics and Biosafety	5	4	25	75
	20UMBQ61	Core courses Quiz - Online	-	1	100		
	Part - IV	20UMBS61	Skill Enhancement Course - 6 (SEC – 6) Vermitechnology	2	2	40	60
TOTAL			30	27	900		



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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY (2020 -21 onwards)

Semester I	GENERAL MICROBIOLOGY	Hours/Week: 4	
Core Course-1		Credits: 4	
Course Code 20UMBC11		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: recall the historical perspective of the microbial world and basic structural features of microscopic organisms. [K1]
- CO2: discuss the contributions of microbiologists and functional features of microbial diversity. [K2]
- CO3: explain the discovery, scope and relevance of microbiology and microorganisms. [K2]
- CO4: interpret the cellular organization, life cycle and economic importance of prokaryotic and eukaryotic cells. [K3]
- CO5: analyze the inclusion bodies and organelles to build the structural properties of prokaryotic and eukaryotic cells. [K4]

UNIT I

Historical perspective: Discovery of microbial world - Contributions of Leeuwenhoek, Louis Pasteur and Robert Koch. Microbial role in disease (germ theory) - Scope and relevance of microbiology - Spontaneous generation conflicts. (8 Hours)

UNIT II

Prokaryotic cell Structure and function: Cell wall (Gram positive and Gram negative), Cell membranes, Mesosomes, Flagella, Pili, Capsule, Cytoplasm, Inclusion bodies, Ribosomes, Nucleoid, Endospores and Gas vesicles. (14 Hours)

UNIT III

Eukaryotic cell organelles: Endoplasmic reticulum, Golgi apparatus, Mitochondria, Ribosome, Lysosomes, Chloroplasts and Nucleus. Difference between prokaryotic and eukaryotic cells. (14 Hours)

UNIT IV

Salient features of Bacteria: *Bacillus*, *Escherichia coli*, *Streptococcus* and *Staphylococcus*. Structure and reproduction of Algae - *Chlamydomonas* and *Chlorella*. Structure and reproduction of Fungi - *Penicillium* and *Saccharomyces*. (12 Hours)

UNIT V

Structure and life cycle of bacterial viruses: T4 & Lambda. Structure and life cycle of plant and animal viruses: TMV & HIV. Salient features and Life cycle of Protozoa: *Plasmodium* & *Entamoeba histolytica*. (12 Hours)

TEXT BOOK

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

REFERENCE BOOKS

1. Pelczar, M.J., Chan, E.C.S., & Kreig, N.R., (2001). *Microbiology*, 5th edition. New Delhi: Tata McGraw Hill Publishing Co Ltd.
2. Schlegel, H.G., (2000). *General Microbiology*, 7th edition. Cambridge: Cambridge University Press.
3. Stainer, R.Y., Ingraham, Wheelis, M.G., & Paintor, P.R., (1999). *The Microbial World*, 5th edition. New Jersey: Prentice Hall.

Course Code 20UMBC11	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	H	M	H	L	L	L	L	L	-	-
CO2	H	L	H	M	L	L	L	L	-	-
CO3	H	M	H	M	L	M	L	L	-	-
CO4	H	M	M	M	L	L	M	L	-	-
CO5	H	L	M	M	L	L	L	H	-	-

Mrs.J.Jeya
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Mrs.M.M.Fatima Mansoor
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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY (SEMESTER)

(2020 -21 onwards)

Semester I	BIOCHEMISTRY	Hours/Week: 4	
Core Course-2		Credits: 4	
Course Code 20UMBC12		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: recall the fundamental structure, physical and chemical properties of biomolecules. [K1]
- CO2: explain the chemistry of biomolecules and their biological significance. [K2]
- CO3: illustrate the classification and structure of macromolecules, vitamins and hormones. [K2]
- CO4: apply knowledge on structural organization and conformation of proteins and nucleic acids. [K3]
- CO5: analyze the metabolic actions and diseases associated with hormonal imbalance. [K4]

UNIT I

Water and Life – pH and buffers. Carbohydrates –Biological significance – classification, structure, chemical and physical properties of monosaccharides (Glucose), disaccharides (Sucrose) and polysaccharides (Starch). (10 Hours)

UNIT II

Lipids – Biological significance, Classification, Structure, Physical and Chemical properties of Fats, Fatty acids, Glycerol, phospholipids, Spingolipids, Lipoproteins and Eicosanoids. (10 Hours)

UNIT III

Amino acids –Classification and Properties. Proteins – Primary, Secondary, Tertiary and Quaternary structure. Nucleic acids – components, Structural conformation, types & properties of DNA and RNA. (12 Hours)

UNIT IV

Vitamins – classification – Fat soluble vitamins – Structure, properties and functions of Vitamin A,D,E and K –. Water soluble vitamins – Structure, properties and functions of Vitamin C, B₁, B₂, Folic acid and B₁₂. (14 Hours)

UNIT V

Hormones – Introduction – Biosynthesis and metabolic actions of Thyroid, Insulin, Glucagon, Adrenal and Pituitary hormones. (14 Hours)

TEXT BOOK

Jain J.L., Sunjayjain&Nitinjain, (2005). *Fundamentals of Biochemistry*, 6th edition. New Delhi: Chand Publications.

REFERENCE BOOKS

1. Lehninger, A.L., (2012). *Principles of Biochemistry*, 6th edition. New Delhi: CBS Publishers.
2. Zubay, G., (1998). *Biochemistry*, 4th edition. London: McMillan Publishers.
3. AmbikaShanmugam, (2016). *Fundamentals of Biochemistry for Medical Students*, 8th edition. Chennai: Karthick printers.
4. LubertStryer, (2009). *Biochemistry*, 4th edition. United states: W.H Freeman & Co Ltd.

Course Code 20UMBC12	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	H	L	H	L	L	M	L	L	-	-
CO2	H	L	H	L	M	M	L	L	-	-
CO3	H	L	M	H	M	M	L	L	-	-
CO4	M	H	L	L	L	M	M	L	-	-
CO5	M	M	L	H	L	M	M	H	-	-

Mrs.J.Jeya
Head of the Department

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VIRUDHUNAGAR - 626 001

ALLIED COURSE I CHEMISTRY FOR MICROBIOLOGY

(2020 -21 onwards)

Semester I	ALLIED COURSE I- ORGANIC, INORGANIC AND PHYSICAL CHEMISTRY – I	Hours/Week: 4	
Allied Course -1		Credits: 4	
Course Code 20UCHA11		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the basic principles, statements, laws and theories in chemistry. [K1]

CO2: understand the fundamental concepts in organic, inorganic and physical chemistry.

[K2]

CO3: illustrate the preparations, uses and applications of polymers, hydrogen and water, various metallurgical process, bonding theories, colloids, sols, emulsion and gels.

[K2]

CO4: predict the type of reactions involved in polymers preparation, utility of biomedical polymers, suitable process for metal extraction and water purification, shape of molecules using VSEPR, VB and MO theories, properties of gaseous and colloidal substances. [K3]

CO5: analyze different methodology of preparing polymers, separation of metals from their ores, water purification processes, various bonding theories, gas laws and properties of various colloids, applications of colloids and biomedical polymers.

[K4]

UNIT I

1. Polymers – Polymerization – Definition – Classification – examples –Preparation and uses of polythene, PVC, teflon, polystyrene, dacron, nylon- 6,6.
2. Natural and synthetic rubbers – examples – vulcanization of rubber- Preparation and uses of SBR, Buna – N and neoprene.
3. Biomedical polymers – characteristics – examples - Biomedical applications of polymer.

(12 Hours)

UNIT II

1. Metallurgy

Ores, minerals – various steps in the metallurgical processes – Froth floatation – calcination – roasting – leaching – smelting – Mond's process – Van Arkel –de-Boer process – Zone refining – Electrolytic refining – Extraction of titanium.

2. Hydrogen

Isotopes of hydrogen – Heavy water – uses- ortho and para hydrogen Interconversion.

Occluded hydrogen – Nascent hydrogen – uses of hydrogen.

3. Water

Hardness of water – Types of hardness – Removal of hardness – sodalime, Permutit and Ion-exchange processes - Demineralisation process – purification of water using chlorine, Ozone and UV light. (12Hours)

UNIT III

1. Bonding – Valence bond theory – postulates – Types of overlapping- σ & π bonds - Concept of hybridization – sp , sp^2 and sp^3 hybridisation – VSEPR Theory – NH_3 and H_2O molecules.

2. Molecular orbital theory – postulates – Application to the formation of H_2 , O_2 and He_2 molecules. Comparison of VBT and MOT. (12 Hours)

UNIT IV

1. Gas Laws - Boyle's law – Charles law – Gay Lussac's law – Ideal gas equation – Avogadro's law – molar gas volume – Dalton's law of partial pressure -Graham's law of diffusion.

2. Kinetic Theory of gases - Postulates – Kinetic gas equation (Derivation not required) – Deduction of gas laws from kinetic gas equation.

3. Different types of Velocities – Average velocity, RMS velocity, most probable velocity – relationship between them. (No derivation)

4. Ideal and real gases - Definition – Deviation of real gases from ideal behavior – reasons for deviation. (12 Hours)

UNIT V

1. Colloids – Definition and classification.
2. Sols – Different types – examples –Dialysis – electro osmosis – electrophoresis – stability of colloids- Gold number.
3. Emulsion – Types of emulsion – Emulsifier – Examples – Cleansing action of soap.
4. Gels – Types of gels – examples – Properties – Hydration – Swelling – syneresis – Thixotropy.
5. Applications of colloids. (12 Hours)

TEXT BOOKS

- 1.P.L.Soni, (2008) *Text book of Organic Chemistry*, Latest Edition.Sultan Chand & Sons.
2. P.L.Soni, (2008).*Text book of Inorganic Chemistry*,Latest Edition. Sultan Chand& Sons.
3. P.L.Soni, (2008).*Text book of Physical chemistry*Latest Edition.Sultan Chand & Sons.

REFERENCE BOOKS

1. Bahl and Arun Bahl,*Advanced Organic Chemistry*,22nd Edition.S.Chand&Company Ltd.
2. Puri, Sharma, Kalia, (2008).*Principles of Inorganic Chemistry*, 43rd Edition. Vishal Publishing Co.
3. Puri,Sharma,Patania,*Principles of Physical Chemistry*, 43rd Edition. Vishal Publishing Co.

Course Code 20UCHA11	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	H	L	L	H	L	L	L
CO2	L	L	-	-	L	-	-
CO3	-	H	-	M	L	-	M
CO4	H	L	-	L	M	L	L
CO5	H	H	M	M	L	L	-

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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY (SEMESTER)

(2020 -21 onwards)

Semester II	MICROBIAL TAXONOMY	Hours/Week: 4	
Core Course-4		Credits: 4	
Course Code 20UMBC21		Internal 25	External 75

COURSE OUTCOMES

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. [K2]
- CO3: explain the kingdom concepts to learn major characteristic features of microscopic community in different ecosystems. [K2]
- CO4: Illustrate the nature of microorganisms according to Bergey's manual of systematic bacteriology in different volumes. [K3]
- CO5: classify the Structural, genomic and nomenclature features of viruses that infects bacteria, plants and animals. [K4]

UNIT I

Introduction to microbial diversity – Taxonomic ranks, hierarchial arrangements in taxonomy. Classification systems - phenetic and phylogenetic. Major characteristics used in taxonomy – Morphological, Physiological, Biochemical and molecular characteristics. Principles of numerical taxonomy. (12 Hours)

UNIT II

Classification based on Kingdom systems – Whittaker, Carl Woese & Cavalier Smith. Classification of bacteria as per the Bergey's manual of systematic bacteriology –Gram negative bacteria (Vol - 1): Gram Negative Aerobic Rods (*Pseudomonas*) and Cocci (*Neisseria*), Facultatively Anaerobic Gram Negative Rods (*Enterobacteriaceae* & *Vibrionaceae*), Aerobic, Motile and Helical Gram Negative Bacteria *Bdellovibrio*. (13 Hours)

UNIT III

Gram positive bacteria (Vol - II): Gram positive cocci(*Staphylococcus*), Endospore forming Gram Positive Rods (*Clostridium*)&Cocci(*Sporosarcina*). Gram negative bacteria (Vol - III): Oxygenic and anoxygenic photosynthetic bacteria, Archaeobacteria: Methanogens, Halophiles, Acidophiles, and Thermophiles. General properties of *Actinomycetes* (Vol - IV): *Streptomyces*. (13 Hours)

UNIT IV

Classification of of algae and their characteristics: Fritsch. Classification of fungi and their characteristics: Alexopoulos& Mims. Classification of Protozoa and their salient features. (12 Hours)

UNIT V

Viral taxonomy: characteristic features used in nomenclature - classification of bacterial, plant and animal viruses. (10 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. Nester, E.W., Roberts, C.V., & Nester, M.T., (1995). *Microbiology – A Human Perspective*, USA: The McGraw-Hill companies.
4. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L.,&Paintor, P.R.,(1999). *General Microbiology*, London: McMillan Educational Ltd.
5. Bergey, D.H., John.G.,Holt, (1994). *Bergey's Manual of Determinative Bacteriology*, 9th edition. New York: Bergey's Manual Trust Publications.

Course Code 20UMBC21	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	H	H	M	M	L	M	M	L	-	-
CO2	H	M	M	M	L	M	L	L	-	-
CO3	H	L	M	M	L	L	M	M	-	-
CO4	H	M	H	H	M	L	M	M	-	-
CO5	H	L	M	H	L	M	M	H	-	L

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B.Sc. MICROBIOLOGY

(2022 -23 onwards)

Semester II	MICROBIAL TAXONOMY	Hours/Week: 4	
Core Course-4		Credits: 4	
Course Code 20UMBC21N		Internal 25	External 75

COURSE OUTCOMES

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. [K2]
- CO3: explain the kingdom concepts to learn major characteristic features of microscopic community in different ecosystems. [K2]
- CO4: Illustrate the nature of microorganisms according to Bergey's manual of systematic bacteriology in different volumes. [K3]
- CO5: classify the Structural, genomic and nomenclature features of microorganisms. [K4]

UNIT I

Introduction to Microbial diversity – Taxonomic ranks, hierarchial arrangements in taxonomy. Classification systems - phenetic and phylogenetic. Major characteristics used in taxonomy – Morphological, Physiological, Biochemical, Ecological, Genetic and Molecular characteristics. Principles of numerical taxonomy – Similarity matrix, Dendrogram, Simple matching coefficient and Jaccard coefficient (12 Hours)

UNIT II

Classification based on Kingdom systems – Ernest Hackel, Whittaker, Carl Woese & Cavalier Smith. Classification of bacteria as per the Bergey's manual of systematic bacteriology –Gram negative bacteria (Vol - 1): Gram Negative Aerobic Rods (*Pseudomonas*) and Cocci (*Neisseria*), Facultatively Anaerobic Gram Negative Rods

(*Enterobacteriaceae* & *Vibrionaceae*), Aerobic, Motile and Helical Gram Negative Bacteria *Bdellovibrio*, *Rickettsia* and *Chlamydiae* (13 Hours)

UNIT III

Gram positive bacteria (Vol - II): Gram positive cocci(*Staphylococcus*), Endospore forming Gram Positive Rods (*Clostridium*) & Cocci (*Sporosarcina*),Mycobacteria. Gram negative bacteria (Vol - III): Oxygenic and Anoxygenic photosynthetic bacteria. Archaeobacteria: Methanogens, Halophiles, Acidophiles, and Thermophiles. General properties of *Actinomycetes* (Vol - IV): Nocardioform Actinimycetes & *Streptomyces*. (13 Hours)

UNIT IV

Classification of algae and their characteristics: Fritsch. Classification of fungi and their characteristics: Alexopoulos & Mims. Classification of Protozoa and their salient features. (12 Hours)

UNIT V

Viral taxonomy: Characteristic features used in nomenclature - classification of animal virus, Plant virus and Bacteriophages. (10 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. Nester, E.W., Roberts, C.V., & Nester, M.T., (1995). *Microbiology – A Human Perspective*, USA: The McGraw-Hill companies.
4. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L., & Paintor, P.R., (1999). *General Microbiology*, London: McMillan Educational Ltd.
5. Bergey, D.H., John.G., Holt, (1994). *Bergey's Manual of Determinative Bacteriology*, 9th edition. New York: Bergey's Manual Trust Publications.

