

B.Sc. MICROBIOLOGY

SEM	COURSE CODE	PART	COURSE	COURSETITLE	Ins. Hrs /Week	CREDIT	MARKS		TOTAL
							CIA	ESE	
I	20U1LT1/LA1/LF1 /LH1/LU1	I	Language – I		6	3	25	75	100
	20UCN1LE1	II	English - I		6	3	25	75	100
	20UMB1CC1	III	Core – I	Introduction to Microbiology and Microbial Diversity	5	5	25	75	100
	20UMB1CC2P		Core – II	Introduction to Microbiology and Microbial Diversity Practical	3	2	25	75	100
	20UMB1AC1		Allied –I	General Biochemistry-I :Biomolecules	5	4	25	75	100
	20UMB1AC2P		Allied –II	General Biochemistry-I :Biomolecules Practical	3	2	25	75	100
	20UCN1AE1	IV	AEC-I	Value Education	2	2	-	100	100
		TOTAL			30	21			700
II	20U2LT2/LA2/LF2 /LH2/LU2	I	Language – II		6	3	25	75	100
	20UCN2LE2	II	English – II		6	3	25	75	100
	20UMB2CC3	III	Core – III	Bacteriology and Virology	6	5	25	75	100
	20UMB2CC4P		Core – IV	Bacteriology and Virology Practical	3	2	25	75	100
	20UMB2AC3		Allied – III	General Biochemistry-II: Bioenergetics and Enzymology	4	3	25	75	100
	20UMB2AC4P		Allied –IV	General Biochemistry-II: Bioenergetics and Enzymology Practical	3	2	25	75	100
	20UCN2SE1	IV	Skill EnhancementCourse - I @	Soft Skills Development	2	2	-	100	100
		TOTAL			30	20			700
III	20U3LT3/LA3/LF3 /LH3/LU3	I	Language– III		6	3	25	75	100
	20UCN3LE3	II	English – III		6	3	25	75	100
	20UMB3CC5	III	Core– V	Microbial Physiology and Metabolism	4	4	25	75	100
	20UMB3CC6P		Core– VI	Microbial Physiology and Metabolism Practical	3	2	25	75	100
	20UMB3AC5		Allied – V	Immunology-I:Principles of Immunology	4	3	25	75	100
	20UMB3AC6P		Allied–VI	Immunology-I:Principles of Immunology Practical	3	2	25	75	100
	20UMB3GE1	IV	Generic Elective I #		2	2	-	100	100
20UCN3AE2	AEC-II		Environmental Science	2	2	-	100	100	
		TOTAL			30	21			800
IV	20U4LT4/LA4/LF4 /LH4/LU4	I	Language–IV		6	3	25	75	100
	20UCN4LE4	II	English– IV		6	3	25	75	100
	20UMB4CC7	III	Core– VII	Clinical Microbiology	5	5	25	75	100
	20UMB4CC8P		Core - VIII	Clinical Microbiology Practical	3	2	25	75	100
	20UMB4AC7		Allied– VII	Immunology-II: Immunohaematology	5	3	25	75	100
	20UMB4AC8P		Allied–VIII	Immunology-II: Immunohaematology Practical	3	2	25	75	100
	20UMB4GE2	IV	Generic Elective – II#		2	2	-	100	100
20UCN4EA	V	Extension Activities	NCC, NSS, etc.	-	1	-	-	-	
		TOTAL			30	21			700
V	20UMB5CC9	III	Core – IX	Microbial Genetics	6	5	25	75	100
	20UMB5CC10		Core – X	Molecular Biology and Recombinant DNA Technology	5	5	25	75	100
	20UMB5CC11		Core – XI	Industrial Microbiology	5	5	25	75	100
	20UMB5CC12P		Core - XII	Microbial Genetics, Molecular Biology and Recombinant DNA Technology and Industrial Microbiology Practical	5	5	25	75	100
	20UMB5DE1		DSE – I **		5	4	25	75	100
	20UMB5SE2	IV	Skill Enhancement Course II@		2	2	-	100	100
	20UMB5SE3		Skill Enhancement Course – III@		2	2	-	100	100
20UMB5EC1		Extra Credit Course - I	General Intelligence for competitive Examination	-	4*	--	100*	100*	
		TOTAL			30	28			700
VI	20UMB6CC13	III	Core– XIII	Food and Dairy Technology	5	5	25	75	100
	20UMB6CC14		Core– XIV	Environmental Microbiology	5	5	25	75	100
	20UMB6CC15		Core - XV	Soil and Agricultural Microbiology	5	5	25	75	100
	20UMB6CC16P		Core - XVI	Food and Dairy Technology Environmental Microbiology, Soil and Agricultural Microbiology Practical	5	5	25	75	100
	20UMB6DE2		DSE II **		5	4	25	75	100
	20UMB6DE3		DSE III **		4	4	25	75	100
	20UCN6AE3	IV	AEC-III	Gender Studies	1	1	-	100	100
20UMB6EC2		Extra Credit Course - II	Microbiology for competitive examinations	-	4*	--	100*	100*	
20UMB6ECA		Extra Credit Course for all	Online Course	-	1*	--	-	-	
		TOTAL			30	29			700
		GRAND TOTAL			180	140			4300

Not Considered for Grant Total and CGPA.

Generic Electives for other major electives

Semester	Course code	Course Title
III	20UMB3GE1	Microbial Food Products
IV	20UMB4GE2	Cosmetic Microbiology

@ Skill Enhancement Courses

Semester	Course code	Course Title
V	20UMB5SE2A	Biofertilizers and Biopesticides
	20UMB5SE2B	Analytical Techniques
	20UMB5SE3A	Textile Microbiology
	20UMB5SE3B	Mycology

**Discipline Specific Electives

Emester	Course code	Course Title
V	20UMB5DE1A	Bioinformatics and Biostatistics
	20UMB5DE1B	Medical Entomology
VI	20UMB6DE2A	Plant Pathology
	20UMB6DE2B	Applied Phycology
	20UMB6DE3A	Social and Preventive Medicine
	20UMB6DE3B	Biosafety and Intellectual property rights

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20UMB1CC1	Core – I	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY	5	5	100	25	75

Course Outcomes

At the end of the course, students will be able to

1. Explicit the historical inventions, scope of Microbiology and Principles of Microscopy.
2. Systematize the taxonomy of Microorganisms.
3. Demonstrate the bacterial growth by using various measurement techniques.
4. Illustrate the methods of sterilization, media preparation, pure culture, preservation and decontamination techniques.
5. Describe the microbial diversity and their economic importance.

UNIT I

15 hours

Introduction- Definition, Scope and Landmark discoveries relevant to the field of microbiology; #Germ theory of disease#, Theory of spontaneous generation. Biogenesis. Microscopy: Introduction, Principle – Bright field, dark field, phase contrast, confocal, fluorescent and electron microscope-TEM and SEM. Specimen preparation of Electron Microscopy.

UNIT II

15 hours

Taxonomy: Types of classification (artificial, natural, phylogenetic); #binomial nomenclature#. Haeckel's three kingdom, Whittaker's five kingdom and Eight kingdom (Cavalier Smith). Outline classification based on Bergey's manual of systemic Bacteriology (9th edition). Difference between the prokaryotic and eukaryotic microorganisms.

UNIT III

15 hours

Growth and Measurement: Modes of cell Division, New cell formation. Growth curve, Synchronous growth and Continuous growth. Quantitative Measurement of Bacteria– Direct Microscopic Count, Electronic Enumeration of Cell Numbers, #Plate count method#, Membrane – Filter Count, Turbidometric methods. Anaerobic culture techniques– Wright's tube, Roll tube, McIntosh Fildes jar method.

UNIT IV

15 hours

Methods in Microbiology: Sterilization- Principles, Methods of Sterilization– Physical and Chemical methods. Media preparation -Solid and Liquid media – Different types of Media. Pure culture techniques - Serial dilution technique, Pour plate, Spread plate, Streak plate and #Micro manipulator#. Methods of maintenance and preservation of microbes. Safe decontamination practices.

UNIT V

15 hours

Diversity of microbes: Fungi: General characteristics, classification, reproduction and its economic importance. **Algae:** General characteristics and Classification basic knowledge on its reproduction and its economic importance. **Actinomycetes:** General characteristics and their

importance. **Protozoa:** #General characteristics#, classification, reproduction and its economic importance.

Self-study portion.

1

Text Books:

T.B-1. Michael J. Pelczar, Jr.E.C.S. Chan, Noel R.Krieg, Microbiology, 5thedition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.

T.B-2. Lansing M. Prescott, John P. Harley and Donald A. Klein's, Microbiology, 7thedition, McGrawHill, 2008.

T.B-3. Roger Y. Stainer, John L. Ingraham, Mark L, Wheelis and Page R. Painter, General Microbiology, 5thEdition, Macmillan Press Ltd, London,1992.

T.B-4. R.C. Dubey and D.K Maheswari, A Textbook of Microbiology (Revised edition), S. Chand and Company Ltd, New Delhi, 2012.

UNIT I	Chapter I, II &IV	T.B-1
UNIT II	Chapter II	T.B-4
UNIT III	Chapter VI	T.B-2
UNIT IV	Chapter II	T.B-3
UNIT V	Chapter XVII, XVIII, XIX	T.B-1
	Chapter II	T.B-4

Books for Reference:

1.R.Ananthanarayan and C.K.JayaramPaniker, Textbook of Microbiology, 8thedition, Universities Press (India) Private Limited, 2009.

2. Jeffrey C. Pommerville, Alcamo's Fundamentals of Microbiology, 9th edition, Jones and Bartlett publishers, Massachusetts, 2011.

3.S.S. Purohit, Microbiology- Fundamentals and Applications, 7th Edition, Agrobios (India) Jodhpur, 2008.

Web Source:

1. <https://www.studyandscore.com/studymaterial-detail/phylum-protozoa-general-characters-and-classification>
2. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=5205>
3. <https://microbeonline.com/maintenance-and-preservation-of-pure-cultures-of-bacteria/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
I	20UMB1CC1	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY					5	5		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓			✓	✓	✓		
CO2	✓	✓		✓		✓	✓		✓	
CO3	✓	✓	✓	✓		✓	✓	✓	✓	
CO4		✓	✓	✓			✓	✓	✓	
CO5	✓	✓		✓	✓	✓	✓		✓	✓
Number of Matches= 34, Relationship : Moderate										

Prepared by:
K.Vijayalakshmi

Checked by:
1.A.Fasila Begum
2. Dr.A.KhaleelAhamed

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External Marks
I	20UMB1CC2P	Core – II	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY- PRACTICAL	3	2	100	20	80

Course Outcomes:

At the end of the course, students will be able to

1. Assess the biosafety measures and aseptic techniques.
2. Illustrate the methods of sterilization, media preparation and pure culture techniques.
3. Detect the microorganisms from various samples.
4. Recapitulate the bacteria by counting methods.
5. Execute the various staining techniques.

List of Practicals

1. Laboratory practice and precautions. Antiseptics and disinfectants.
2. Cleaning and sterilization of glass wares.
3. Culture media preparation –Solid, semi-solid and liquid medium.
4. Pure culture techniques- Streak, Spread and Pour plate method.
5. Isolation of bacteria.
6. Isolation of fungi.
7. Isolation of actinomycetes.
8. Isolation of cyanobacteria.
9. Enumeration of bacteria by viable count and total count.
10. Staining of bacteria- Simple and Gram staining technique.
11. Staining of Fungi –Lacto phenol cotton blue method.

Practical Manual:

1. James G. Cappuccino, Natalie Sherman, Microbiology – A laboratory manual, The Benjamin Cummings Publishing Company, Inc, 1996.
2. Mackie and McCartney, Practical Medical Microbiology, Churchill Livingstone, 1989.
3. K.R. Aneja, Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
4. B.K. Khuntia, Basic Microbiology – An Illustrated Laboratory Manual, 2nd Edition, Daya Publishing House, New Delhi, 2013.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
I	20UMB1CC2P	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY PRACTICAL					3	2		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2		✓	✓	✓			✓	✓	✓	
CO3	✓	✓		✓		✓	✓		✓	
CO4	✓	✓		✓		✓	✓		✓	
CO5	✓	✓				✓	✓			
Number of Matches= 32, Relationship : Moderate										

Prepared by:
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Checked by:
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Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External Marks
I	20UMB1AC1	ALLIED - I	GENERAL BIOCHEMISTRY I: BIOMOLECULES	5	4	100	25	75

Course Outcomes

At the end of the course, students will be able to

1. Describe the structure of atoms, unit concentrations and stabilizing interactions of Biomolecules.
2. Restate the structure, classification, function and sources of Carbohydrates.
3. Explain the classification, structure, properties of Aminoacids and Proteins.
4. Summarizethe classification, structure and functions of Lipids.
5. Determine the classification and structure of Vitamins and Nucleic acids.

UNIT I

15 hours

Biomolecules: Structure of atoms, molecules and chemical bonds.Units of measurement of solutes in solution- Normality, molalityandmolarity.Stabilizing interactions -Vander Waals, electrostatic, hydrogen bonding and hydrophobic interaction.Principles of biophysical chemistry - #pH and buffer#.

UNIT II

15 hours

Carbohydrates: Biological significance, Occurrence,Structure, Classification and properties of carbohydrates and Stereoisomerism.Structure of glucose-Straight chain structure and #Ring structure#.DisaccharidesMaltose, Lactose and Sucrose. Polysaccharides- Homo and Heteropolysaccharides.

UNIT III

15 hours

Amino acids and proteins: Structure, Classification, properties and types of amino acids. Proteins- Classification, Structure and #function#. Primary, Secondary, Tertiary and Quaternary structure- forces stabilizing the structure of proteins.

UNIT IV

15 hours

Lipids: Structure, classification,occurrence, properties and function of lipids.Saturated and unsaturated fatty acids- Triacylglycerols,Phospholipids,Glycolipids,Steroidsand#Amphipathic lipids#.-oxidation of fatty acid.

UNIT V

15 hours

Vitamins and Nucleic acid: Definition, sourcesand functions of Fat soluble vitamins and Water soluble vitamins.Nucleic acid: Introduction- Nucleotides and #Nucleosides# and their importance – composition, structure and metabolism of nucleic acid.