Course Code 20UMBC21N	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	H	H	M	M	L	M	M	L	-	-
CO2	H	M	M	M	L	M	L	L	-	-
CO3	H	L	M	M	L	L	M	M	-	-
CO4	H	M	H	H	M	L	M	M	-	-
CO5	H	L	M	H	L	M	M	H	-	L

Mrs.J.Jeya
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Mrs.M.M.FatimaMansoor
Course Designer



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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester II	MICROBIAL PHYSIOLOGY AND METABOLISM	Hours/Week: 4	
Core Course-5		Credits: 4	
Course Code 20UMBC22		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: recall the basic concepts of various anabolic and catabolic pathways, microbial nutrition and growth. [K1]
- CO2: outline the microbial metabolism of carbohydrates, proteins and fats, role of photoautotrophs and physiological changes during growth. [K2]
- CO3: explain the biosynthesis and degradation pathways involved in the physiology and growth of microbes. [K2]
- CO4: develop knowledge on bacterial photosynthesis and transport of nutrients. [K3]
- CO5: analyze the impacts of environmental factors on microbial growth and metabolism. [K4]

UNIT I

Bioenergetics – Laws of thermodynamics, Entropy, Free energy and Generation of ATP. Carbohydrate metabolism – Embden Meyerhof (EMP) and Entnerdoudoroff (ED) pathways, Tricarboxylic acid Cycle (TCA), Substrate level phosphorylation, Electron Transport Chain (ETC) and Oxidative phosphorylation. Fermentation pathways from Pyruvate (Lactic acid Fermentation). Gluconeogenesis. (12 Hours)

UNIT II

Biosynthesis of aminoacids (Glutamic acid, lysine), Urea cycle. Fatty acid biosynthesis and oxidation (beta oxidation). Cell wall biosynthesis in prokaryotes.

(12 Hours)

UNIT III

Bacterial photosynthesis – Oxygenic and Anoxygenic Photosynthesis. Carbon dioxide fixation. Transport of sugar and metabolites – active, passive and facilitated transport systems, Chemiosmosis and ion gradients. (12 Hours)

UNIT IV

Physiology of Bacterial Growth – Growth Factors – Different phases – Growth measurements. Survival at Extreme Environments – Thermophilic, Psychrophilic, Halophilic, Barophilic and Acidophilic bacteria. Radiation resistance: *Deinococcus radiodurans*, Magnetotactic Bacteria: *Magnetospirillum magneticum*. (12 Hours)

UNIT V

Morphology and Life cycle of *Hyphobacterium* and *Caulobacter*, Gliding bacteria, Life cycle of fruiting bacteria - *Myxobacteria*. Life cycle of *Bacillus* – Stages of endospore formation, germination and outgrowth. (12 Hours)

TEXT BOOK

Moat, AG., Foster, JW., & Spector, MP., (2002). *Microbial Physiology*, 4th edition. New Jersey : Wiley- liss Publications.

REFERENCE BOOKS

1. Prescott, Harley & Klein, (2008). *Microbiology*, 6th edition. New York: The McGraw-Hill companies.
2. Powar, C.B., & Dagainawala, H.F. (1997). *General Microbiology (Vol I)* 2nd edition. New Delhi: Himalaya Publishing House.

Course Code 20UMBC22	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	H	M	H	H	L	M	M	M	-	-
CO2	H	M	M	H	L	L	M	L	-	-
CO3	H	L	M	H	L	M	L	M	-	-
CO4	H	M	L	H	L	M	L	M	-	-
CO5	H	L	L	M	M	L	L	H	-	L

Mrs.J.Jeya
Head of the Department

Mrs.J.Jeya
Course Designer



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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2022 -23 onwards)

Semester II	MICROBIAL PHYSIOLOGY AND METABOLISM	Hours/Week: 4	
Core Course-5		Credits: 4	
Course Code 20UMBC22N		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: recall the basic concepts of various anabolic and catabolic pathways, microbial nutrition and growth. [K1]
- CO2: outline the microbial metabolism of carbohydrates, proteins and fats, role of photoautotrophs and physiological changes during growth. [K2]
- CO3: explain the biosynthesis and degradation pathways involved in the physiology and growth of microbes. [K2]
- CO4: develop knowledge on transport of nutrients and growth characteristics of the microorganisms and the mechanisms of energy production for their survival. [K3]
- CO5: analyze the concepts of central metabolic pathways and the impacts of environmental factors on microbial growth. [K4]

UNIT I

Introduction to Metabolism - Bioenergetics – Laws of thermodynamics, Entropy, Free energy and Generation of ATP. Carbohydrate metabolism – Embden Meyerhof (EMP) pathway, HMP pathway and Entnerdoudoroff (ED) pathway. Tricarboxylic acid Cycle (TCA), Substrate level phosphorylation, Electron Transport Chain (ETC) and Oxidative phosphorylation. Fermentation pathways from Pyruvate (Lactic acid Fermentation). Gluconeogenesis. (12 Hours)

UNIT II

Biosynthesis of aminoacids (Glutamic acid, lysine, Glycine and Serine), Urea cycle. Fatty acid biosynthesis and oxidation (beta oxidation). Cell wall biosynthesis in prokaryotes. (12 Hours)

UNIT III

Bacterial photosynthesis – Oxygenic and Anoxygenic Photosynthesis. Light reactions in Cyanobacteria, Green and Purple bacteria. Carbon dioxide fixation- Calvin cycle, Reductive tricarboxylic acid cycle and Hydroxy propionate pathway. Transport of sugar and metabolites – active, passive and facilitated transport systems, Chemiosmosis and ion gradients. (12 Hours)

UNIT IV

Physiology of Bacterial Growth – Growth Factors – Different phases – Growth measurements. Survival at Extreme Environments – Thermophilic, Psychrophilic, Halophilic, Barophilic and Acidophilic bacteria. Radiation resistance: *Deinococcus radiodurans*, Magnetotactic Bacteria: *Magnetospirillum magneticum*. (12 Hours)

UNIT V

Morphology and Life cycle of *Hyphobacterium* and *Caulobacter*, Gliding bacteria, Life cycle of fruiting bacteria - *Myxobacteria*. Life cycle of *Bacillus* – Stages of endospore formation, germination and outgrowth. (12 Hours)

TEXT BOOK

Moat, AG., Foster, JW., & Spector, MP., (2002). *Microbial Physiology*, 4th edition. New Jersey :Wiley- liss Publications.

REFERENCE BOOKS

1. Prescott, Harley & Klein, (2008). *Microbiology*, 6th edition. New York: The McGraw-Hill companies.
2. Powar, C.B., & Daginawala, H.F. (1997). *General Microbiology* (Vol I) 2nd edition. New Delhi: Himalaya Publishing House.

Course Code 20UMBC22N	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	H	M	H	H	L	M	M	M	-	-
CO2	H	M	M	H	L	L	M	L	-	-
CO3	H	L	M	H	L	M	L	M	-	-
CO4	H	M	L	H	L	M	L	M	-	-
CO5	H	L	L	M	M	L	L	H	-	L

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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester I/II	CORE PRACTICAL - I MAJOR PRACTICAL - I	Hours/Week: 2	
Core Course-3		Credits: 2	
Course Code 20UMBC21P		Internal 40	External 60

COURSE OUTCOMES

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

- CO1: apply the basic theoretical concepts & practical knowledge of Microscopy, staining, sterilization, characterization of microbes along with biomolecules estimation. [K3]
- CO2: make use of aseptic techniques for isolating pure cultures, bacterial growth kinetics and to perform routine culture handling tasks safely, effectively and eco friendly. [K3]
- CO3: identify the characteristic features of unknown microorganisms by using various morphological, ecological, biochemical and physiological analysis. [K3]
- CO4: experiment with the presence of bio-molecules like enzymes, carbohydrates, proteins and Vitamins in known and unknown samples. [K3]
- CO5: examine the use of tools, techniques and methodologies vital to practical skills in microbiology and Biochemistry. [K4]

Basic Microbiology

1. Personal protection and conduct in Microbiology laboratory.
2. Isolation and Enumeration of bacteria / fungi from environmental samples (Soil & Water)
3. Pure culture techniques: streak, spread and pour plate methods
4. Observation of bacterial motility by hanging drop method
5. Staining methods: Simple staining, Gram-staining, Fungal staining (Lactophenol Cotton Blue).

Biochemistry

1. Estimation of Carbohydrates – Anthrone Method
2. Estimation of Proteins – Lowry's Method
3. Estimation of Ascorbic acid by Volumetric Analysis.
4. Separation of Amino acids by paper chromatography.

Microbial Taxonomy

Biochemical tests for bacterial identification

1. Carbohydrate fermentation
2. IMViC tests
3. Catalase test
4. Oxidase test
5. Starch hydrolysis

Microbial Physiology

1. Measurement of growth - Turbidity method.
2. Effect of pH and Utilization of Carbohydrates on the growth of microorganisms.

REFERENCE BOOKS

1. Gunasekaran, P., (1996). *Microbiology: A laboratory manual*, 2nd edition. United States: New Age international publishers.
2. Kannan, N., (2002). *Laboratory manual in general microbiology*, 1st edition. New Delhi: Panima publishers.
3. Cappuccino, J.G.,&Sherman,N. (2002.) *Microbiology: A laboratory manual*, 4th edition. Boston: Additon Wesley.
4. Palanivelu, P.,(2004). *Analytical Biochemistry & Separation Techniques*, 4th edition – Madurai: 21st Century Publication.
5. Jeyaraman, J., (1992). *Laboratory manual in biochemistry*, 4th edition. United states: Wiley Eastern Publishers.

Course Code 20UMBC21P	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	H	H	M	M	M	L	L	M	L	-
CO2	H	H	M	M	M	L	L	M	M	M
CO3	H	H	H	M	M	M	L	L	H	-
CO4	H	M	H	L	M	L	M	L	M	-
CO5	H	H	H	H	M	L	M	L	M	-

Mrs.J.Jeya
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VIRUDHUNAGAR - 626 001

ALLIED COURSE I CHEMISTRY FOR MICROBIOLOGY

(2020-21 onwards)

Semester II	ALLIED COURSE- I- ORGANIC, INORGANIC AND PHYSICAL CHEMISTRY – II	Hours/Week: 4	
Allied Course -I		Credits: 4	
Course Code 20UCHA21		Internal 25	External 75

COURSE OUTCOMES

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

CO1: know about the basic concepts in organic, inorganic and physical chemistry. [K1]

CO2: understand the chemical constituent in oils and fats, soaps and detergents, biomolecules, fuels, fertilizers and pollutants. [K2]

CO3: identify the methods of preparation for organic and inorganic compounds, sources, effects and control measures of pollutions, methods for removal of salt from water. [K2]

CO4: comprehend about the classification of biomolecules, fuels, fertilizers, catalyst and pollutions, application of adsorption and uses of biomolecules. [K3]

CO5: analyze the oil, fats and biomolecule functions, different sources of pollutions, characteristics and catalytic properties of chemicals and the effects with remedies for various pollution. [K4]

UNIT I

1. Oils and Fats – Definition – Properties - Distinction between them -Hydrogenation,

Hydrogenolysis, Rancidification and Drying of oils – Preparation of Vanaspathi- Analysis of oils and Fats – Saponification and iodine number.

2. Soaps and Detergents

Soap – Definition – Different types – Manufacture of soap – Kettle process - Detergent – Definition – Synthetic detergents – examples – Distinction between soaps and detergents.

(12Hours)

UNIT II

1. Carbohydrates – classification – Differences between glucose and fructose – Inter conversion of glucose and fructose – Haworth structure of glucose and fructose- Differences between starch and cellulose – Derivatives of cellulose and their uses.
2. Amino acids – classification – preparation of α -amino acids– properties – Zwitterion – isoelectric point .
3. Proteins – classification – Biological function – colour reaction of proteins.
4. Nucleic acids – RNA and DNA – Biological functions (Elementary idea only).

(12 Hours)

UNIT III

1. Fuels – classification – Advantages of gaseous fuels – constituents and uses of water gas, producer gas, LPG, Gobar gas and natural gas.
2. Fertilizers – classification – Macro and micro nutrients – Functions of nutrients preparation and uses of urea, ammonium sulphate, superphosphate, triple superphosphate, potassium nitrate and NPK.

(12 Hours)

UNIT IV

1. Air pollution – Definition – sources of air pollution –classification and effects of air pollutants – Ozone layer- formation and depletion – Green house effect – Acid rain – Preventive measures of air pollution.
2. Water pollution –types and sources of water pollution –classification and effects of water pollutants-control of water pollution-Desalination of sea water by electro dialysis and reverse osmosis.
3. Radioactive pollution – sources – nuclear waste disposal – Effects of radiations.

(12 Hours)

UNIT V

1. Adsorption – Characteristics – Types of adsorption and comparison – Factors influencing adsorption – Langmuir and Freundlich adsorption isotherm (No derivation) – Applications of adsorption.
2. Catalysts – Characteristics- Different types with examples – Catalytic poisoning – promoters with examples.

(12 Hours)

TEXT BOOKS

1. Soni P.L.,(2008).*Text book of Organic Chemistry*, Latest Edition.Sultan Chand & Sons.
2. Soni P.L.,(2008).*Text book of Inorganic Chemistry*, Latest Edition. Sultan Chand & Sons.
3. JayashreeGhosh,(2013). *Fundamental Concepts of Applied Chemistry*,S.Chand & Company Ltd.
4. Soni, P.L.(2008).*Text book of Physical chemistry*, Latest Edition,Sultan Chand & Sons.

REFERENCE BOOKS

1. Jain, M.K. & Sharma, S.C. (2016). *Modern Organic Chemistry*, 1stEdition.New Delhi: Vishal Publishing Co.
2. SindhuP.S.,*Environmental Chemistry*.
- 3 Jain, P.C. & Monika Jain. (2013). *Engineering Chemistry*. 1stEdition.New Delhi: DhanpatRai Publishing Company Pvt.Ltd.
4. Puri, Sharma, Pathania, (2008). *Elements of Physical Chemistry*, 4th Edition. Jalandhar Delhi: Vishal Publishing & Co.