###Self-study portion.

Text Books:

T.B-1. David L. Nelson and Michael M.Cox, Lehniger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, 2005.

T.B-2. Eric E. Conn, Paul K. Stumpf, George Bruening and Roy H. Doi, Outlines of Biochemistry, 5th Edition, John Wiley and Sons, New Delhi, 2006.

T.B-3. Ambikashanmugam, Fundamentals of Biochemistry for Medical students 7th Edition, Kartik offset Printers, Chennai, 1998.

T.B-4. U.Satyanaarayana and U.Chakrapani, Biochemistry, 4th edition, Elsevier, New Delhi, 2013.

UNIT I	Chapter I	T.B-2
UNIT II	Chapter VII	T.B-1
UNIT III	Chapter III	T.B-1
UNIT IV	Chapter II	T.B-3
UNIT V	Chapter V&VII	T.B-4

Books for Reference:

1. Dawn, B. Markus, Biochemistry, Harwal Publishing, New York, 1994.
2. Donald voet and Judith voet, Biochemistry, John Wiley and Sons, New York, 1990.
3. Jeremy M. Berg, Joghnl.Tymoczko and LubertStryer, Biochemistry, 5th Edition, W.H. Freeman and Company, New York, 1995.

Web Source:

1. <https://sciencenotes.org/concentration-units-for-solutions/>
2. https://ww2.chemistry.gatech.edu/~lw26/structure/molecular_interactions/mol_int.html
3. <https://www.mikeblaber.org/oldwine/BCH4053/Lecture10/Lecture10.htm>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
I	20UMB1AC1	GENERAL BIOCHEMISTRY I: BIOMOLECULES					5	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓		✓		✓	✓		
CO2	✓	✓	✓			✓	✓	✓			
CO3	✓	✓	✓			✓	✓	✓			
CO4	✓	✓	✓		✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓		
Number of Matches= 34, Relationship : Moderate											

Prepared by:
A.Fasila Begum

Checked by:
1.K.Vijayalakshmi
2. Dr.A.KhaleelAhamed

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
I	20UMB1AC2P	ALLIED – II	GENERAL BIOCHEMISTRY I: BIOMOLECULES - PRACTICAL	3	2	100	20	80

Course Outcomes

At the end of the course, students will be able to

1. Prepare different Buffers.
2. Perform qualitative analysis of sugars and Amino acids.
3. Demonstrate the amino acid and ascorbic acid quantitatively.
4. Predict the amount of proteins and Lipids.
5. Create an entrepreneurship in biomolecules extraction.

List of Practicals

1. Preparation of normal, molar and percentage solutions.
2. Preparation of Buffers.
3. Qualitative Analysis of sugars.
4. Qualitative Analysis of Amino acids.
5. Estimation of glucose.
6. Estimation of amino acid
7. Estimation of ascorbic acid from biological sample - burette method.
8. Estimation of Protein by Lowry's method.
9. Estimation of Lipid.
10. Extraction of Biomolecules: i) Starch from potato ii) Casein from milk.

Practical Manual:

1. Keith Wilson and John Walker, Principles & Techniques of Practical Biochemistry, 4th Edition, Cambridge University press, Britain, 1995.
2. B.A. Strolv and V.C. Makavora, Laboratory manual in Biochemistry, MIR Publisher, Moscow, 1989.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits				
I	20UMB1AC2P	GENERAL BIOCHEMISTRY I: BIOMOLECULES PRACTICAL					3	2				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓			✓		✓			✓			
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO3	✓		✓	✓	✓	✓		✓	✓	✓		
CO4	✓		✓	✓	✓	✓		✓	✓	✓		
CO5	✓		✓	✓	✓	✓		✓	✓	✓		
Number of Matches= 38, Relationship : High												

Prepared by:
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Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20UMB2CC3	CORE -III	BACTERIOLOGY AND VIROLOGY	6	5	100	25	75

Course Outcomes

At the end of the course, students will be able to

1. Investigate the Ultra structure of Bacteria.
2. Comment thevarious bacteria and interpret staining techniques.
3. Grasp the knowledge on cultivation and economic importance of bacteria.
4. Describe the general characteristics of viruses.
- 5.Explain the plant and animal viruses.

UNIT I

18 hours

Structural organization of bacteria: Size, Shape and Arrangement of Bacterial cells. Ultra structure of a bacterial cell - cell wall, cell membrane, ribosomes, capsule, flagella, spores , cysts, plasmid, mesosomes and cytoplasmic inclusions, Mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, #peroxisomes#, chloroplast, structure and function of cytoskeleton and its role in motility.

UNIT II

18 hours

Biology of bacteria: *Staphylococcus, Streptococcus, E.coli, Klebsiella, Bacillus, Proteus, Salmonella, Vibrio, Pseudomonas, Mycobacterium, Spirochetes, Mycoplasma, Rickettsiae and Chlamydiae*, Archaeobacteria. Staining: Principles and Types of staining–Simple, Differential, Capsule staining, #Nuclear and Flagella staining#.

UNIT III

18 hours

Cultivation and Importance of Bacteria- Nutritional requirements, Nutritional Types of bacteria- Phototrophs, Chemotrophs, Autotrophs, Heterotrophs and #Obligate parasites#. Economic importance of bacteria in Agriculture-Nitrogen fixing organisms; Ecological importance-bioremediation and biopesticides; Industrial importance- antibiotics and vaccines.

UNIT IV

18 hours

Virology: History General properties of viruses. Classification (Baltimore system) and nomenclature of viruses. Structure and replication of virus- Plant, animal and bacterial viruses- Lytic life cycle- T-Even coliphages and Lysogenic life cycle- #Lambda phage#. Isolation, purification, assay and cultivation of viruses. Concept of virions, viroids, virusoids, and Prions.

UNIT V

18 hours

Plant and Animal viruses: General characteristics and multiplication of Plant Viruses- #Tobacco mosaic virus#, Potato leaf roll virus, Bunchy top of banana. Animal viruses- Adenoviruses, Herpes viruses, Poxviruses, Rhabdo viruses and Retrovirus.

Text Books:

T.B-1. Michael J. Pelczar, Jr. E.C.S. Chan, Noel R.Krieg, Microbiology, 5thedition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.

T.B-2. Lansing M. Prescott, John P. Harley and Donald A. Klein's, Microbiology, 7thedition, McGrawHill, 2008.

T.B-3. R.Ananthanarayan and C.K.Jayaram Paniker, Textbook of Microbiology, 8thedition, Universities Press (India) Private Limited, 2009.

T.B-4. K.C.Sawant, Virology, Dominant Publishers and Distributors, New Delhi, 2015.

UNIT I	Chapter V	T.B-1
UNIT II	Chapter III	T.B-3
UNIT III	Chapter XLIV	T.B-2
UNIT IV	Chapter I & II	T.B-4
UNIT V	Chapter XVII	T.B-3

Books for Reference:

1. Jeffrey C.Pommerville, Alcamo's Fundamentals of Microbiology, 9th edition, Jones and Bartlett publishers, Massachusetts, 2011.

2. N.J. Dimmock and S.B. Primrose, Introduction to Modern Virology, 4th Edition, Blackwell Scientific Publications, Oxford, 1994.

3. A. Maharajan, Virology, Daya Publishing House, New Delhi 2015.

4. S.S. Purohit, Microbiology- Fundamentals and Applications, 7th Edition, Agrobios (India) Jodhpur, 2008.

Web Source:

1. https://en.wikibooks.org/wiki/Structural_Biochemistry/Cell_Organelles/Cytoskeleton

2. <https://ucmp.berkeley.edu/archaea/archaea.html>

3. <https://www.britannica.com/science/virion>

4. <https://www.khanacademy.org/science/biology/biology-of-viruses/virus-biology/a/bacteriophages>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
II	20UMB2CC3	BACTERIOLOGY AND VIROLOGY					6	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓		✓		✓	✓		✓		
CO2	✓	✓	✓	✓		✓	✓	✓	✓		
CO3	✓	✓	✓	✓		✓	✓	✓	✓		
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓		
Number of Matches= 40, Relationship : High											

Prepared by:
K.Vijayalakshmi

Checked by:
1.A.Fasila Begum
2. Dr.A.KhaleelAhamed

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20UMB2CC4P	CORE -IV	BACTERIOLOGY AND VIROLOGY-PRACTICAL	3	2	100	20	80

Course Outcomes

At the end of the course, students will be able to

1. Examine the motility of bacteria.
2. Perform different staining techniques.
3. Determination of bacterial growth by different methods.
4. Demonstrate the isolation of bacteriophages.
5. Justify the amount of bacteriophages in sewage.

List of Practicals

1. Temporary wet mount (TWM) technique by hay infusion broth.
2. Motility of bacteria - Hanging drop technique.
3. Acid –Fast Staining.
4. Bacterial spore (endospore) staining.
5. Capsule staining
6. Negative staining technique.
7. Determination of bacterial growth by direct count and
8. Determination of bacterial growth by turbidity measurements (Spectrophotometric method).
9. Isolation of Bacteriophage from sewage.
10. Cultivation and Enumeration of Bacteriophages.

Practical Manual:

1. James G. Cappuccino, Natalie Sherman, Microbiology – A laboratory manual, The Benjamin Cummings Publishing Company, Inc, 1996.
2. K.R. Aneja, Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
3. B.K.Khuntia, Basic Microbiology – An Illustrated Laboratory Manual, 2nd Edition, Daya Publishing House, New Delhi, 2013.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits				
II	20UMB2CC4P	BACTERIOLOGY AND VIROLOGY PRACTICAL					3	2				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		✓	✓	✓	✓			
CO3	✓	✓	✓	✓		✓	✓	✓	✓			
CO4	✓	✓		✓		✓	✓		✓			
CO5	✓	✓		✓		✓	✓		✓			
Number of Matches= 38, Relationship : High												

Prepared by:
K.Vijayalakshmi

Checked by:
1.A.Fasila Begum
2.Dr.A.KhaleelAhamed

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20UMB2AC3	ALLIED - III	GENERAL BIOCHEMISTRY II: BIOENERGETICS AND ENZYMOLGY	4	3	100	25	75

Course Outcomes

At the end of the course, students will be able to

1. Explicit the concepts of bioenergetics.
2. Acquire the knowledge on energy conversions.
3. Describe the enzymes and its source.
4. State the mechanisms of enzyme action.
5. Interpret the enzyme kinetics.

UNIT I

12hours

Bioenergetics:Laws of Thermodynamics. Definitions of Gibb's Free Energy, enthalpy, entropy and relationship among them. Standard free energy change and Energy rich compounds: Phosphoenolpyruvate, 1,3- Bisphosphoglycerate, #Thioesters#.

UNIT II

12hours

Energy Conversions - Mitochondria:Chemical activity of mitochondria. Sequence of electron carriers and sites of oxidative phosphorylation, ATP generation. Theories ofoxidative phosphorylation, #uncouplers# and inhibitors of energy transfer.

UNIT III

12hours

Enzymes: Classification of enzymes - Enzymes as biocatalysts, catalytic power, activation energy, substrate specificity and active site. Sources of enzymes – Media for enzyme production- Preparation of enzymes – Centrifugation, filtration, #Cell breakage# and Chromatography

UNIT IV

12hours

Mechanism of Enzymes Action: Theories of mechanisms of enzyme action -Enzyme specificity – Active site – Study of Mechanism of enzyme reaction – Pathway of enzyme catalyzed reactions. Mechanism of action of lysozyme, #chymotrypsin# and ribonuclease.

UNIT V

12hours

Enzyme kinetics: Importance of enzyme kinetics, factors affecting rates of enzyme mediated reactions -pH, temperature, substrate concentration, #enzyme concentration and reaction time#. Derivation of Michaelis - Menton equation and its significance in enzyme kinetic studies.

Self-study portion.

Text Books:

T.B-1. David L. Nelson and Michael M.Cox, Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, 2005.

T.B-2. U.Satyanarayana and U.Chakrapani, Biochemistry, 4th edition, Elsevier, New Delhi, 2013.

T.B-3. Keith Wilson and John Walker, Principles and techniques of Biochemistry and Molecular Biology, 6th Edition, Cambridge University Press, New York, 2005.

T.B-4. Amita Saxena, Textbook of Biochemistry, Discovery Publishing House, 2006.

UNIT I Chapter XIII **T.B-1.**

UNIT II Chapter XIX **T.B-1.**

UNIT III Chapter XV **T.B-3.**

UNIT IV Chapter VII **T.B-4.**

UNIT V Chapter VI **T.B-2.**

Books for Reference:

1. Athel Cornish – Bowden. Principles of Enzyme Kinetics. - Portland press, 2004.
2. M.F. Chaplin and C. Bucke. Enzyme Technology, Cambridge University press, 1990.

Web Source:

1. <https://www.khanacademy.org/science/chemistry/thermodynamics-chemistry/gibbs-free-energy/a/gibbs-free-energy-and-spontaneity>
2. <https://www.britannica.com/science/metabolism/ATP-synthesis-in-mitochondria>
3. <http://www1.lsbu.ac.uk/water/enztech/mechan.html>
4. <https://en.wikipedia.org/wiki/Lysozyme>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits				
II	20UMB2AC3	GENERAL BIOCHEMISTRY II: BIOENERGETICS AND ENZYMOLGY					4	3				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓	✓		✓	✓	✓	✓			
CO2	✓		✓	✓		✓		✓	✓			
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO4	✓	✓	✓			✓	✓	✓				
CO5	✓	✓	✓	✓		✓	✓	✓	✓			
Number of Matches= 38, Relationship : High												

Prepared by:
A.Fasila Begum

Checked by:
1.K.Vijayalakshmi
2. Dr.A.KhaleelAhamed

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External Marks
II	20UMB2AC4P	ALLIED - IV	GENERAL BIOCHEMISTRY II: BIOENERGETICS AND ENZYMOLOGY - PRACTICAL	3	2	100	20	80

Course Outcomes

At the end of the course, students will be able to

1. Estimate the protein by different methods.
2. Separate the amino acids by using chromatography.
3. Determine the various influencing factors on enzymes
4. Demonstrate the method of immobilization of enzymes.
5. Perform the rate of anaerobic respiration.