Course Code 20UCHA21	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	M	-	H	-	-	-	L
CO2	H	H	M	M	M	-	L
CO3	H	H	M	M	L	H	-
CO4	H	H	H	M	M	H	M
CO5	H	H	L	-	H	-	L

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Tmt. R.Nagasathya
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VIRUDHUNAGAR - 626 001

ALLIED COURSE I CHEMISTRY FOR MICROBIOLOGY (2020-2021 onwards)

Semester II	VOLUMETRIC ANALYSIS	Hours/Week: 2	
Allied Course I Practical		Credits:2	
Course Code 20UCHA21P		Internal 40	External 60

COURSE OUTCOMES

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

- CO1: apply the principles involved in the volumetric analysis. [K3]
- CO2: find out the strength of standard solutions. [K3]
- CO3: estimate the amount of the substance present in the given solution by volumetric analysis. [K3]
- CO4: determine the concentration of the unknown solutions. [K4]
- CO5: analyse and evaluate the accuracy of the results. [K4]

a. Acidimetry and Alkalimetry:

1. Titration between a strong acid and strong base
2. Titration between a strong acid and weak base.
3. Titration between a weak acid and strong base

b. Permanganimetry:

Titration between potassium permanganate and

- i) oxalic acid ii) ferrous sulphate and iii) ferrous ammonium sulphate (Mohr's salt)

c. Iodometry:

Titration between sodium thiosulphate and i) potassium permanganate and

- ii) potassium dichromate.

Course Code 20UCHA21P	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	H	-	M	M	M
CO2	H	H	H	M	H	-	M
CO3	H	H	H	L	-	-	L
CO4	H	H	H	M	L	M	M
CO5	H	H	M	L	L	M	L

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Head of the Department

Dr.M.Amutha
Course Designer



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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester II	MICROBIOLOGICAL AND ANALYTICAL TECHNIQUES	Hours/Week: 2	
Skill Enhancement Course -1		Credits: 2	
Course Code 20UMBS21		Internal 40	External 60

COURSE OUTCOMES

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

CO1: describe the facts, ideas, need of equipments in microbiological and biochemical analysis. [K1]

CO2: explain the theoretical skills behind the usage, working mechanism and its visualizing effect of the instruments. [K2]

CO3: relate the laboratory skills to detect the problem and rectification in an efficient way. [K2]

CO4: identify the separation techniques to recover the biomolecules from the experimental works. [K3]

CO5: compare the efficacy of the modern day equipments with the basic lab apparatus in recent days. [K4]

UNIT I

Principles and Types of sterilization - Physical methods - radiation and heat. Chemical methods – disinfectants. (4 Hours)

UNIT II

Sterilization equipment - Autoclave, Hot air oven. Principles and functions of Laminar air flow chamber, Incubator, pH meter and Colorimeter. (7 Hours)

UNIT III

Microscopy – Principles, parts and functions of Light, Dark field, Phase contrast, Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM).

(7 Hours)

UNIT IV

Centrifugation – Centrifugal force and principles of sedimentation, Sedimentation coefficient, Types of centrifugation – Differential centrifugation, density gradient centrifugation and Ultracentrifugation. (6 Hours)

UNIT V

Chromatography – Types and principles of paper chromatography, Thin layer chromatography and Column chromatography (ion exchange chromatography). (6 Hours)

TEXT BOOK

Palanivelu, P., (2004). *Analytical Biochemistry & Separation Techniques*, 4th edition – Madurai: 21st Century Publication.

REFERENCE BOOKS

1. Prescott, Harley & Klein, (2008). *Microbiology*, 6th edition, New York. The McGraw-Hill companies.
2. Aneja, K.R. (2003). *Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation*, 4th edition, Bengaluru: New Age International Publishers.

Course Code 20UMBS21	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO1	H	H	H	L	H	M	-	L	-	L
CO2	H	H	H	L	H	L	L	L	-	L
CO3	H	H	H	L	M	L	L	M	-	L
CO4	H	H	H	L	M	M	L	M	-	-
CO5	H	H	H	M	M	H	M	H	-	L

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B.Sc. MICROBIOLOGY

(2022 -23 onwards)

Semester II	MICROBIOLOGICAL AND ANALYTICAL TECHNIQUES	Hours/Week: 2	
Skill Enhancement Course -1		Credits: 2	
Course Code 20UMBS21N		Internal 40	External 60

COURSE OUTCOMES

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

CO1: Describe the facts, ideas, need of equipment's in microbiological and biochemical analysis. [K1]

CO2: Explain the theoretical skills behind the usage, working mechanism and its visualizing effect of the instruments. [K2]

CO3: Relate the laboratory skills to detect the problem and rectification in an efficient way. [K2]

CO4: Identify the separation techniques to recover the biomolecules from the experimental works. [K3]

CO5: Compare the efficacy of the modern day equipment with the basic lab apparatus in recent days. [K4]

UNIT I

Principles and Types of sterilization - Physical methods - radiation and temperature (high and low). Chemical methods – disinfectants. (4 Hours)

UNIT II

Essential equipment's in Microbiology - Principles and functions of Autoclave, Hot air oven, Laminar air flow chamber, Incubator, pH meter, pH pen and Colorimeter. (7 Hours)

UNIT III

Microscopy – Principles, parts and functions of Light, Dark field, Phase contrast, Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM). Methods of specimen preparation in SEM & TEM. Applications of microscopy in Microbiology.

(7 Hours)

UNIT IV

Centrifugation – Centrifugal force and principles of sedimentation, Sedimentation coefficient, Types of centrifugation – Differential centrifugation, density gradient centrifugation and Ultracentrifugation, Applications of centrifuge in Microbiology.

(6 Hours)

UNIT V

Chromatography – Types and principles of paper chromatography (Ascending & descending), Thin layer chromatography and Column chromatography (ion exchange chromatography). Applications of Chromatography in biochemical analysis. (6 Hours)

TEXT BOOK

Palanivelu, P., (2004). *Analytical Biochemistry & Separation Techniques*, 4th ed, Madurai: 21st Century Publication.

REFERENCE BOOKS

1. Prescott, Harley & Klein, (2008). *Microbiology*, 6th edition, New York. The McGraw-Hill companies.
2. Aneja, K.R. (2003). *Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation*, 4th edition, Bengaluru: New Age International Publishers.

Course Code 20UMBS21N	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO1	H	H	H	L	H	M	-	L	-	L
CO2	H	H	H	L	H	L	L	L	-	L
CO3	H	H	H	L	M	L	L	M	-	L
CO4	H	H	H	L	M	M	L	M	-	-
CO5	H	H	H	M	M	H	M	H	-	L

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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester III	MOLECULAR BIOLOGY	Hours/Week: 5	
Core Course - 6		Credits: 5	
Course Code 20UMBC31		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 and role of enzymes in molecular mechanisms of both prokaryotic & eukaryotic cells. [K1]
- CO2: explain the theoretical concepts of molecular events like organization, replication, transcription, translation and gene regulation in living organisms. [K2]
- CO3: find the sources, types of factors and its significance in maintaining all cellular activities. [K3]
- CO4: analyze the molecular underpinnings of various post processes and the functional output of genes. [K4]
- CO5: assess the knowledge about malfunction of genes due to environmental and biological factors in recent days. [K5]

UNIT I

Molecular Biology: Introduction, Central dogma of cell, one gene one enzyme hypothesis, Cistron, Muton and Recon. Genome organization in Prokaryotes and Eukaryotes. Types of DNA replication: Conservative, Semi conservative and dispersive replication, Experimental evidences for semi conservative replication - Models of replication: D-loop, Theta and Rolling circle mechanism. (12 Hours)

UNIT II

Mechanism of DNA replication in prokaryotes and eukaryotes. Enzymes involved in DNA replication: DNA polymerase, Primase, DNA helicase, SSB, Nuclease, Topoisomerase and DNA ligase. (15 Hours)

UNIT III

Transcription: Transcription in prokaryotes and eukaryotes: initiation, elongation and termination. Basic features and functions of *E.coli* RNA polymerase, Classes of RNA molecules, processing of tRNA, mRNA and rRNA in *E.coli*. RNA Polymerases of eukaryotes, Promoters, enhancer and silencer. Post transcriptional modifications - capping, polyadenylation and RNA splicing. (18 Hours)

UNIT IV

Genetic code: Salient features, and Wobble hypothesis - Translation: mechanism of protein synthesis in prokaryotes and eukaryotes: initiation, elongation and termination, factors involved in translation - Post translational modifications. (15 Hours)

UNIT V

Gene regulation: Need for gene regulation and Reasons for gene regulation. Regulation of gene expression in bacteria – Operon model: detailed study of *lac*, *trp* and *ara* operon. (15 Hours)

TEXT BOOKS

Verma P.S., & Agarwal V.K., (2002). *Concepts of Molecular Biology*, 2nd edition. New Delhi: S.Chand & Company Limited.

REFERENCE BOOKS

1. Jeyanthi, G.P., (2009). *Molecular Biology*, 1st edition. New Delhi: MJP Publishers.
2. Verma, P.S., & Agarwal, V.K., (2013). *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*, 1st edition. New Delhi: S.Chand and company (P) Ltd.
3. Watson, D., & Hopkins. H., (1988). *Molecular Biology of the Gene*, 4th edition. California: The Benjamin/cummings Publishing Company, Inc.
4. David Freifelder, (1998). *Molecular Biology*, 2nd edition. New Delhi: Narosa Publishing House.

Course Code 20UMBC31	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	M	L	M	M	L	M	L	M	-	-
CO2	H	M	L	L	L	H	L	M	-	-
CO3	M	L	M	M	L	M	L	L	-	-
CO4	H	M	L	L	L	H	L	M	-	-
CO5	H	M	H	M	M	M	M	H	-	M

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VIRUDHUNAGAR - 626 001

ALLIED BIOLOGY FOR BIOCHEMISTRY, MICROBIOLOGY AND BIOTECHNOLOGY

(2020 -2021 onwards)

Semester III	CELL BIOLOGY	Hours/Week:4+2(P)	
Allied Course		Credits:4	
Course Code 20UBIA31		Internal 25	External 75

COURSE OUTCOMES

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

- CO1 : state the basic cytological techniques. [K1]
- CO2 : explain the origin, structure and chemistry of each organelles. [K2]
- CO3 : interpret the functions of cell organelles. [K2]
- CO4 : identify the importance of cell as a basic unit of life. [K3]
- CO5 : distinguish the harmful viruses, cancer cells and living with hygienic Environment. [K4]

UNIT I

Basic techniques for cytological studies - Microscopy - Light and Electron microscope (brief account only). Sub cellular fractionations - Ultra centrifugation, Differential and Density gradient centrifugation. Cell count Method – Haemocytometer. Histochemical staining: Proteins - Mercuric Bromophenol blue method. Lipids and lipoproteins - Sudan black B method. (12 Hours)

UNIT II

Cell Structure - Prokaryotic and Eukaryotic (brief account only). Plasma membrane - Ultra structure of Fluid mosaic model, chemistry and functions (brief account only). Protoplasm – Physical and Biological properties. (12 Hours)

UNIT III

Membrane systems in Eukaryotes - Endoplasmic Reticulum, Golgi complex and Ribosomes – Origin, structure and functions. (12 Hours)

UNIT IV

Cell Organelles in Eukaryotes – Nucleus, Mitochondria, Chloroplast and Chromosomes -
Origin, structure and functions. (12 Hours)

UNIT V

Cell cycle – Cell Division – Mitosis and Meiosis – Stages and significance, Cell growth –
Oncogens, Comparative aspects of Normal and Cancerous cell. (12 Hours)

TEXT BOOKS

1. Verma, P.S. & Agarwal, V.K. (2006). *Cell Biology*, New Delhi: S. Chand & Company Ltd.,
2. Mariyakuttikan, G. (1992). *Cell Biology*, JAC Publication.

REFERENCE BOOKS

1. De Robertis, P, Nowinski, E.D and Saez, A, (2001 reprint), *Cell Biology*, WB Saunders Co, Philadelphia.
2. Debnath, M. (2008). *Molecular cell Biology*, Jaipur: Vol 2. Pointers Publishers.
3. Dalela, R.C, (1984). *Cytology*, Jai Prakash Nath & Co.
4. Rastogi, S.C. (1990). *Cell Biology*, New Delhi: Tata Mc Graw Hill Publishing Company Ltd.,

Course Code 20UBIA31	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	M	M	L	L	-
CO2	H	M	M	M	L	L	-
CO3	H	M	M	M	L	L	-
CO4	H	M	M	M	L	L	-
CO5	H	M	M	M	L	L	-

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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester III	DIAGNOSTIC MICROBIOLOGY	Hours/Week: 2	
SEC - 2		Credits: 2	
Course Code 20UMBS31		Internal 40	External 60

COURSE OUTCOMES

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

CO1: Recall the role of Microbiology laboratory for the analysis of various clinical specimens. [K1]

CO2: Illustrate the collection and handling procedures need to analyze body fluids. [K2]

CO3: Explain the diagnosis of blood and various microbial infections. [K2]

CO4: Develop the laboratory examination of bacterial infections. [K3]

CO5: analyze the routine hematological tests and current diagnostic procedures for identifying diseases. [K4]

UNIT I

Introduction to Diagnostic Microbiology – Role of Microbiology laboratory – Basic rules for working in Microbiology Laboratory. Specimen collection and Handling – Transportation of specimen – Laboratory records – Procedures for reporting of results.

(7 Hours)

UNIT II

Diagnostic Bacteriology – Collection, Handling and diagnosis of specimens: Blood (Bacteraemia), throat swab (Septic sore throat), Sputum (Tuberculosis), Stool (Dysentery).

(7 Hours)

UNIT III

Diagnosis of Mycotic infections – Specimen collection & Processing. Histopathology of fungal infection. Macroscopic : Wood's lamp – Microscopic : Wet mount in alkali & LPCB.

(5 Hours)

UNIT IV

Diagnosis of parasitic infections – Collection, Handling and preservation of faecal specimen – Laboratory examination – Gross examination – wet mount – staining – Trichome stain. (5 Hours)

UNIT V

Routine haematological tests- RBC, WBC, ESR, Haemoglobin and Platelets. Routine biochemical tests – Glucose, Blood urea, Creatinine, Cholesterol. (6 Hours)

TEXT BOOKS

1. Mukherjee, K.L., 1988. *Medical Laboratory Technology*, Volume – I to III, 2nd edition. New Delhi: Tata McGraw-Hill Publishing Company Limited.
2. Rajan, S. (2009). *Medical Microbiology*, 1st edition. New Delhi: MJP Publishers.