List of Practicals

1. Estimation of Proteins – Biuret and Folin method.
2. Separation of amino acids by paper chromatography.
3. Assay of enzyme activity.
4. Effect of pH on enzyme activity.
5. Effect of temperature on enzyme activity.
6. Effect of substrate enzyme activity.
7. Immobilization of enzymes by alginate beads.
8. Determine the of sugar concentration rate of anaerobic respiration

Practical Manual:

1. James G. Cappuccino, Natalie Sherman. Microbiology – A laboratory manual, The Benjamin Cummings Publishing Company, Inc, 1996.
2. K.R. Aneja, Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
3. Jyoti Saxena, Mamta Baunthiyal, Indu Ravi, Comprehensive Laboratory Manual of Life Sciences, Scientific Publishers, 2019.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits				
II	20UMB2AC4P	GENERAL BIOCHEMISTRY II: BIOENERGETICS AND ENZYMOLGY PRACTICAL					3	2				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓		✓	✓		✓		✓	✓			
CO2	✓		✓	✓	✓	✓		✓	✓	✓		
CO3	✓		✓	✓		✓		✓	✓			
CO4	✓	✓	✓	✓		✓	✓	✓	✓			
CO5	✓	✓	✓	✓		✓	✓	✓	✓			
Number of Matches= 36, Relationship : High												

Prepared by:
A.Fasila Begum

Checked by:
1.K.Vijayalakshmi
2. Dr.A.KhaleelAhamed

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
III	20UMB3CC5	Core – V	MICROBIAL PHYSIOLOGY AND METABOLISM	4	4	100	25	75

Course Outcomes:

At the end of this course, students will be able to

1. Examine the effects and types of nutritional transport on bacteria.
2. Acquire the knowledge on bacterial growth and the influence of various factors on the growth.
3. Explain the energy metabolism and prominent features of bacteria.
4. Summarize the protein metabolism in bacteria.
5. Acquire the relevant knowledge about nitrogen fixation.

UNIT I

12 Hours

Transport of nutrients and biosynthesis: Bacterial motility, Diffusion – Passive and facilitated, Primary active and secondary active transport, Group translocation-phosphotransferase system, symport, antiport and uniport, electrogenic and #electro neutral transport#, Structure and Biosynthesis of a cell-wall Peptidoglycan.

UNIT II

12 Hours

Microbial growth: Definitions of growth and generation time, measurement of microbial growth and specific growth rate. Batch and continuous culture. Factors influencing microbial growth – #temperature#, pH, pressure, salt concentration.

UNIT III

12 Hours

Metabolism of carbohydrates: Anabolism, catabolism, primary and secondary metabolism, Synthesis of carbohydrates - Sugar degradation pathways i.e., EMP, ED and Pentose phosphate pathway, Krebs's cycle (TCA) - Electron transport system and ATP production. Photosynthesis –#light and dark reactions#

UNIT IV

12 Hours

Metabolism of protein: metabolic pathways of nitrogen utilization, Biosynthesis of amino acids, peptides and proteins. #Degradation of amino acids#.

UNIT V

12 Hours

Anaerobic respiration and Nitrogen fixation: Nitrate, sulphate & Methane respiration – Fermentations- alcohol, mixed acid, lactic acid fermentation – Anabolic and catabolic processes of lipids. Nitrogen Fixation – Physiology of nitrogen cycle. #Nitrogen fixers'#. #Self-study portion.

Text Books:

T.B-1 Moat A.G., Foster J.W. and Spector M.P. 2002. Microbial Physiology, 4th edition. A John Wiley and Sons Inc., publication.

T.B-2 Kim B.H. and Gadd G.M. 2008. Bacterial physiology and metabolism. Cambridge University Press, Cambridge.

T.B-3 Michael J. Pelczar, Jr. E.C.S. Chan, Noel R. Krieg. Microbiology. 5th edition, Tata McGraw Hill Edition, 2010.

T.B-4 Prescott, L.M. Harley and C.A. Klein's. Microbiology 10th edition McGrawHill, 2017.

UNIT I	Chapter I	T.B-1
UNIT II	Chapter III & V	T.B-2
	Chapter V	T.B-3
UNIT III	Chapter XXIII	T.B-4
UNIT IV	Chapter XVII	T.B-1
UNIT V	Chapter XVIII	T.B-1

Books for Reference:

1. JM. Willey, L.M. Sherwood and C.J. Woolverton, Prescott's Principles of Microbiology. McGraw-Hill Higher Education p.969, 2009.
2. Caldwell, D. R., Microbial Physiology and Metabolism. Star Publishing Company. Belmont, CA, 2000.
3. B. H. Kim and G. M. Gadd. Bacterial physiology and Metabolism Cambridge University Press The Edinburgh Building, Cambridge CB2 8RU, UK, 2008.

Web Source:

1. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/microbial-physiology>
2. <https://courses.lumenlearning.com/microbiology/chapter/introduction-to-microbial-metabolism/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper					Hours	Credits	
III	20UMB3CC5		MICROBIAL PHYSIOLOGY AND METABOLISM					4	4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓		✓	✓		✓		✓
CO2	✓	✓			✓	✓	✓			✓
CO3	✓		✓	✓	✓	✓		✓	✓	✓
CO4	✓		✓	✓	✓	✓		✓	✓	✓
CO5	✓		✓	✓	✓	✓		✓	✓	✓
Number of Matches= 36, Relationship : Moderate										

Prepared by:
Dr.P.Sivalingam

Checked by:
1.K.Vijayalakshmi
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
III	20UMB3CC6P	Core – VI	MICROBIAL PHYSIOLOGY AND METABOLISM-PRACTICAL	3	2	100	20	80

Course Outcomes:

At the end of this course, students will be able to

1. Examine the effect of abiotic factors on the growth of microorganisms.
2. Acquire the knowledge about microorganism and its physiology.
3. Compare the factors affecting bacterial growth.
4. Report the reproducible data from biochemical experiments.
5. Examine the photosynthetic bacteria.

1. Bacterial growth curve: Cell count, Viable count and absorbance method
2. Effect of temperature on bacterial growth.
3. Effect of pH on bacterial growth.
4. Isolation of Photosynthetic bacteria
5. Indole production test.
6. Methyl red test.
7. Voges Proskauer test.
8. Citrate utilization test.
9. Catalase test.
10. Oxidase test.
11. TSI test.

Practical Manuals

1. Cappuccino and James, G. Microbiology a laboratory manual. Addison Wesley Publishing Company Inc., England, California. 2013.
2. Aneja, KR. Experiments in Microbiology, Plant pathology and Biochemistry (4th Edition). New age International publishers, India 2003.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
III	20UMB3CC6P	MICROBIAL PHYSIOLOGY AND METABOLISM PRACTICAL					3	2		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓	✓		✓	✓	✓
CO2	✓	✓		✓	✓	✓	✓		✓	✓
CO3			✓	✓				✓	✓	
CO4	✓		✓		✓	✓		✓		✓
CO5	✓		✓	✓	✓	✓		✓	✓	✓
Number of Matches= 34, Relationship : Moderate										

Prepared by:
1. Dr.P.Sivalingam

Checked by:
1.K.Vijayalakshmi
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
III	20UMB3AC5	Allied- V	IMMUNOLOGY-I: PRINCIPLES OF IMMUNOLOGY	4	3	100	25	75

Course Outcomes:

At the end of this course, students will be able to

1. Describe the immune system and organs of human.
2. Acquire the knowledge on different types of the immune response against pathogens.
3. Describe the transplantation and its immunological significance.
4. Acquire the knowledge of different types of vaccines and tumour biology.
5. Explain the various immunotechniques applicable in diagnostics.

UNIT I

12 Hours

Immune cells and organs of the immune system - Historical Perspective, Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell. Organs of Immune system- #primary# and secondary lymphoid organs.

UNIT II

12 Hours

Immune Response- Types of immunity-Innate (non-specific) and Adaptive Immunity (specific). #Antibody (humoral) mediated immunity# and Cell mediated immunity. Antigens- Properties of antigen, Immunoglobulins- Structure and types of antibody.

UNIT III

12 Hours

Transplantation: Structure, function of Major histocompatibility complex and HLA system. Transplantation- organ transplantations in humans, #HLA typing methods#, Graft rejection- Graft disease (GVHD).

UNIT IV

12 Hours

Immunoprophylaxis and Tumor Immunity – Vaccine-Types – Killed, Live attenuated (bacterial and viral) and Toxoid with an example each. Types of tumors, #tumor Antigens#, causes and therapy for cancers.

UNIT V

12 Hours

Immunological Techniques: Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluorescence, Flow cytometry, #Immunoelectron microscopy#.

Self-study portion.

Text Books:

T.B-1 Goldsby RA, Kindt TJ, Osborne BA. Kuby's Immunology. 8th edition W.H. Freeman and Company, New York, 2019.

T.B-2 Ananthanarayan R and Paniker CKJ. Textbook of Microbiology. 9th edition (edited by Paniker CKJ). University Press Publication, 2013.

T.B-3 David male, Jonathan Brostoff, Roth, D.B. and Ivan Roitt. Immunology (8th edition) Mosy Elsevier publication, Canada. 2012.

T.B-4 Benjamin, E., Coico, R. and Sunshine, G. Immunology (7th edition). Wiley Publication, USA. 2015.

T.B-5 Donal, M. Weir, John Steward. Immunology (8th edition). ELBS, London, 2001.

UNIT I	Chapter III	T.B-2
UNIT II	Chapter V	T.B-3
UNIT III	Chapter XXIV, XXV	T.B-1
UNIT IV	Chapter XIX	T.B-4
UNIT V	Chapter VIII	T.B-5

Books for Reference:

1. Ivan M. Roit . Essential Immunology – Thirteenth Edition. Blackwell Scientific Publications, Oxford, 2017.
2. Kuby J. Immunology (7th edition) – WH Freeman and Company, New York, 2013.
3. Richard M. Hyde. Microbiology and Immunology. National Medical series, Williams and Wilkins, Harward Publishing company, 2011.
4. David male, Jonathan Brostoff, Roth, D.B. and Ivan Roitt. Immunology (7th edition) Mosy Elsevier publication, Canada. 2006.
5. Austin J. M. and Wood K. J. Principles of Molecular and Cellular Immunology, Oxford University Press, London, 2000.

Web Source:

1. <https://www.sciencedirect.com/topics/medicine-and-dentistry/transplantation>
2. <https://vk.ovg.ox.ac.uk/vk/types-of-vaccine>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
III	20UMB3AC5	IMMUNOLOGY-I: PRINCIPLES OF IMMUNOLOGY					4	3		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓		✓	✓	✓	✓		✓	✓	✓
CO3	✓	✓				✓	✓			
CO4			✓	✓	✓			✓	✓	✓
CO5	✓			✓	✓	✓			✓	✓
Number of Matches= 34, Relationship :						Moderate				

Prepared by:
1. Dr.P.Sivalingam

Checked by:
1. A.FasilaBegum
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
III	20UMB3AC6P	Allied-VI	IMMUNOLOGY-I: PRINCIPLES OF IMMUNOLOGY - PRACTICAL	3	2	100	20	80

Course Outcomes:

At the end of this course, students will be able to

1. Identify the human bloodgroup.
2. Examine the antibodies against the target pathogen.
3. Analyze the immunodiffusion.
4. Demonstrate the immunoelectrophoresis.
5. Determine the antigen and antibody interactions.

1. Identification of human blood group and Rh factor
2. Latex agglutination-CRPT test.
3. Anti Streptolysin O (ASO) test.
4. WIDAL Test.
5. VDRL Test.
6. Radial Immuno Diffusion,
7. Ouchterlony Double Diffusion.
8. Demonstrations of Immunoelectrophoresis.
9. Demonstration of ELISA (Antigen/Antibody detection)

Practical Manual

1. Barbara Detrick, Robert G. Hamilton, John L. Schmitz. Manual of Molecular and Clinical Laboratory Immunology, 8th Edition, 2016.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
III	20UMB3AC6P	IMMUNOLOGY-I: PRINCIPLES OF IMMUNOLOGY PRACTICAL					3	2		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓	✓		✓	✓	✓
CO2	✓	✓		✓	✓	✓	✓		✓	✓
CO3			✓	✓	✓			✓	✓	✓
CO4	✓		✓		✓	✓		✓		✓
CO5	✓		✓	✓	✓	✓		✓	✓	✓
Number of Matches= 35, Relationship : Moderate										

Prepared by:
1. Dr.P.Sivalingam

Checked by:
1. A.FasilaBegum
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
IV	20UMB4CC7	Core – VII	CLINICAL MICROBIOLOGY	5	5	100	25	75

Course Outcomes:

At the end of this course, students will be able to

1. Identify the Epidemiology and pathogenicity of diseases.
2. Summarize the characteristics and pathogenicity of various types of bacteria.
3. Describe the characteristics and mechanism of pathogenesis of different fungi.
4. Illustrate the morphology, pathogenesis and clinical manifestations of viruses.
5. Determine the structure, life cycle, clinical manifestations and diagnosis of parasites.

UNIT I

15 hours

Introduction to Clinical Microbiology: Scope and applications. Disease prevalence and incidence. Epidemiology and Infection – stages and transmission. Normal microflora of human body. Host defense against microbial invasion and Harmful microbial interactions. #Nosocomial infections#.

UNIT II

15 hours

Bacterial pathogens: Morphology, cultural characteristics, pathogenesis, diagnosis and prophylaxis of *Staphylococcus*, *Streptococcus*, *Vibrio*, *Bacillus*, *Mycobacterium*, *Corynebacterium*, #*Salmonella*#, *Proteus*, *E.coli*, *Klebsiella*, *Neisseria* and *Mycoplasma*.

UNIT III

15 hours

Fungal pathogens: General characteristics, morphology, pathogenesis, laboratory diagnosis and prophylaxis of Superficial- Dermatophytes-*Microsporum*, *Trichophyton* and #*Epidermophyton*#. Subcutaneous- Sporothrix and Mycetoma. Systemic- *Histoplasma* and *Blastomyces*. Opportunistic fungal infections-*Candida*, *Cryptococcus* and *Aspergillus*.