REFERENCE BOOKS

1. Praful Godkar, B., & Darshan Godkar, P. (2014). *Text Book of Medical Laboratory Technology*, Volume I & II, 3rd edition. New Delhi: Bhalamni Publishing House.
2. Jawetz, E., Melnic, J.L., & Adelberg, E.A. (2004). *Medical microbiology*, 21st edition. New Delhi: McGraw Hill Companies.
3. David Greenwood. (1997). *Medical Microbiology*, 15th edition. London: Churchill Livingstone publisher.
4. Patrick Murray, R. (1990). *Medical Microbiology*, 1st edition. United States: The C.V. Mosby Company.
5. Rajesh Karyakarte, P. (2005). *Medical Parasitology*, 3rd edition. Kolkata: Books and Allied (P) Ltd

Course Code 20UMBS31	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO1	H	M	M	-	M	L	L	L	-	-
CO2	H	H	H	-	M	-	L	L	-	-
CO3	M	L	H	L	H	L	M	L	-	-
CO4	M	H	M	L	M	L	M	M	-	-
CO5	H	H	H	-	M	L	M	H	-	L

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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester IV	MICROBIAL GENETICS	Hours/Week: 5	
Core Course - 8		Credits: 5	
Course Code 20UMBC41		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: relate the basics of gene, mutated gene transfer and its identification techniques. [K1]
- CO2: explain the concepts of genetics, mechanism of genetic exchanges, gene modification, damage and repair works in bacteria. [K2]
- CO3: apply the gene transfer methods in bacteria, effects of mutagenic cells and its impact in genetics research. [K3]
- CO4: apply the rectification of DNA damage, screening procedures along with gene manipulation techniques in biology to expand their experimental skills. [K4]
- CO5: assess the knowledge about creating awareness among the public regards the effect of mutations. [K5]

UNIT I

Genetics – Concepts of gene, Episomes and plasmids. DNA and RNA as a genetic material: Experimental evidences – Genetic exchange in bacteria: Transformation, Transduction (Generalized & Specialized), Co-transduction and Conjugation: F factor mediated, Hfr and Sexduction – arriving at *E.coli* genetic map. (18 Hours)

UNIT II

Mutation – kinds of Mutation: spontaneous & induced Mutation – Mutagens: Physical mutagens (ionizing and non ionizing) & Chemical mutagens (5 Bromouracil, Hydroxylamine, Alkylating agents, Intercalating agents & Nitrous acid) and their mode of action. Phenotypic effects of Mutation, Molecular basis of Mutation, Significance & Practical applications of Mutation. (12 Hours)

UNIT III

Screening procedures for the isolation of mutants: Visible mutations, Nutritious mutations, Conditional mutations. Isolation of auxotrophic mutants - Complementation - Fluctuation test and its significance - Detection of mutation by Ames test. (15 Hours)

UNIT IV

DNA damage and repair: Introduction: DNA damage, types of DNA repair and their mechanisms – Direct repair, Base excision repair, Nucleotide excision repair, mismatch repair, recombinational repair, Photoreactivation, SOS repair; DNA repair genes, role of P53 gene in DNA repair (Briefly). (15 Hours)

UNIT V

General characteristics and significance of transposable elements - modes of transposition: replicative & non replicative - Simple transposons: IS elements - Complex transposons: Tn3 - Composite transposons: Tn10 - Eukaryotic transposable elements: Ty, Retrotransposons (15 Hours)

TEXT BOOK

Verma, P.S., & Agarwal, V.K., (2013). *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*, 2nd edition. New Delhi: S.Chand and company (P) Ltd.

REFERENCES BOOKS

1. Ajoy Paul, (2011). *The Text Book of Genetics – from genes to genomes*, 2nd edition. Kolkata: Books and Allied (P) Ltd.,
2. David Friefelder, (1987). *Microbial Genetics*, 2nd edition. New Delhi: Narosa Publishing House.
3. Peter Russell, J., (2001). *Genetics*, 5th edition. California: Benjamin/ Cumming Publishing Company, Inc.

Course Code 20UMBC41	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO1	M	L	L	L	L	M	L	L	-	-
CO2	H	M	L	M	L	L	M	L	-	-
CO3	H	L	M	M	L	L	L	M	-	-
CO4	H	M	M	M	L	M	L	M	-	-
CO5	M	M	M	M	M	L	M	H	-	M

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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester IV	MAJOR PRACTICAL –II	Hours/Week: 2	
Core Course - 7		Credits: 2	
Course Code 20UMBC41P		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 techniques. [K3]
- CO2: apply the methodologies involved in the isolation, estimation and mechanism of inheritance of genetic molecules. [K3]
- CO3: make use of theoretical knowledge in an application oriented manner to carry out practical. [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: analyze the use of apparatus, chemicals and the importance of these things in molecular biology & microbial genetics experiments. [K4]

Molecular Biology

1. Laboratory safety guidelines and regulations for molecular biology and microbial genetics.
2. Extraction of DNA from fruits.
3. Isolation of Chromosomal DNA from bacteria.
4. Quantification of DNA by Diphenylamine method.
5. Separation of protein by polyacrylamide gel electrophoresis.
6. Induction of *lac* operon.

Microbial genetics

1. Isolation of spontaneous mutant: antibiotic resistant mutants (streptomycin)
2. Isolation of auxotrophic mutants by UV mutagenesis.
3. Transformation in *E.coli* (Blue white selection)
4. Genetic recombination in bacteria (Conjugation)

REFERENCE BOOKS

1. Palanivelu, P., (2004). *Analytical Biochemistry & Separation Techniques*, 4th edition. Madurai: 21st Century Publication,.
2. Murugalatha, N., (2012). *Microbiological Techniques*, 1st edition. New Delhi: MJP publishers.
3. Dubey, R.C., & Maheshwari, (2005). *Practical Microbiology*, 2nd edition. New Delhi: S.Chand & company Ltd.
4. Kanika Sharma, (2011). *Manual of Microbiology Tools and Techniques*, 2nd edition. Chennai : Ane Books pvt Ltd.
5. Aneja, K.R. (2003). *Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation*, 4th edition. Bengaluru: New Age international publishers.
6. Ameerkhuro, Preetam Raj, J.P., (2017). *Practical Bacteriology*, 1st edition. New Delhi: Narosa Publishing House.

Course Code 20UMBC41P	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO1	M	M	M	L	M	L	L	L	-	-
CO2	H	M	M	L	M	M	M	L	M	-
CO3	H	H	L	L	H	M	L	L	M	-
CO4	M	H	M	M	H	M	L	L	M	-
CO5	M	M	H	L	M	L	M	M	-	M

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VIRUDHUNAGAR - 626 001

ALLIED BIOLOGY FOR BIOCHEMISTRY, MICROBIOLOGY AND BIOTECHNOLOGY

(2020 -2021 onwards)

Semester IV	APPLIED BIOLOGY	Hours/Week: 4+2(P)	
Allied Course		Credits: 4	
Course Code 20UBIA41		Internal 25	External 75

COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 : find the applied areas of Biology. [K1]
- CO2 : learnt skills related to laboratory as well as industries based work. [K2]
- CO3 : explain the applications areas of Biology in various industries and how to become an entrepreneur. [K2]
- CO4 : solve the issues related to the applied areas of Biology. [K3]
- CO5 : analyze the applied potential areas/branches of Biology. [K4]

UNIT I

Mushroom cultivation

Introduction - morphology and reproduction of mushroom - nutritive and medicinal value of mushrooms, identification of edible and poisonous mushrooms, cultivation methods of oyster and button mushrooms. Contaminations in mushroom cultivation- fungi - green mould disease, bacteria – bacterial blotch disease and virus – die back disease. Mushroom recipes, Post harvesting technology. Economic importance of mushrooms. (13 Hours)

UNIT II

Vermiculture

Morphological features of earthworm, Cultivable species of earthworm (any five) and its significance. Vermicomposting methods (bin and windrow) and conditions required for vermicomposting. Vermicast and vermiwash, economic importance of earthworms.

(11 Hours)

UNIT III

Apiculture

Life cycle of honeybee, Ecological services of honey bees. Bee hive - natural and artificial bee hive - Newton's bee hive. Rearing appliances. Enemies and diseases of honeybee – Nosemosis, Acariasis, American fowl brood. Chemical composition, nutritional and medicinal values of honey, honey harvesting and processing, economic importance of honeybees. (11 Hours)

UNIT IV

Sericulture

Type of Silkworms, Life cycle of *Bombyx mori*. Moriculture- mulberry cultivation. Rearing operations – disinfection, hatching, brushing, bed cleaning, feeding, mounting and harvesting. Rearing appliances. Diseases of silkworm – Bebrine and Muscardine. Economic importance of silkworm. (13 Hours)

UNIT V

Horticulture

Introduction, tools of horticulture techniques, methods of vegetative propagation – cuttage – stem and leaf, layerage – simple, compound and air layering, graftage – whip and cleft. Indoor gardening - Hanging pots, Planning and layout of kitchen garden and orchards. (12 Hours)

TEXT BOOK

Kumaresan, V. (2009). *Biotechnology*, Nagercoil: Saras Publication.

REFERENCE BOOKS

1. Bahl, N. (2006). *Hand book on Mushrooms* (Ed-IV), New Delhi: Oxford and IBH Publishing Co Pvt Ltd,
2. Ravindranathan, K.R. (2003). *Economic Zoology*, New Delhi: Dominant Publishersand Distributors.
3. Sathe, T.V. (2006). *Fundamentals of Bee Keeping*, Delhi: Daya Publishing House
4. Ganga,G & Sulochana Chetty, J. (1998). *An Introduction to Sericulture (Ed-II)*, New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

Course Code 20UBIA41	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	L	L	L	L	-
CO2	H	M	M	M	L	L	-
CO3	H	M	M	M	L	L	-
CO4	M	M	M	M	L	L	-
CO5	M	M	M	M	M	L	-

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VIRUDHUNAGAR - 626 001

ALLIED BIOLOGY FOR BIOCHEMISTRY, MICROBIOLOGY AND BIOTECHNOLOGY

(2020 -2021 onwards)

Semester IV	Allied Biology Practical – I Cell Biology and Applied Biology	Hours/Week: 2	
Allied Course		Credits: 2	
Course Code 20UBIA41P		Internal 40	External 60

COURSE OUTCOMES

On completion of the course, students will be able to

- CO1: apply the basic concepts learnt in biology for the preparation of slides. [K3]
- CO2: identify and dissect the biological specimens and to draw the anatomical features. [K3]
- CO3: observe and comment on the biological specimens. [K3]
- CO4: infer about the mitotic cell division stage and completion the record work. [K3]
- CO5: analyze and categorize the functions of cell organelles and in the related area. [K4]

Botany

1. Parts and functions of compound Microscope.
2. Spotters - Plasma membrane – Fluid mosaic model.
3. Study of cell organelles - Chloroplast, Mitochondria, Endoplasmic reticulum and Golgi complex.
4. Cell division - Mitosis and Meiosis Studies
5. Histochemical localization of proteins and lipids (Pea and Coconut).
6. Morphology and anatomy of edible mushroom (*Pleurotus* and *Agaricus*)
7. Demonstration of Horticulture techniques - Whip and cleft grafting

Zoology

1. Preparation of human blood smear and identification of blood cells. Mounting of buccal epithelium.
2. Spotters - Study of Cell organelles: Ribosomes, Lysosomes, Chromosomes- Giant chromosome and Nucleus.
3. Identification and differentiation among honeybees - Queen, Worker and Drone bee.
4. Newton's hive and other appliances (Queen Excluder, Honey extractor, Bee veil and Smoker)
5. Vermicompost – Demonstration only.
6. Various developmental stages of silkworm (Chart)
7. Identification of diseased silkworms – (Pebrine, Muscardine)

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7
20UBIA41P							
CO1	H	M	H	M	L	M	L
CO2	H	M	H	M	L	M	L
CO3	H	M	H	M	L	M	L
CO4	H	M	H	M	L	M	L
CO5	H	M	H	M	L	M	L

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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester IV	MUSHROOM TECHNOLOGY	Hours/Week: 2	
Skill Enhancement Course - 3		Credits: 2	
Course Code 20UMBS41		Internal 40	External 60

COURSE OUTCOMES

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

CO1: describe the structure, cultivation, diseases and importance of mushrooms. [K1]

CO2: demonstrate mushroom cultivation strategies, disorders and economics of mushroom production. [K2]

CO3: explain the various steps in the cultivation and management of edible mushrooms and its importance. [K2]

CO4: develop skills in the preparation of compost, spawn and Post harvest technology. [K3]

CO5: analyze various biotic and abiotic disorders of mushrooms. [K4]

UNIT I

Introduction – History of Mushroom cultivation – Morphology of Mushroom – Life cycle of Mushroom – Identification of Mushroom – Essential growth factors for mushroom.

(6 Hours)

UNIT II

Mushroom cultivation strategies – Preparation of compost – Preparation of spawn – Casing – Harvesting – Post harvest technology: Preservation and Processing of Mushroom.

(8 Hours)

UNIT III

Cultivation of Edible Mushrooms – *Agaricusbisporus*, *Pleurotusspp.*, *Volvariella sp.*

(6 Hours)

UNIT IV

Mushroom diseases: Bubble disease, Truffle disease, Bacterial blotch disease – Abiotic disorders of Mushrooms – Insect pests of Mushrooms. (5 Hours)

UNIT V

Importance of Mushrooms – Nutritional values and Medicinal values of Mushrooms – Mushroom recipes – Mushroom soup and Mushroom tikka. Mushroom marketing. (5 Hours)

TEXT BOOK

1. Pathak, V.N., NagendraYadav&Maneesha Gaur,(2000). *Mushroom Production and Processing Technology*, 2nd edition. New Delhi:Agrobios Publications.

REFERENCE BOOKS

1. Nita Bahl, (2015). *Handbook on Mushrooms*, 4th edition. New Delhi: Oxford & IBH Publishing.
2. Aneja,K.R. (2003).*Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation*, 4th edition. Bengaluru: New Age International Publishers.

Course Code 20UMBS41	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO1	H	M	L	L	L	L	L	L	-	-
CO2	M	H	M	L	M	L	L	L	-	-
CO3	H	M	M	M	M	L	L	M	L	-
CO4	H	H	M	L	M	M	L	M	L	-
CO5	M	L	M	L	L	H	M	H	-	-

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B.Sc. MICROBIOLOGY

(2022 -23 onwards)

Semester IV	MUSHROOM TECHNOLOGY	Hours/Week: 2	
Skill Enhancement Course - 3		Credits: 2	
Course Code 20UMBS41N		Internal 40	External 60

COURSE OUTCOMES

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

CO1: describe the structure, cultivation, diseases and importance of mushrooms. [K1]

CO2: demonstrate mushroom cultivation strategies, disorders and economics of mushroom production. [K2]

CO3: explain the various steps in the cultivation and management of edible mushrooms and its impacts. [K2]

CO4: develop skills in the preparation of compost, spawn, disease management and recipes. [K3]

CO5: analyze various beneficial and harmful aspects of Mushrooms. [K4]

UNIT I

Introduction – History of Mushroom cultivation – Morphology of Mushroom - Life cycle of Mushroom – Identification of Mushroom – Essential growth factors for mushroom.

(6 Hours)

UNIT II

Mushroom cultivation strategies – Preparation of compost – Preparation of spawn – Casing – Harvesting – Post harvest technology: Preservation and Processing of Mushroom.

(8 Hours)

UNIT III

Cultivation of Edible Mushrooms – *Agaricus bisporus*, *Pleurotus* spp., *Volvariella* sp

(6 Hours)

UNIT IV

Mushroom diseases: Bubble disease, Truffle disease, Bacterial blotch disease – Abiotic disorders of Mushrooms – Insect pests of Mushrooms – Sciarids, Phorids, Spring tails, Cecid, Mites and Nematodes – Disease control: Fungicide and Insecticides. (5 Hours)

UNIT V

Importance of Mushrooms – Nutritional values and Medicinal values of Mushrooms – Mushroom recipes – Mushroom soup, Mushroom pickle and Mushroom tikka. Mushroom marketing. (5 Hours)

TEXT BOOK

1. Pathak, V.N., NagendraYadav&Maneesha Gaur,(2000). *Mushroom Production and Processing Technology*, 2nd edition. New Delhi:Agrobios Publications.