UNIT IV

15 hours

Viral disease: Characteristics, morphology, pathogenesis, clinical manifestations, diagnosis and prophylaxis of Measles, Mumps, Herpes virus, Pox virus, #Polio virus#, Rabies, Corona, Chikungunya, Ebola, Dengue Hepatitis B and HIV.

UNIT V

15 hours

Parasitic infections: General characteristics, structure, life cycle, pathogenesis, epidemiology, clinical manifestations and laboratory diagnosis of Amoebiasis, #Giardiasis#, Trypanosomiasis, Leishmaniasis, Malaria, Ascariasis and Filariasis.

Self-study portion.

Text Books:

- T.B-1.** David Greenwood, Richard Slack, Mike Barer and Will Irving, Medical Microbiology A guide to microbial infections: Pathogenesis, immunity, laboratory investigation and control, 18th edition, Church Hill Living stone Elsevier, 2012.
- T.B-2.** Anathanarayanan and Paniker, Text book of Microbiology, 8th edition, Orient Blackswan Publication, 2013.
- T.B-3.** Jawetz E. Melnic, JL and Adelberg EA. A review of Medical Microbiology. Lange Medical Publications, USA, 2007.

UNIT I	Chapter VI	T.B-1
UNIT II	Chapter III	T.B-1
UNIT III	Chapter V	T.B-1
UNIT IV	Chapter IV	T.B-2
UNIT V	Chapter IV	T.B-3

Books for Reference:

1. Michael J. Pelczar, Jr. E.C.S. Chan, Noel R.Krieg, Microbiology, 5thedition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi,2010.
2. Mark Gladwin, William Trattler, and Scott Mahan, C., Clinical Microbiology made ridiculously simple, 6th edition, Med Master, Inc., USA,2014.

Web Source:

1. <https://www.msmanuals.com/professional/infectious-diseases/biology-of-infectious-disease/factors-facilitating-microbial-invasion>
2. <https://www.slideshare.net/doctorrao/mycoplasma>
3. <https://www.ncbi.nlm.nih.gov/books/NBK7782/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits				
IV	20UMB4CC7	CLINICAL MICROBIOLOGY					5	5				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓		✓	✓	✓	✓		✓	✓	✓		
CO2		✓	✓	✓			✓	✓	✓			
CO3		✓	✓	✓			✓	✓	✓			
CO4		✓	✓	✓			✓	✓	✓			
CO5		✓	✓	✓			✓	✓	✓			
Number of Matches= 32,Relationship : Moderate												

Prepared by:
A.FasilaBegum

Checked by:
1.K.Vijayalakshimi
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
IV	20UMB4CC8P	Core – VIII	CLINICAL MICROBIOLOGY - PRACTICAL	3	2	100	20	80

Course Outcomes

At the end of this course, students will be able to

1. Describe the epidemiology of diseases.
2. Illustrate the methods for isolation and identification of microorganisms from various specimens.
3. Predict the susceptibility of microorganisms to drugs.
4. Identify the minimum inhibitory and bactericidal concentration of antibiotics.
5. Demonstrate the methods for examination of fungi, yeast and protozoa from different specimens.

1. Isolation of bacterial flora of skin by swab method.
2. Isolation and identification of microorganisms from sputum sample.
3. Isolation and identification of microorganisms from wound sample.
4. Antimicrobial susceptibility test against specific pathogens – Kirby-Bauer method.
5. Examination of medically important fungi by Lacto phenol cotton blue stain.
6. Demonstration of blood parasites by Giemsa staining.
7. Estimation of serum sugar.
8. Estimation of serum cholesterol.
9. Estimation of SGOT.
10. Estimation of SGPT.

Practical Manual

1. James G. Cappuccino, Natalie Sherman, Microbiology – A laboratory manual, The Benjamin Cummings Publishing Company, Inc, 2005.
2. Benson H.J, Microbiological Applications: A Laboratory Manual in General Microbiology, The McGraw– Hill Companies, 2015.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
IV	20UMB4CC8P	CLINICAL MICROBIOLOGY PRACTICAL					3	2			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓		✓	✓	✓	✓		
CO2		✓	✓	✓	✓		✓	✓	✓	✓	
CO3	✓	✓	✓	✓		✓	✓	✓	✓		
CO4	✓	✓	✓	✓		✓	✓	✓	✓		
CO5	✓	✓		✓	✓	✓	✓		✓	✓	
Number of Matches= 40, Relationship : High											

Prepared by:
A.FasilaBegum

Checked by:
1.K.Vijayalakshmi
2.Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
IV	20UMB4AC7	ALLIED - VII	IMMUNOLOGY II: IMMUNOHAEMATOLOGY	5	3	100	25	75

Course Outcomes

At the end of this course, students will be able to

1. Explicit the historical inventions in Immunohematology and bloodgrouping.
2. Acquire the knowledge on components, preservation and storage of blood.
3. Describe the methods for counting of bloodcells.
4. Gain the comprehensive knowledge on basics of bloodtransfusion.
5. Report the hemolytic diseases of new born, prevention and treatment.

UNIT I

15 Hours

Introduction to Immunohematology – Definition, Historical overview of Immunohematology, Discovery of blood grouping - ABO grouping - Rh factor, Blood group genetics, Clinical significance of blood groups. Biochemical properties and characteristics of blood group antigens and antibodies. #Identification of natural and immune antibodies#. Role of hybridoma technology in Immunohematology.

UNIT II

15 Hours

Blood – Definition, Composition, morphology and functions of blood cells. Erythropoiesis, Leucopoiesis and Thrombopoiesis. Hemoglobin – structure and function. Collection of blood from adults and infants (vein puncture, fingerstick, heelstick). #Preservation and storage of blood and components#. Preparation and standardization of blood components.

UNIT III

15 Hours

Counting of blood cells - Total RBC count – Diluting fluids, Macro dilution and micro dilution technique. Total WBC count – Diluting fluids, Macro dilution and micro dilution technique. Differential leucocyte count, #Total platelet count#. Anticoagulants – Definition, mode of action, uses, and different types.

UNIT IV

15 Hours

Blood Transfusion – Pre-transfusion testing – Basic procedures and techniques for compatibility testing. Emergency and elective techniques, Typing and screening of blood. Techniques for cross matching. Principle and practice of blood transfusion, Clinical consideration in transfusion. Guidelines for the appropriate use of blood, quality assurance. #Types of transfusion reactions#.

UNIT V

15 Hours

Hemolytic disorders – Autoimmune Hemolytic anemia, #Immune thrombocytopenia#, Immune neutropenia- Immunohaematological problems in multi transfused patients. Hemolytic disorder of new born – Introduction, due to Rh incompatibility, due to ABO blood group incompatibility, prevention and treatment of HDN.

Self-study portion.

Text Books:

T.B-1. Sheryl A. Whitlock, Immunohematology For Medical Laboratory Technicians, Delmar Cengage Learning, USA, 2010.

T.B-2. Andrew Blann, Gavin knight and Gray Moore, Haematology, Oxford University Press, 2010.

T.B-3. Kanai L. Mukherjee, Medical laboratory technique, Vol 1 & 2, 2nd edition, Tata McGraw Hill Education Private Ltd, New Delhi, 2010.