REFERENCE BOOKS

1. Nita Bahl, (2015). *Handbook on Mushrooms*, 4th edition. New Delhi: Oxford & IBH Publishing.
2. Aneja,K.R. (2003). *Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation*, 4th edition. Bengaluru: New Age International Publishers.

Course Code 20UMBS41N	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO1	H	M	L	L	L	L	L	L	-	-
CO2	M	H	M	L	M	L	L	L	-	-
CO3	H	M	M	M	M	L	L	M	L	-
CO4	H	H	M	L	M	M	L	M	L	-
CO5	M	L	M	L	L	H	M	H	-	-

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B.Sc. MICROBIOLOGY

(2022 -23 onwards)

Semester IV	Internship / Field Project (2020 -21 onwards)	Hours/Week: 0
PART IV		Credit: 1
Course Code 20UMBI41G		Internal 100

COURSE OUTCOMES

On completion of the Internship/Field Project, students will be able to

- CO1: relate their theoretical insights with hands-on experience. [K3]
- CO2: develop technical skills to their respective field of study .[K3]
- CO3: demonstrate the attributes such as observational skills, team spirit and interpersonal skills built through site visits. [K3]
- CO4: exhibit the written communication skills acquired through internship/field project. [K3]
- CO5: analyze the observations and results and communicate their academic and technological knowledge appropriately oral means. [K4]

GENERAL INSTRUCTIONS:

- **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 a project that involves conducting surveys inside/outside the college premises and collection of data from designated communities or natural places.
- Internal Assessment only.

Course Code 20UMBI41G	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	M	M	M	M	H	-
CO2	H	M	M	M	M	H	
CO3	H	M	-	-	-	H	
CO4	H	H	M	M	-	M	H
CO5	H	M	H	H	M	-	

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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester V	CLINICAL MICROBIOLOGY	Hours/Week: 4	
Core Course – 7		Credits:4	
Course Code 20UMBC51		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: describe the conceptual basis of microorganisms by their pathogenic mechanisms in which they cause disease in human body. [K1]
- CO2: categorize the association of medically important microorganisms with human host as normal and pathogenic flora. [K2]
- CO3: apply the epidemiology of infectious agents with the identification of clinical Manifestations. [K3]
- CO4: analyze the phases of infection, lifecycle and treatment strategies of infectious agents. [K4]
- CO5: evaluate procedures for the therapeutic management and contemporary diagnosis of pathogenic microbes. [K5]

UNIT I

The History of Infectious Diseases: Human and microbe interactions – Normal flora in human body- Mechanism of pathogenesis- Host–defense mechanisms. Epidemiology of infectious diseases – Nosocomial infections. (10 Hours)

UNIT II

Bacterial diseases: Cultural and Biochemical characteristics, Transmission, diagnosis, Clinical symptoms and Treatment of bacterial diseases- Tuberculosis, Cholera, Typhoid, Syphilis, UTI (*E.coli*), Staphylococcal and Streptococcal diseases. (13 Hours)

UNIT III

Viral diseases: Etiology, Prophylaxis, Clinical symptoms and Treatment for human viral diseases - Rabies, Hepatitis, Poliomyelitis, Dengue Fever, Flu Fever (H1N1) & COVID-19. (12 Hours)

UNIT IV

Fungal diseases: Superficial mycoses: Pityriasis versicolor & Piedra - Cutaneous mycoses: Dermatomycosis - Subcutaneous mycoses: Sporotrichosis & Mycetoma - Systemic mycoses: Histoplasmosis & Coccidioidomycosis - Opportunistic mycoses: Aspergillosis and Candidiasis. (12 Hours)

UNIT V

Protozoan diseases: Life cycle, diagnosis and treatment of protozoan diseases – Amoebiasis, Malaria, Filariasis, Kala-azar and Trypanosomiasis, Ascariasis & Enterobiasis. (13 Hours)

TEXT BOOKS

1. Rajan, S. (2021). *Medical Microbiology*, 2nd edition. New Delhi: MJP Publishers.
2. Rajesh Karyakarte, P. (2012). *Medical Parasitology*, 3rd edition. Kolkata: Books and Allied (P) Ltd.

REFERENCE BOOKS

1. Jawetz, E., Melnick, J.L., & Adelberg, E.A. (2019). *Medical microbiology*, 28th edition. New York: McGraw Hill Companies.
2. David Greenwood. (2012). *Medical Microbiology*, 18th edition. London: Churchill Livingstone publisher.
3. Patrick Murray, R. (2015). *Medical Microbiology*, 8th edition. United States: The C.V. Mosby Company.
4. Ananthanarayanan, R., & Jayaram Panicker, C.K. (2020). *Textbook of Microbiology*, 11th edition. Hyderabad: Orient Longman.

Course Code	PO 1		PO 2	PO 3		PO 4		PO 5	PO 6	PO 7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO6	PSO7
CO 1	H	M	M	L	L	M	H	L	M	M
CO 2	H	H	H	M	L	L	H	L	L	M
CO 3	M	H	H	L	L	L	H	L	M	M
CO 4	M	H	H	H	H	H	H	L	M	L
CO 5	M	M	H	L	H	L	H	L	L	L

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M.M.FatimaMansoor
Course designer



V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY (2020 -21 onwards)

Semester V	IMMUNOLOGY	Hours/Week: 4	
Core Course – 8		Credits:4	
Course Code 20UMBC52		Internal 25	External 75

COURSE OUTCOMES

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

CO1: recall the principles and concepts of Immunology. [K1]

CO2: demonstrate the basis of immune mechanism to infection, autoimmune disease, hypersensitivity, transplantation and tumor. [K2]

CO3: apply the knowledge underlying the components of immune system and its adverse effects. [K3]

CO4: analyze the key cellular and molecular components of immune system and how they interact to both prevent and cause diseases. [K4]

CO5: interpret the basic techniques for identifying antigen antibody interactions and various immunological disorders. [K5]

UNIT I

Basic concepts in immunology (History), overview of the Immune system Humoral and cell mediated immune response –principles of innate and acquired immunity – Cells and organs of the immune system. (13 Hours)

UNIT II

Antigen and their characteristics – factors influence the antigenicity. Haptens and Adjuvants. Antibody - structure, types and characterization. Monoclonal antibodies– Introduction, production and uses. Antigen- Antibody reactions- Precipitation(Ouchterlony double immunodiffusion) agglutination(Blood typing) and Immunofluorescence. (12 Hours)

UNIT III

B cell maturation, activation and differentiation. Major Histocompatibility complex (MHC) – antigen processing and differentiation. T cell maturation, activation and differentiation- complement system – Classical and alternative pathway. (13 Hours)

UNIT IV

Hypersensitivity reaction – Types and mechanism. Auto immunity – induction of autoimmunity, mechanism of tissue damage in autoimmunity, autoimmune diseases – Rheumatoid arthritis and autoimmune thyroiditis. Immune tolerance. Vaccines. (12 Hours)

UNIT V

Transplantation immunology: Basics of graft rejection & acceptance, tumor antigens, immune response to tumor. Tissue typing – HLA. Clinical transplantation- kidney and eye transplantation. (10 Hours)

TEXT BOOK

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

REFERENCE BOOKS

1. Roitt, I.M., (2017). *Essential of immunology*, 13th edition. New Jersey: Blackwell scientific publication.
2. Tizard, R. (2007). *Immunology*, 4th edition. United States: Thomson organization Ltd.
3. Robert Coleman, M. (1992). *Fundamental Immunology*, 2nd edition. New York: WCB Publishers.
4. Haleem Khan, A.A. (2011). *Textbook of Immunology*, 1st edition. New Delhi: Ane Books Pvt. Ltd.

Course Code (20UMBC12)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	L	H	M	M	L	H	M	M	L
CO 2	H	M	M	M	L	L	M	M	L	-
CO 3	H	M	M	L	L	L	H	L	-	-
CO 4	H	L	H	L	L	L	H	M	M	L
CO 5	M	H	H	L	H	H	H	M	M	H

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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester V	BIOINFORMATICS	Hours/Week: 4	
Core course – 9		Credits:4	
Course Code 20UMBC53		Internal 25	External 75

COURSE OUTCOMES

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

CO1: relate the basic parts of computer and its significance in data abstraction

from biological data bases. [K1]

CO2: Explain the type's biological database, tools used to integrate the alignments

and data interpretation for macromolecules. [K2]

CO3: Predict the methodologies used in bioinformatics and its application in recent day's

research activities. [K3]

CO4: Compare the structure related prediction as well as the evolutionary aspects

of analysis for interpreting the results in an accurate and meaningful way. [K4]

CO5: Compile the overall techniques for the betterment of human survival and \

also develop skills about creating new bioinformatics tools. [K5]

UNIT I

History and development of computers; generations of computers, Input devices: Keyboard and mouse, Modern input devices: OMR, MICR, Bar code reader, Output devices: Visual display unit (LCD & LED), Printers: (Dot Matrix and Laser), Storage devices: primary memory (RAM and ROM), Secondary memory: Magnetic storage (Hard disk), Optical storage: (CD & DVD), Solid state storage: (Pen drive & memory card). (10 Hours)

UNIT II

Bioinformatics: Introduction, Scope and objectives, Introduction of Database related programs (brief description): DBMS, RDBMS & SQL and Classification of biological databases (generalized & specialized). Internet basics: World Wide Web, HTTP, HTML, FTP, Electronic mail and Intranet, Operating system: Windows Xp. (10 Hours)

UNIT III

Nucleotide sequence databases: NCBI - GenBank, EMBL and DDBJ, Sequence submission methods and tools (Bankit), sequence retrieval systems (Entrez), Pairwise alignment: gap penalty, scoring matrices, alignment methods (Dot plot & Dynamic programming), Multiple sequence alignment (Progressive alignment), Useful programs: BLAST, FASTA and Clustal-W, Significance of sequence alignments. (15 Hours)

UNIT IV

Protein databases: Sequence file formats and tools: PIR, Swiss Prot, Tr-EMBL and Expasy, Derived databases: Prosite, Pfam and PRINTS. Protein structural databases: PDB, Protein structural classification databases: CATH and SCOP, Secondary structure prediction: Chou Fasman, GOR and Neural network methods. (15 Hours)

UNIT V

Carbohydrate structure database: CCSD, Glycome DB, Metabolic databases: KEGG, Specialized database: EST & BRENDA, Literature Data Bank (PubMed). Evolutionary analysis: Cladistic methods (Maximum parsimony and Maximum likelihood) and Phenetic methods (UPGMA and Neighbor Joining). Phylogenetic analysis tools - Phylip. (10Hours)

TEXT BOOKS

1. Sundaralingam, R., and Kumaresan, V. (2008). *Bioinformatics*, 1st edition. Nagarcoil: Saras Publication.
2. Ignacimuthu, S.J. (2009). *Basic Bioinformatics*, 1st edition. New Delhi: Narosa Publishing House.
3. Rajaraman, V. (2010). *Fundamentals of computers*, 5th edition. New Delhi: PHI Learning Pvt Ltd

REFERENCE BOOKS

1. Teresa Attwood, K., & David parry smith, J. (2006). *Introduction to Bioinformatics*, 1st edition. London: Dorling Kindersley Pvt, Ltd.
2. Kuppaswamy, C. (2006). *Bioinformatics*, 1st edition. New Delhi: Dominant Publishers.
3. Subramanian, C. (2006). *A textbook of bioinformatics*, 8th edition. New Delhi: Dominant Publishers.
4. Srinivasa Rao, D. (2010). *Bioinformatics*, 1st edition. Hyderabad: Biotech Pharma publications.
5. Ignacimuthu, S.J. (2009). *Basic Bioinformatics*, 1st edition. New Delhi: Narosa Publishing House.
6. <https://www.wikipedia.org>

Course Code (20UMBC12)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	L	M	M	H	L	L	H	M	L
CO 2	M	M	L	L	M	M	M	L	L	L
CO 3	H	M	H	L	M	H	H	L	L	L
CO 4	M	M	L	L	M	M	M	M	L	M
CO 5	M	M	L	L	M	L	L	L	L	M

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M.Vijayalakshmi
Course designer



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VIRUDHUNAGAR - 626 001

B.Sc. BIOTECHNOLOGY

(2020 - 21 onwards)

Semester V	GENOMICS AND PROTEOMICS	Hours/Week: 4	
DSEC- 1		Credits: 4	
Course Code 20UBOE51		Internal 25	External 75

COURSE OUTCOMES

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

CO1: Recall the concept of genomes, proteomes and meta genomes. [K1]

CO2: Understand the methods used in the sequencing of genomes, proteomes and meta genome. [K2]

CO3: Apply the knowledge gained from the history and genome projects. [K3]

CO4: Analyse genome and proteome structure organization using tools and software. [K4]

CO5: Predict the structure of genomes, proteomes and meta genomes. [K5]

UNIT I

Introduction - definition and history, Types of Genomics; structural genomics, functional genomics, and comparative genomics. Structure and organization of prokaryotic and eukaryotic genomes. (12 Hours)

UNIT II

Genome sequencing: Microbial genome sequencing project; viral and bacterial, eukaryotic genome sequencing; human genome project. Methods of genome sequencing; Sanger's method, next generation sequencing, whole genome shotgun sequencing, expressed sequencing tag. (12 Hours)

UNIT III

Genome assembly and gene prediction; trimming of vector sequences and sequence quality determination, genome finishing, gene prediction using Algorithms and software, single nucleotide polymorphisms. (12 Hours)

UNIT IV

Proteomics: definition and types of proteomics; Expression proteomics, structural proteomics and functional proteomics, protein structure databases, protein structure prediction. (12 Hours)

UNIT V

Meta genomics: definition and history, meta genomic projects, nucleic acid extraction and enrichment strategies, applications of meta genomics. (12 Hours)

REFERENCE BOOKS

1. S.K. Aggarwal, (2018). Genomes, Med Tech.
2. R.C. Dubey, (2014). Advanced Biotechnology, S. Chand & Company Pvt. Ltd. First edition.
3. S.C. Rastosi, (2014). Molecular Biology, CBS Publishers & Distributors Pvt. Ltd.
4. S.B. Primrose and R.M. Twyman, (2007). Principles of Gene Manipulation and Genomics, Seventh Edition, Blackwell Publishing.
5. Anthony J.F. Griffiths, Susan R. Wessler, Sean B. Carroll, John Doebley, (2012). Introduction To Genetic Analysis -Tenth edition, W.H. Freeman and Company.

CourseCode 20UBOE51	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	PSO5	PSO6	PSO7
CO1	H	-	H	M	M	L	H	M	-	-
CO 2	H	H	M	H	L	H	H	M	L	-
CO 3	H	-	M	H	H	H	M	M	L	M
CO 4	M	H	M	H	M	M	M	H	-	-
CO 5	H	M	M	H	M	H	M	H	M	L

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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2020 -2021 onwards)

Semester V	VIROLOGY	Hours/Week: 4	
DSEC – 2		Credits:4	
Course Code 20UMBE52		Internal 25	External 75

COURSE OUTCOMES

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

CO1: Describe the diversity of virus structures and various molecular techniques used by viruses to infect and replicate in host cell. [K1]

CO2: Explain the molecular details of the life cycle of pathogenic virus and identify the implications for human disease. [K2]

CO3: Demonstrate the interaction of virus-host and mechanism of diseases to develop antiviral and phage therapy. [K3]

CO4: Compare and contrast the replication mechanisms used by pathogenic viruses for understanding Immunization . [K4]

CO5: Evaluate the pharmacological importance of viruses in treating bacterial infections and vaccination. [K5]

UNIT I

Introduction-History-Viral diversity-Classification, General structure and composition of viruses-capsid, viral envelope and nucleic acids. Cultivation, purification and assay of viruses. (12 Hours)

UNIT II

Animal viruses- Introduction, structure and replication of Pox, Adeno, Rhabdo, Influenza and HIV. Prions and Viroids. (12 Hours)

UNIT III

Plant viruses – Introduction, structure and replication of TMV, Potyvirus, CaMV and Rice tungrovirus. Transmission of plant viruses. Symptoms of plant virus infections. (12 Hours)

UNIT IV

Bacteriophages – Introduction- lytic and lysogenic cycle. Virulent phages- structure and replication of T4 and ϕ X174. Temperate phage- lysogenic replication of Lambda, choice between lytic and lysogenic cycle. Filamentous phage- M13. (12 Hours)

UNIT V

Control of viral diseases- prevention, immunization and treatment of viral diseases. Antiviral therapy- Acyclovir and Amantidine. Phage therapy- commercial production and treatment for bacterial infections. (12 Hours)

TEXT BOOK

1. Dr.Dubey,R.C.,&Dr. Maheswari,D.K. (2014). *A textbook of microbiology*, 4th edition. New Delhi: S. Chand & company pvtLtd.

REFERENCE BOOKS

1. Saravanan, P. (2006). *Virology*, 1st edition. New Delhi: MJP Publishers.
2. Sawant, K.C. (2015). *Virology*, 1st edition. New Delhi: Dominant publishers.
3. Prescott, Harley & Klein. (2010). *Microbiology* 10th edition. New York: The McGraw-Hill Companies.
4. Sri Ramkumar,S.R. (2016). *Basic concepts of Microbiology and Pathology*, 1st edition. Nagercoil: Nanjil book Publishers

Course Code (20UMBE52)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	M	M	H	H	L	M	M	L	-
CO 2	H	L	L	M	L	L	L	L	M	M
CO 3	H	M	H	L	L	M	L	L	M	-
CO 4	H	H	L	H	M	M	M	M	H	M
CO 5	H	M	M	H	L	M	L	L	M	L

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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2020 – 2021 onwards)

Semester V	NANOBIOTECHNOLOGY	Hours/Week: 4	
DSEC – 3		Credits: 4	
Course Code 20UMBE53		Internal 25	External 75

COURSE OUTCOMES

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

CO1: Relate the basic concepts of Nanotechnology- Biotechnology for biomedical application. [K1]

CO2: Understand the production and Characterization techniques of nano materials and their influences on human health. [K2]

CO3: Apply the nano medicine in drug delivery based on classification and assess their environmental risks. [K3]

CO4: Analyse the characterized nanomaterials in treating diseases and their impact in environment. [K4]

CO5: Interpret the application of classified nano materials and comment their toxic effects. [K5]

UNIT I

History and Scope of Nanotechnology- Basics- Nanobiotechnological devices: Nanorobot and Nanoshell. Nanoparticle – Introduction – Morphology, Classification and Properties of Nanoparticles (12 Hours)

UNIT II

Nanoparticles: Carbon nanotubes, Dendrimers, Quantumdots, Gold nanoparticles, Silvernanoparticles, liposomes and their application- Synthesis of Nanoparticles- physical, chemical method and Biological Sources: Plants, bacteria and Fungi. (12 Hours)

UNIT III

Characterisation of Nanoparticles: Ultra Violet Spectroscopic analysis, X-ray diffraction and energy dispersive, Scanning Electron Microscope, Transmission Electron Microscope, Fourier Transform Infrared Spectroscopy, Atomic Force Microscopy.(12 Hours)

UNIT IV

Biomedical application of Nanoparticles – Drug delivery System: Dendrimers, Hydrogel - Quantum dot technology in Cancer Treatment and cell repair Machines. Nanocomposite: uses and Application .Biosensor - Diagnostic Imaging techniques. (12 Hours)

UNIT V

Health and Environmental impacts of Nanotechnology: Routes of entry of Nanomaterials in the body - Toxic mechanisms - Toxicological Health Effects by nanoparticles – Integrated concept of risk assessment - Environmental implications of nanoparticles. (12 Hours)

TEXT BOOKS

1. SubbiahBalaji. (2010).*Nanobiotechnology*, 1stedition.New Delhi: MJP Publishers.
2. ManasiKarkare. (2017).*Nanotechnology*, 1stedition.New Delhi: I.K.International Publishing House Pvt. Ltd.

REFERENCE BOOKS

1. Shanmugam, S. (2011).*Nanotechnology*, 1stedition.New Delhi: MJP Publishers.
2. Pradeep, T. (2013).*Nano: The essentials*, 1stedition.New York: McGraw Hill Publications.

3.[file:///C:/Users/microbiology/Downloads/\[libribook.com\]%20Nanotechnology%20in%20Cancer%20Management%201st%20Edition.Pdf](file:///C:/Users/microbiology/Downloads/[libribook.com]%20Nanotechnology%20in%20Cancer%20Management%201st%20Edition.Pdf)

Course Code (20UMBE53)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	L	H	L	M	H	M	M	L	M
CO 2	H	L	M	L	H	M	L	M	-	-
CO 3	H	M	M	H	M	H	L	L	-	-
CO 4	M	M	M	L	M	M	L	L	-	-
CO 5	L	L	M	M	L	H	M	L	L	-

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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2020 – 2021 onwards)

Semester V	PROJECT	Hours/Week: 0
Project		Credits: 1
Course Code 20UMBC5PR		Internal 100

COURSE OUTCOMES

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

CO1: Identify the problems which are related to microorganisms and frame objective of the study in consultation with mentor. [K3]

CO2: Make use of appropriate Microbiological methods and lab equipment. [K3]

CO3: Build the research skills involved in expectation of Microbiological proposal. [K3]

CO4: Analyze the relevant experiments, conduct experiments and record data. [K4]

CO5: Interpret the research report and its oral demonstrations. [K5]

Students are expected to select a project in the field of Microbiology, Biotechnology and related interdisciplinary fields. Two students can do one project. Minimum pages for project report should be 20 pages. Two typed copies of the report on the completed project will be submitted to the Controller of Examination through the Head of the Department in the month of November during V Semester. Evaluation will be done internally.

Project work & Report -60 Marks

Presentation & Viva- Voce - 40 Marks

Course Code (20UMBS51)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	M	H	M	-	M	L	-	L	M	M
CO 2	M	H	H	-	H	L	-	-	L	M
CO 3	M	M	H	-	L	L	-	L	M	M
CO 4	L	H	L	-	L	L	-	L	M	M
CO 5	L	H	M	-	M	H	-	H	M	M

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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester V	COSMETIC MICROBIOLOGY	Hours/Week: 2	
Skill Enhancement Course – 4		Credits:2	
Course Code 20UMBS51		Internal 40	External 60

COURSE OUTCOMES

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

CO1: relate the basic principles associated with cosmetic manufacturing using physical, chemical and biological properties of cosmetic agents. [K1]

CO2: understand the process from sanitation to dispensing along with monitoring regimes of cosmetic plant. [K2]

CO3: explain the methodologies to evaluate new and existing products quality by laboratory tests for maintaining the stability. [K2]

CO4: apply the knowledge of sources, cosmetic contamination and the method to overcome the impacts by using cosmetic regulations. [K3]

CO5: analyze new ideas to satisfy the needs of cosmetics by implementing eco-friendly approaches in cosmetic formulation. [K4]

UNIT I

History, scope and need of cosmetic microbiology, Natural Cosmetic Agents and its antimicrobial property: garlic, neem, turmeric, thulasi and aloe vera. Plant enzymes in cosmetics preparation. (5 Hours)

UNIT II

Sanitization basics: detergents, surfactants, chemical and physical sanitizers for sanitizing the equipment, Sanitization procedure: cleansing in manufacturing, filling and waste disposal areas, personal hygiene, raw material handling, sanitary design of air, water systems and monitoring. (5 Hours)

UNIT III

Manufacturing of cosmetics: Physical & Chemical properties of Cosmetics agents- Surface active agents, pH stabilizers, Hydrocolloids, Talc, color additives: definition, classification, properties and its significance, Preservatives: Types, Ideal characters and factors influencing the effectiveness of preservatives. (10 Hours)

UNIT IV

Contamination of cosmetic products: *Pseudomonas*, *Staphylococcus* and *Clostridia*, Quality control measures in cosmetic preparation: Microbial resistance, Critical control point, and methods of detection of preservatives (PET). Significance of Biosensors in cosmetic industry. Laws and safety regulations. (6 Hours)

UNIT V

Dispensing of cosmetic formulations: Importance of different materials for containers and closures, Packaging of cosmetic product and labeling, appropriate recycling and disposal methods, Green packaging. (4 Hours)

TEXT BOOK

1. Daniel Brannan, K. (2004). *Cosmetic Microbiology*, A practical Hand book, Florida: CRC press.

REFERENCE BOOKS

1. Philip A. Geis, Taylor and Francis. (2021). *Cosmetic Microbiology A Practical Approach*, 3rd edition. New York: Taylor & Francis, CRC press.
2. Shailendra Saraf, Swarnlata Saraf. (2015). *Cosmetics: A practical manual*, 3rd edition. Hyderabad: PharmaMed Press.
3. Donald Orth, (2009). *Insights into Cosmetic Microbiology Hardcover*, 1st edition, Chicago: Allured Pub Corporation.
4. <https://www.wikipedia.org>

Course Code (20UMBS51)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	L	H	L	M	L	M	L	L	L
CO 2	M	L	M	L	H	M	M	M	M	L
CO 3	H	M	M	H	M	M	L	L	M	L
CO 4	H	M	M	L	M	L	L	L	M	M
CO 5	H	L	M	M	L	L	L	L	L	M

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B.Sc. MICROBIOLOGY

(2020 – 2021 onwards)

Semester V	FOOD MICROBIOLOGY	Hours/Week: 2	
Skill Enhancement course - 5		Credits:2	
Course Code 20UMBS52		Internal 40	External 60

COURSE OUTCOMES

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

CO1: relate the basics of food spoilage and its effect in human as well as in food factory. [K1]

CO2: explain the significance of various factors involved in survival and retardation of food borne microbes. [K2]

CO3: understand the role of microbes and its' detection in food packaging process. [K2]

CO4: find the method of food quality and nutrient enhancement by controlling the Microbes. [K3]

CO5: analyze the methodology to overcome recent day's obstacles in food processing Industry. [K4]

UNIT I

Introduction to Food Microbiology: Scope of Food microbiology, General characteristics of Microorganisms in Food. Food as substrate for microorganisms: Intrinsic – pH, water activity, Redox potential, nutrient content, food additives and bio preservatives-bacteriocins. (5 Hours)

UNIT II

Extrinsic factors affecting growth and survival of microorganisms in foods: High temperature – classification of thermal processes (D value, Z value and F value), Heat penetration - Pasteurization, Canning & Baking. Low temperature – concepts of cold sterilization, changes during Freezing, storage, thawing, Lyophilization& Cryogenic freezing. Radiation – ionizing & non-ionizing radiation. Drying – sun drying & dehydration methods, Treatments of foods before and after drying. (7Hours)

UNIT III

General principles underlying food spoilage: Sources, causes of deterioration and preventing methods of food spoilage in various foods like vegetables, bread, egg, meat, milk. (8 Hours)

UNIT IV

Food borne infection: Bacterial (Salmonellosis) and Viral (hepatitis). Food borne intoxication: Bacterial (Botulism and Staphylococcal food poisoning), Mycotoxin (Patulin). Applications of Probiotics and prebiotics. (5 Hours)

UNIT V

Methods for detection of microorganisms in food: Physical, Chemical & Immunological assays. Food quality evaluation: Total quality control and total quality management. Microbiological quality standards in food: India - FDA, Agmark & FSSAI. (5 Hours)

TEXT BOOK

Frazier, WC., & Westhoff, DC. (2012). *Food Microbiology*, 4th edition. New York: McGraw-Hill.

REFERENCE BOOKS

1. Adams, MR., & Moss, MO. (2005). *Food Microbiology*, 2nd edition. Bengaluru: New age International Pvt Ltd publications.
2. Jay, J.M. (2000). *Modern Food Microbiology*, 4th edition. New York: Aspen publishers.
3. Bibek Ray, (2005). *Fundamental Food Microbiology*, 3rd edition, New York: CRC press.
4. <https://www.wikipedia.org>

Course Code (20UMBS52)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	L	M	H	H	H	L	M	L	M
CO 2	H	M	M	H	H	M	L	M	L	M
CO 3	H	M	H	M	M	L	M	L	L	L
CO 4	M	L	L	L	L	M	L	L	L	L
CO 5	L	M	M	M	M	M	L	L	L	M

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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2020 – 21 onwards)

Semester V	BIOCONTROL	Hours/Week: 0
Extra Credit Course		Credits: 2
Course Code 20UMB051		Internal 100

COURSE OUTCOMES

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

CO1: explain the history, theory, practice and science of biological control.

CO2: evaluate the scientific studies and concepts related to biological control.

CO3: assess the current and future roles of biological control with in context of agricultural and natural ecosystem.

CO4: understand the types of biological control agents of insects and their biology.

CO5: apply the ecological principles of plant pests by parasitoids, predators and entomopathogenic nematodes to manage pest problems.

UNIT I

Introduction to biological control- Definition, need of biocontrol agents. Predators, parasitoids and Pathogens as biocontrol agents- Importation, Conservation and augmentation. Economics of biocontrol.

UNIT II

Biopesticides- Microbes used in biopesticides. Bacterial pesticides – *Bacillus thuringiensis* and *Pseudomonasaeruginosa* as biocontrol agents, benefits and limitations.

UNIT III

Viral insecticides -NPV and CPV as biocontrol agents, benefits and limitations. Fungal pesticides – *Beauveria bassiana* and *Metarhiziumanisopliae* as biological control agents, potentials and limitations.

UNIT IV

Microsporidia –Nosemapyrausta as biocontrol agent, potentials and limitations. Insect parasitic nematodes – Steinernema and heterorhabditis as biopesticides ,benefits and limitations. Protozoa in insect control. Biological control of weeds – Bioherbicides.

UNIT V

Integrated pest management – Definition, Need for IPM, Methods of IPM, Components and benefits of IPM. Genetic engineering in biological control.

TEXTBOOK

1. Chaube, H.S., & Pundhir, V.S. (2005). *Crop diseases and their management*, 1st edition. New Delhi: Prentice Hall of India Pvt. Ltd.

REFERENCE BOOKS

1. Van Driesche, G., & Bellows, Jr. TS. (1996). *Biological control – Guide to its applications*, New York: Springer.
2. Ronald Atlas, M., & Richard Bartha. (1998). *Microbial Ecology*, 4th edition. San Francisco: Benjamin/Cummings Science Publishing.
3. Sharma, P.D. (2006). *Plant Pathology*, 1st edition. New Delhi: Narosa Publishing House Pvt. Ltd.
4. Helmut Fritz Van Embden, & Service, M.W. (2004). *Pest and vector control*, Chennai: Cambridge University Press.

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B.Sc. MICROBIOLOGY (2020 -21 onwards)

Semester VI	SOIL&AGRICULTURAL MICROBIOLOGY	Hours/Week: 5	
Core Course – 15		Credits: 4	
Course Code 20UMBC61		Internal 25	External 75

COURSE OUTCOMES

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

CO1: describe the distribution and multifarious role of soil microbes in agriculture improvement. [K1]

CO2: discuss set of skills to recognize harmful and beneficial microbes to manipulate transgenic plants. [K2]

CO3: interpret the inter relationship of soil with microbes in determining soil fertility, plant diseases and genetic manipulation. [K3]

CO4: organize agricultural system by microbial communities and build pathway for sustainable agriculture. [K4]

CO5: appraise the significance of biotechnological methods and current research in agriculture. [K5]

UNIT I

Soil Microbiology: Classification of soil - physical and chemical properties of soil - structure of soil - Stages of Soil formation. Historical developments in soil microbiology – Contributions of Beijerinck, Winogradsky, Fleming and Waksman. Soil as a nutrient for microorganisms - Factors affecting the activities of soil microorganisms. Enumeration of soil microorganisms: Quantitative (direct microscopic method) & Qualitative (slide technique).

(15 Hours)

UNIT II

Microbial interactions: mutualism, commensalism, amensalism, synergism, parasitism, predation and competition. Plant microbe interactions: Rhizosphere,

Phyllosphere & Mycorrhizae - Biological nitrogen fixation: Symbiotic (*Rhizobium*) & asymbiotic (*Azotobacter*) association.

(13 Hours)

UNIT III

Plant pathology – Mechanism of pathogen establishment and symptoms – Plant diseases caused by Bacteria: Bacterial blight of rice (*Xanthomonasoryzae*), Wilt of potato (*Ralstoniasolanacearum*) & Fire blight of apple (*Erwiniaamylovora*). Virus: Bunchy top of banana (*Banana bunchy top virus*), Nematode: Root knot of brinjal(*Meloidogyne incognita*).
(16 Hours)

UNIT IV

Plant pathology: Fungi - Foot rot of papaya (*Pythiumaphanidermatum*), Wheat stem rust (*Pucciniagraminis*)&Tikka in ground nut (*Cercosporapersonata*). Biofertilizers –Mass production of *Rhizobium*, *Azotobacter*, BGA, *Frankia*, AM, and *PGPR*. Standard parameters and Quality control guidelines of biofertilizers.
(16 Hours)

UNIT V

Genetic manipulation in Agriculture –Regeneration of plants from Protoplasts - *Agrobacterium* mediated gene transfer and improvements of crops - Virus resistant papaya & tobacco, Innate potato, Insect resistant plant (Bt toxin), Herbicide resistant plant (Glyphosate) & Ice nucleating bacteria in strawberry.
(15 Hours)

TEXT BOOKS

1. Subba Rao, N.S. (2020).*Soil Microbiology*, 4th edition. New York: Oxford and IBH PublishingCo.Pvt. Ltd.
2. Sharma, P.D. (2018).*Plant Pathology*, 2nd edition. Uttar Pradesh: Rastogi Publications.

REFERENCE BOOKS

1. Rangasami, G., &Bagyaraj, DJ. (2009).*Agricultural Microbiology*, 2nd edition. New Jersey: Prentice – Hall publications.
2. Ronald Atlas,M.,& Richard Bartha.(1997). *Microbial Ecology*, 4thedition.San Francisco: Benjamin/Cummings Science Publishing
3. Chaube, H.S.,&Pundhir, V.S. (2005). *Crop diseases and their management*, 1stedition.New Delhi: Prentice Hall of India Pvt. Ltd.
4. <https://www.wikipedia.org>

Course Code (20UMBC61)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	L	M	M	L	L	L	M	L	L
CO 2	H	M	L	M	L	L	S	L	M	L
CO 3	H	L	L	M	L	M	L	L	M	M
CO 4	H	M	L	H	M	M	M	L	L	M
CO 5	H	M	M	H	M	M	H	L	M	M

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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester VI	INDUSTRIAL MICROBIOLOGY	Hours/Week: 5	
Core Course – 16		Credits: 4	
Course Code 20UMBC62		Internal 25	External 75

COURSE OUTCOMES

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

CO1: recall the basis of various fermentations and industrially important microbes. [K1]

CO2: demonstrate the bioreactor designs, various parameters, media formulation, upstream and downstream processing. [K2]

CO3: apply the knowledge underlying the components of various fermenter, large scale fermentation and screening strategies. [K3]

CO4: analyze the fermentation types and assess the nature and utility of fermented products. [K4]

CO5: interpret the techniques for identifying industrially useful microorganisms by various isolation, screening and strain improvement methods. [K5]

UNIT I

Design of fermenters - Basic fermenter, components of basic fermenter, various designs of fermenters- lift- tube fermenter, fixed-bed reactor, fluidized bed reactor. Fermentation types: batch, fed batch, continuous, aerobic, anaerobic and solid state fermentation. (17 Hours)

UNIT II

Control and monitoring of variables: temperature, pH, agitation, pressure, online measurement, on/off control and PD control - Computer applications in fermentation technology - Biosafety consideration - Biosafety levels, guidelines and regulations.

(13 Hours)

UNIT III

Industrially important microorganisms -Screening strategies for industrially important microorganisms - strain improvement by classical and recombinant methods. Media composition & optimization – Classical & Statistical Design (PlackettBurman). (13 Hours)

UNIT IV

Large scale fermentation and downstream processing - Fermentation processes: inoculum preparation, inoculum built-up, scale up of microbial fermentation - Downstream processing: precipitation, centrifugation, filtration, solvent extraction, chromatographic purification and affinity purification. (16 Hours)

UNIT V

Major products of Industrial Microbiology - Single cell proteins: Cultivation of *Spirulina*- Industrial enzymes (amylase and protease), alcoholic fermentation (beer), antibiotics (penicillin), organic acid (citric acid), amino acid (glutamate), and vitamins (B₁₂) - Quality assurance (*fssai*) and quality control of fermented products. (16 Hours)

TEXT BOOK

1. Patel, A.H.(2021). *Industrial Microbiology*, 2nd edition. Hyderabad: Macmillan India Limited.
2. Stanbury, O.F., Whittaker, A., & Hall, S.J. (2016). *Principles of Fermentation Technology*, 3rd edition. New Delhi: Aditya Books (P) Ltd.

REFERENCE BOOKS

1. Cassida, L.E. (2019). *Industrial Microbiology*, 2nd edition. Bengaluru: New Age International (P) Limited Publishers.
2. Siva Kumar, P.K. (2015). *An Introduction to Industrial Microbiology*, 1st edition. New Delhi: S.Chand & company Ltd.
3. Prescott & Dunn's (2004). *Industrial Microbiology*, 4th edition. New Delhi: CBS Publishers & Distributors.

Course Code (20UMBC12)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	L	H	H	M	M	L	H	H	M
CO 2	M	H	H	H	H	M	L	M	M	M
CO 3	H	H	M	M	H	H	L	L	L	L
CO 4	L	M	L	L	M	H	L	L	-	-
CO 5	L	H	M	L	M	M	L	L	M	L

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B.Sc. MICROBIOLOGY (2020 -21 onwards)

Semester VI	RECOMBINAT DNA TECHNOLOGY	Hours/Week: 5	
Core course 17		Credits:4	
Course Code 20UMBC63		Internal 25	External 75

COURSE OUTCOMES

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

CO1: recall the strategies and basic needs, requirements and ethics of gene cloning. [K1]

CO2: explain the theoretical as well as molecular techniques involved in gene transfer with proper guidelines. [K2]

CO3: identify process of gene modification in transgenic plants and animals for getting approval of patenting products. [K3]

CO4: correlate the impact of transfer of gene in the field of biotechnology and its protection by regulation act. [K4]

CO5: assess the novel activities of genetic modification in recent days and its effect in future. [K5]

UNIT I

Introduction: Scope of Biotechnology, General Strategies of gene cloning, enzymes used in biotechnology: Restriction enzymes – Types, significance of Hind III, EcoR I & Bam HI. Nuclease, DNA polymerase, polynucleotide kinase, cohesive and blunt end ligation, alkaline phosphatase, linkers and adaptors. (10 Hours)

UNIT II

Gene cloning vectors: Properties of good Vector, Constructed plasmids - pBR322 & pUC18, Phagemids, Cosmids, Animal vectors - SV40, Plant vectors –Ri&Ti plasmids (structure only). Expression, Shuttle vectors and super vectors: YAC & BACs. (20Hours)

UNIT III

Gene transfer methods: Vector mode and Vector less mode – Biolistic, Electroporation, Microinjection, PEG and Liposome mediated transfer. Gene manipulation techniques: Marker and reporter genes, Selection of recombinants, Marker techniques – RFLP, Hybridization techniques: Southern, Northern and western blotting, Biochips. Production of transgenic animals – Mice and Sheep. Stem cells and regenerative medicine: uses of stem cells in diabetes. (20 Hours)

UNIT IV

Plants and Animals as bioreactors: Production of biofuels (bioethanol) and Bioplastics. Transgenic plants – FlavrSavr tomato & Golden rice. Recombinant protein expression in medicine Insulin, Interferon and Human growth hormone. Genetically Modified Foods: Bovine somatotropin, alpha lactalbumin & lactoferrin in milk. Edible vaccine (Cholera vaccine- potatoes & Hepatitis B vaccine - maize). (15 Hours)

UNIT V

Introduction of IP - Types of Intellectual Property: Patents, Trade mark, Copy right, Industrial design; patenting procedures. Agreement: GATT & TRIPS; Treaties: WIPO, PCT & Budapest; IPR – national & international scenario and patenting of biological materials. Biohazards and biosafety levels, Role of Institutional biosafety Committee – RCGM, GEAC; Bioethical values in animal and plant biotechnology. (10 Hours)

TEXT BOOK

1. Dubey, R. C. (2007). *A text book of Biotechnology*, 5th edition. New Delhi: S. Chand & Company Ltd.
2. James D. Watson, Gilman Michael, Jan Witkowski and Mark Zoller, (1992). *Recombinant DNA*, 2nd edition, New York: W.H. Freeman & Co Ltd.

REFERENCE BOOKS

1. Satyanarayana, U. (2020). *Biotechnology*, 1st edition. Kolkotta: Books and Allied (p) Ltd.
2. Gupta, P.K. (2006). *Elements of Biotechnology*, 1st edition. Utter Pradesh: Rastogi publications
3. Ignacimuthu, S. (2012). *Biotechnology An Introduction*, 2nd edition. New Delhi: Narosa publications.
4. Chawla. (2003). *Introduction to Plant Biotechnology*, 2nd edition. New Delhi: Oxford and IBH publishers.

5.. <https://www.wikipedia.org>

	PO1		PO2	PO3		PO4		PO5	PO6	PO7
Course Code (20UMBC63)	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	H	H	H	H	H	M	H	L	L
CO 2	H	H	H	M	H	H	M	H	L	L
CO 3	H	H	M	H	H	M	M	M	-	L
CO 4	H	H	M	H	M	L	M	M	-	-
CO 5	M	M	M	H	H	H	M	M	L	L

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B.Sc. MICROBIOLOGY

(2020 -21 onwards)

Semester VI	PHARMACEUTICAL MICROBIOLOGY	Hours/Week: 5	
DSEC – 1		Credits:4	
Course Code 20UMBE61		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: Recall the principles of pharmacology, concept of drug discovery and identify the specific drugs belong to major drug classes for therapeutic use. [K1]
- CO2: Explain the pharmacokinetics and mechanism of drug action at macromolecular levels and understand the tests involved in checking the quality of pharmaceutical product. [K2]
- CO3: Apply the knowledge of systemic pharmacology, drug-receptor interactions and its resistance mechanisms to design a novel drug with the aid of computer. [K3]
- CO4: Analyse the pharmacotherapy, adverse effects of specific drugs and also categorize the practices to be followed in pharmaceutical industry. [K4]
- CO5: Evaluate the ways of specific drug action on microbes and illustrate the stages of drug development. [K5]

UNIT I

Introduction to Pharmaceutical Microbiology - Pharmacognosy: Nature and Sources of drugs Pharmacology-Introduction- Routes of drug administration (local and systemic). - Microbiological, mineral and plant and animal. Pharmacokinetics: absorption, distribution, metabolism and excretion of drugs. (14 Hours)

UNIT II

Pharmacodynamics: Mechanism of action of drugs, Factors modifying drug action, Drug – receptor interaction, Site of drug action, Structure activity relationship .Adverse reactions of drugs, Drug toxicity. (14 Hours)

UNIT III

Principles of Drug Design Synthetic procedures (Theoretic Aspects): Drug discovery (Lead identification and optimization, Target identification and validation) and Drug development (clinical trials)- Traditional analog (QSAR) and Computer Aided Drug Designing (CADD). Determining the level of Antimicrobial activity: Dilution susceptibility tests, Disk diffusion tests. (17 Hours)

UNIT IV

Chemotherapy and Antibiotics: Mechanism of action of antimicrobial drugs – Penicillin, Chloramphenicol, Polymyxin, Aminoglycosides, Isoniazid, Rifampin, Sulfonamides , Tetracycline , Amphotericin B, Acyclovir, Metronidazole. Miscellaneous drugs : Vitamins and Minerals. Drug resistance in bacteria. (17 Hours)

UNIT V

Assessment of microbial contamination in pharmaceutical industry: Microbial limit tests, Preservative efficacy test (challenge test), Sterility & Cytotoxicity tests of Pharmaceutical products. Quality Assurance: Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP). (13 Hours)

TEXT BOOK

Satoskar, Kale, Bhandarka, S. (2009). *Pharmacology and Pharmacotherapeutics*, 21th edition. Mumbai: Popular prakashan.

REFERENCE BOOKS

1. Prescott, Harley & Klein, (2008). *Microbiology*, 7th edition. New York: The McGraw-Hill companies.
2. Patrick, & Murray, R. (2017). *Medical Microbiology*, 8st edition. Missouri: The C.V. Mosby Company.
3. Hugo, W.B., & Russell, A. D. (2016). *Pharmaceutical Microbiology*, 8th edition. Oxford: Blackwell Science.
4. <https://docs.google.com/file/d/0B3NFnX-IIB29cnZDSTNvZjRCSFE/edit?resourcekey=0-wKgQrd9fUpj3gjYdoEJyuw>
5. <https://pharmabookbank.files.wordpress.com/2019/03/10.2.pmicro2.pdf>

Course Code (20UMBE61)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	L	H	H	M	M	L	H	H	M
CO 2	H	H	H	H	H	M	L	M	M	M
CO 3	H	H	M	M	H	H	L	L	L	M
CO 4	L	M	L	M	M	H	L	L	H	L
CO 5	L	H	M	L	M	M	L	L	M	L

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B.Sc. MICROBIOLOGY

(2020 – 21 onwards)

Semester VI	ENVIRONMENTAL MICROBIOLOGY	Hours/Week: 5	
DSEC - 2		Credits: 4	
Course Code 20UMBE62		Internal 25	External 75

COURSE OUTCOMES

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

CO1: Describe the diversity of microbes and microbial communities in soil habitats based on the beneficial as well as harmful aspects in the environment. [K1]

CO2: Understand the role of microbes in biogeochemical processes in different ecosystems for removal of selected pollutants in environment. [K2]

CO3: Apply the major principles of environmental microbiology and the relationship of microbes to environmental processes and other living organisms to understand and solving environmental problems. [K3]

CO4: Analyse the microbes in degradation of toxic organic compounds and heavy metals to reduce the natural pollution in our environment. [K4]

CO5: Evaluate the remedies regards creating awareness among the society. [K5]

UNIT I

Introduction to environmental microbiology- Basic concepts of ecology – Ecological niches- Natural habitats of microorganisms. Adaptations of microorganisms – structural and physiological adaptations. Development and succession of microbial communities. Adaptations of extremophiles. (13 Hours)

UNIT II

Microbes in biogeochemical cycles – carbon, nitrogen, phosphorous and sulphur cycles. Air microbiology – Adaptations of air borne microbes – microbes in aerosol – Assessment of quality of air, air borne diseases and preventive measures. (17 Hours)

UNIT III

Aquatic microbiology – microbes in fresh and marine water – Eutrophication – microbiological quality testing of water – MPN test. Water borne diseases and preventive measures. Soil Microbiology- microbial communities in soil. (15 Hours)

UNIT IV

Waste treatment- types of wastes- characterization of solid and liquid waste. Waste treatment and useful byproducts. Solid waste treatment (sanitary land fills and composting). Liquid waste treatment – primary, secondary and tertiary treatments. (17 Hours)

UNIT V

Biodegradation principles, types and applications. Biodegradation of xenobiotics (chlorinated pesticides) – Bioaccumulations – Biomagnification – Bioleaching of metals (copper and gold). (13 Hours)

TEXT BOOK

Ronald Atlas, M., & Richard Bartha . (1998). *Microbial Ecology*, 4th edition. San Francisco: Benjamin/Cummings Science Publishing.

REFERENCES

1. Dr. Ramanathan, N., & Dr. Muthukkaruppan, S.M. (2002). *Environmental Microbiology*, 1st edition. Chidambaram: Om Sakthi Pathippagam.
2. Vijaya Ramesh, K. (2004). *Environmental Microbiology*, 1st edition. New Delhi: MJP Publishers.

Course Code (20UMBE62)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	L	M	M	L	L	H	-	L	-
CO 2	H	M	L	M	M	L	L	L	M	L
CO 3	H	M	M	M	L	M	L	L	H	M
CO 4	H	L	L	H	M	M	M	L	H	M
CO 5	H	M	M	H	L	M	-	L	M	-

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B.Sc. BIOTECHNOLOGY

(2020 - 21 onwards)

Semester VI	IPR, BIOETHICS AND BIOSAFETY	Hours/Week: 4	
DSEC- 03		Credits: 4	
Course Code 20UBOE63		Internal 25	External 75

COURSE OUTCOMES

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

- CO1: Define the various forms of intellectual property, bioethics, biosafety levels, and biohazards. [K1]
- CO2: Describe the organizations involved in IPR, Bioethics and Biosafety in India and abroad. [K2]
- CO3: Explain the process of patenting, animal welfare and risk assessment. [K3]
- CO4: Compare the merits and demerits of IPR, Bioethics and GEOs. [K4]
- CO5: Assess the role of IPR, Bioethics and Biosafety procedures in protection of humans and animal rights. [K5]

UNIT I

Introduction: Forms of Intellectual Property - Patent, Copyright, Trademark, Design, Geographical Indication and Trade Secrets, WTO and EMR, IPR in India. (12 Hours)

UNIT II

Patents: Protection by Patents, Patentable Inventions, Patenting of biotechnological inventions in India, Patentable and non Patentable, applying for Patents. (12 Hours)

UNIT III

Bioethics- need for Bioethics, Applications of Bioethics, Prevention of Cruelty to Animals Act , CPCSEA guidelines for laboratory animal facility, Animal Welfare Board, Biopiracy. (12 Hours)

UNIT IV

Introduction to Biosafety: Primary and Secondary Barriers, Biosafety Levels-BSL1, BSL2, BSL3, BSL4, Biosafety Cabinets, Safety measures in the laboratory- Personal safety, good laboratory practices and basic Biosafety equipment's. (12 Hours)

UNIT V

Biohazards: Biohazardous agents and laboratory-acquired infections, disposal of biohazardous waste, dangers of Genetically Engineered Organisms, Containment, Risk Assessment and Release of GEOs. (12 Hours)

REFERENCE BOOKS

1. Research methodology for Biological sciences – N. Gurumani, MJP Publishers, 2014.
2. Ramadass, P (2008), Animal Biotechnology, MJP Publishers,.
3. Florence Pariera Raja, (2013) Animal Biotechnology, Wisdom Press.
4. Ashish S. Verma, Surajit Das, Anchal Singh, (2014).
5. Laboratory Manual for Biotechnology S.Chand
6. Satyanarayana, U. Biotechnology (2010), Books and Allied (p) Ltd.

CourseCode 20UBOE63	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO5	PSO6	PSO7
CO1	H	-	H	L	M	L	-	L	-	H
CO 2	H	L	M	M	M	M	-	L	-	H
CO 3	M	L	H	M	M	M	L	M	M	H
CO 4	H	-	H	M	H	M	L	L	M	H
CO 5	H	M	M	H	M	H	H	M	M	H

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B.Sc. MICROBIOLOGY (2020 -21 onwards)

Semester VI	VERMITECHNOLOGY	Hours/Week: 2	
SEC – 1		Credits: 2	
Course Code 20UMBS61		Internal 40	External 60

COURSE OUTCOMES

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

CO1: Relate the basics characteristics of earthworms and Vermiculture to identify their beneficial aspects in agriculture. [K1]

CO2: Explain the selection of earthworm species, different methods of vermicompost and its parameters for crop improvement. [K2]

CO3: Apply the vermicompost in soil and predict the nutrient content based on characterization to improve the soil fertility. [K3]

CO4: Analyse the plant growth based on standardization of vermicompost and point out their economic importance. [K4]

CO5: Interpret the value of microbes and earthworms in vermicompost for organic waste management and farming. [K5]

UNIT I

Earthworms – Introduction, Types and Characteristics - Biology and Life cycle of *Lumbricusterrestris*, *Eiseniafetida*, *Perionyxexcavatus* – Economic importance. (6 Hours)

UNITII

Vermiculture – Organic resources – Monoculture & Polyculture. Vermicompost – Materials required - Species selection and Parameters. (6 Hours)

UNITIII

Vermicompost methods – Field pits, Ground heaps, Tank method, Roof shed, Bin, Wormery, Windows and Wedges, Indore & Bangalore (anaerobic) Method. (6 Hours)

UNIT IV

Harvest and Storage of vermicompost – Characterization – Uses – Vermiwash. Vermicompost in Plant Growth – Role of earthworms in soil – Aeration in plant root – Nutrient Availability. (6 Hours)

UNIT V

Role of Microbes in Vermicomposting. Plant growth parameter analysis – Standardization, Processing and Economic viability of Vermicompost. (6 Hours)

TEXTBOOK

1. Mary violet Christy, A. (2014). *Vermitechnology*, 1st edition. New Delhi: MJP Publishers.

REFERENCE BOOKS

Dr. Ramanathan, N., Dr. Muthukkaruppan, S.M. (2002). *Environmental Microbiology*, Chidambaram: OmSakthi Pathippagam.

	PO1		PO2	PO3		PO4		PO5	PO6	PO7
Course Code (20UMBS61)	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	M	M	H	H	L	M	M	L	-
CO 2	H	L	L	M	L	L	L	L	M	M
CO 3	H	M	H	L	L	M	L	L	M	-
CO 4	H	H	L	H	M	M	M	M	H	M
CO 5	H	M	M	H	L	M	L	L	M	L

Mrs. J. Jeya
Head of the Department

Mrs. A. Hemalatha
Course designer



V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai

Re-accredited with 'A' Grade (3rd Cycle) by NAAC

VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2020 – 21 onwards)

Semester - VI	MAJOR PRACTICAL - III	Hours/Week: 3	
Core course - 12		Credits: 3	
Course Code 20UMBC61P		Internal 40	External 60

COURSE OUTCOMES

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

CO1: write the basic theoretical concepts and practical knowledge of pathogenic bacteria and immunological reactions. [K3]

CO2: develop the principle behind antimicrobial susceptibility of pathogen and antigen antibody interactions. [K3]

CO3: construct the procedure for isolation of infectious microorganisms, handling of clinical specimen effectively and safely. [K3]

CO4: determine pathological conditions by the identification of causative agents and immune complexes. [K3]

CO5: interpret the methodology and techniques used in Clinical Microbiology and immunology. [K4]

1. Isolation of pathogenic bacteria from clinical specimens –*Streptococcus*, *Staphylococcus*, *Salmonella*, *Shigella* and *Vibrio*.
2. Antibiotic susceptibility test: disc diffusion method.
3. Measurement of minimal inhibitory concentration (MIC).
4. Blood cell Count: RBC & WBC.
5. Separation of serum and plasma.
6. Erythrocyte sedimentation rate.
7. Blood grouping: ABO & Rh typing.

8. Agglutination tests: Widal test.
9. Precipitation: Ouchterlony double immunodiffusion.
10. Diagnosis of human viral diseases-Dot ELISA.
11. Determination of Rheumatoid Arthritis factor.
12. Diagnosis of Venereal diseases- VDRL Test.

REFERENCE BOOKS

1. Murugalatha, N. (2012). *Microbiological Techniques*, 1st edition. New Delhi: MJP Publishers.
2. Cappuccino, J.G., & Sherman, N. (2014.) *Microbiology: A laboratory manual*, 10th edition. Boston: Addison Wesley.
3. Aneja, K.R. (2017). *Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation*, 5th edition. Bengaluru: New Age International Publishers.

Course Code (20UMBC61P)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	H	H	-	H	L	H	L	-	M
CO 2	M	H	H	L	L	L	H	L	-	L
CO 3	M	H	H	L	H	L	H	L	L	L
CO 4	M	H	H	M	H	L	H	-	-	M
CO 5	M	H	H	-	M	L	H	L	L	H

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VIRUDHUNAGAR - 626 001

B.Sc. MICROBIOLOGY

(2020 – 21 onwards)

Semester - VI	MAJOR PRACTICAL - IV	Hours/Week: 3	
Core course - 12		Credits: 3	
Course Code 20UMBC62P		Internal 40	External 60

COURSE OUTCOMES

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

CO1: apply the basic theoretical concepts & practical knowledge of microbial communities inhabiting in multitude of habitats. [K3]

CO2: make use of aseptic techniques for isolating pure cultures and to perform routine culture handling tasks safely, effectively and ecofriendly. [K3]

CO3: identify the characteristic features of unknown microorganisms by using various morphological analysis and quality control techniques. [K3]

CO4: experiment with the protagonist of microbes in agriculture, food and industrial fields. [K3]

CO5: examine the use of tools, techniques and methodologies vital to practical skills in applied fields of Microbiology. [K4]

1. Isolation of symbiotic nitrogen fixing bacteria from root nodules *Rhizobium*.
2. Isolation of phosphate solubilizing bacteria – *Pseudomonas*.
3. Isolation of Ammonifying, Nitrifying & Denitrifying bacteria.
4. Examination of mycorrhizae – AM.
5. Potability testing of water (MPN test).
6. Milk quality test – Methylene blue dye reduction test.
7. Isolation of amylase and protease producing bacteria.
8. Crowded plate technique for antibiotics producing microbes.
9. Alcohol (ethanol) production.
10. Immobilization of yeast.

REFERENCE BOOKS

1. Murugalatha, N. (2012). *Microbiological Techniques*, 1st edition. New Delhi: MJP Publishers.
2. Cappuccino, J.G., & Sherman, N. (2014). *Microbiology: A laboratory manual*, 10th edition. Boston: Addison Wesley.
3. Aneja, K.R. (2017). *Experiments in Microbiology, Plant pathology, Tissue culture & Biotechnology*, 5th edition. Bengaluru: New Age International publishers.

Course Code (20UMBC62P)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
CO 1	H	H	M	M	M	M	M	M	L	L
CO 2	H	H	M	M	M	L	L	L	L	H
CO 3	H	H	H	H	H	L	L	L	H	L
CO 4	H	M	H	L	M	L	L	L	H	M
CO 5	M	H	H	M	H	M	L	M	L	M

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Mrs.M.M.Fatima Mansoor
Course Designer



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B.Sc. MICROBIOLOGY (2020 – 21 onwards)

Semester VI	MAJOR PRACTICAL– V	Hours/Week: 2	
Core Course – 12		Credits: 2	
Course Code 20UMBC63P		Internal 40	External 60

COURSE OUTCOME

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

CO1: Write the aims and principles behind the techniques in the advanced level practical works. [K3]

CO2: make use of theoretical knowledge and as well as experimental applications to carry out practical with effectively. [K3]

CO3: apply the methodologies involved in the retrieve the sequences compare with already known sequences and modify the genetic characters by modern techniques. [K3]

CO4: find out the results with already used protocol and to correlate the sequences by using computer programs or by experimental data. [K3]

CO5: analyze the features of programmes; chemicals and its significance in bioinformatics & biotechnology. [K4]

1. Retrieval of DNA and protein sequences from NCBI
2. Access the primary structure of protein from protparam database
3. Access the protein cleavage site from peptide cutter
4. Retrieve the secondary structure of protein by SOPMA, Chou fasman and GOR method
5. Pair wise sequence alignment by BLAST
6. Multiple sequence alignment
7. Isolation of plasmid DNA
8. Separation of DNA by agarose gel electrophoresis

9. Restriction and digestion analysis

10. Ligation

REFERENCE BOOKS

1. Terasa, K., Attwood & David parry smith, J. (2006). *Introduction to Bioinformatics*, 1st edition. New Delhi: Dorling Kindersley Pvt Ltd.
2. Sundaralingam, R., & Kumaresan, V. (2008). *Bioinformatics*, 1st edition. Nagarcoil: Saras Publication.
3. Cappuccino, J.G., & Sherman, N. (2002). *Microbiology: A laboratory manual*, 4th edition. Boston: Addison Wesley.
4. Murugalatha, N. (2012). *Microbiological Techniques*, 1st edition. New Delhi: MJP publishers.

Course Code (20UMBC63P)	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1a	PSO 1b	PSO 2	PSO 3a	PSO 3b	PSO 4a	PSO 4b	PSO 5	PSO 6	PSO 7
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CO 2	H	H	M	L	M	H	L	L	M	M
CO 3	H	H	L	L	H	L	L	M	L	M
CO 4	H	H	M	L	M	M	L	L	L	L
CO 5	M	L	L	L	M	M	M	M	L	M

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M.Vijayalakshmi
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