UNIT I	Chapter I, V & VI	T.B-1
UNIT II	Chapter X & XI	T.B-1
UNIT III	Chapter IX	T.B-3
UNIT IV	Chapter VIII	T.B-1
UNIT V	Chapter XIII	T.B-1

Books for Reference:

1. Gadkar P.B and Gadakar D.P, Textbook Medical Laboratory Technology,2005.
2. Barbara J. Bain, Blood cells, Wiley Black well Publication,2006.
3. Mukerjee, K.L, Medical Laboratory Technologies Vol I – III, Tata McGraw Hill, Publishers, New Delhi, 2002.

Web Source:

1. <https://www.verywellhealth.com/importance-of-hemoglobin-2249107>
2. https://www.amboss.com/us/knowledge/Oral_anticoagulants
3. <https://sites.google.com/site/abobbsrheumatology/Home/principles-and-practice-of-blood-transfusions-i-and-ii>
4. [https://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=90&ContentID=P02368#:~:text=Hemolytic%20disease%20of%20the%20newborn%20\(HDN\)%20is%20a%20blood%20problem,down%20of%20red%20blood%20cell](https://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=90&ContentID=P02368#:~:text=Hemolytic%20disease%20of%20the%20newborn%20(HDN)%20is%20a%20blood%20problem,down%20of%20red%20blood%20cell)
[s.](#)

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
IV	20UMB4AC7	IMMUNOLOGY II: IMMUNOHAEMATOLOGY					5	3			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1			✓	✓	✓			✓	✓	✓	
CO2			✓	✓	✓			✓	✓	✓	
CO3			✓	✓	✓			✓	✓	✓	
CO4			✓	✓	✓			✓	✓	✓	
CO5			✓	✓	✓			✓	✓	✓	
Number of Matches= 30,Relationship : Moderate											

Prepared by:
A.FasilaBegum

Checked by:
1.K.Vijayalakshmi
2.Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
IV	20UMB4AC8 P	ALLIED - VIII	IMMUNOLOGY II: IMMUNOHAEMATOLOGY- PRACTICAL	3	2	100	20	80

Course Outcomes

At the end of this course, students will be able to

1. Demonstrate the collection and separation of components of blood.
2. Perform the ABO blood grouping and Rhtyping.
3. Describe the methods for counting of bloodcells.
4. Estimate the amount of hemoglobin in blood.
5. Determine the presence of specific antibodies by various techniques.

1. Blood collection.
2. Separation of serum and plasma from whole blood.
3. Determination of bleeding time and clotting time.
4. Total count of WBC.
5. Differential count of WBC.
6. Total count of RBC.
7. Estimation of hemoglobin.
8. Determination of Erythrocyte Sedimentation Rate.
9. Coomb's Test.

Practical Manual

1. Myer's and Koshy's Manual of diagnostic procedures in medical microbiology and immunology/serology. Published by department of clinical microbiology, CMC Hospital, Vellore, TamilNadu.
2. Rajan S and Selvi Christy, Experimental procedures in life sciences, Anjana Book House publishers and distributors, Chennai, 2011.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
IV	20UMB4AC8P	IMMUNOLOGY II: IMMUNOHAEMATOLOGY PRACTICAL					3	2		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			✓	✓	✓			✓	✓	✓
CO2			✓	✓	✓			✓	✓	✓
CO3			✓	✓	✓			✓	✓	✓
CO4			✓	✓	✓			✓	✓	✓
CO5			✓	✓	✓			✓	✓	✓
Number of Matches= 30,Relationship : Moderate										

Preparedby:
A.FasilaBegum

Checked by:
1.K.Vijayalakshmi
2.Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
III	20UMB3GE1	Generic Elective 1#	MICROBIAL FOOD PRODUCTS	2	2	100	-	100

Course Outcomes

At the end of this course, students will be able to

1. Acquire the knowledge on microbes as food and its products.
2. Explicit the concept of Probiotics.
3. Comment the various productions of microbial products.
4. Identify the appropriate unit operations required to produce different types of food products.
5. Grasp the knowledge on the importance of food safety hazards.

UNIT I

6 Hours

Fermented Food Products: Role of microorganisms in food and dairy industry. Fermented dairy products – Cheese, Yogurt, Cultured buttermilk, #Kefir and Bread#. Fermented plant food products-Pickles and Sauerkraut.

UNIT II

6 Hours

Probiotics and Prebiotics: Production and composition of various probiotics; metabolism and bioavailability of probiotics. Effect of probiotics, prebiotics and symbiotics on human health. #Bioactive food#.

UNIT III

6 Hours

Microbial Products: Microbial production of Penicillin and Tetracycline, Acetic acid, #Lactic acid#, Gluconic acid. Production of vitamins- A, B₁₂ and Riboflavin. Enzymes- Amylases, Proteases and Lipases.

UNIT IV

6 Hours

Microbes as Food: Fermented beverages-beer, wine and other alcoholic beverages. Microbial preparation of Tempeh, Single cell protein and #Mushroom production#.

UNIT V

6 Hours

Microbiological criteria of food safety: Microbial standards for food- FDA, BIS, Food Safety and Standard Act of India. Food certification marks in India- ISI, #Agmark#, FPO, BIS, and FSSAI. Food export control and certification.

Self –study portion.

Text Books:

T.B-1. Charles W. Bamforth and David J. Cook, Food, Fermentation and Microorganisms, Blackwell Pubs, 2005.

T.B-2. Ronald Ross Watson and Victor R. Preedy, Probiotics, Prebiotics and Synbiotics, Academic Press Elsevier, 2016.

T.B-3. Patel, A.H. Industrial Microbiology. Macmillan India Ltd, 2005.

T.B-4. Frazier W.C and Westhoff, D.C, Food Microbiology, Tata McGraw Hill Publishing Ltd, New Delhi, 2014.

UNIT I Chapter I **T.B-1**

UNIT II Chapter XIV & XV **T.B-2**

UNIT III Chapter X & XI **T.B-3**

UNIT IV Chapter II & XXVII **T.B-1**

UNIT V Chapter XXVII **T.B-4**

Books for Reference

1. James M. Jay, Loessner, M. J, and Golden D. A, Modern Food Microbiology, 7th edition, 2005.
2. Adams, M. R, and Moss, M. O, Food Microbiology, 4th edition, New Age International (Rt) Ltd, New Delhi,2016.

Web Source:

1. <https://effca.org/microbial-cultures/food-production/>
2. <https://pmj.bmj.com/content/80/947/516>
3. <https://www.news-medical.net/life-sciences/What-are-Recombinant-Proteins.aspx>
4. <https://www.mushroomoffice.com/mushroom-cultivation/>
5. <https://www.cbd.int/financial/greenmarkets/g-certicodex-fao.pdf>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
III	20UMB3GE1	MICROBIAL FOOD PRODUCTS					2	2		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓		✓		✓	✓		✓		✓
CO3	✓		✓	✓	✓	✓		✓	✓	✓
CO4	✓		✓	✓	✓	✓		✓	✓	✓
CO5	✓		✓		✓	✓		✓		✓
Number of Matches= 38, Relationship :High										

Preparedby:
Ms.K.Vijayalakshmi

Checked by:
1.Dr.N.Packiyalakshmi
2.Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
IV	20UMB4GE2	Generic Elective II #	COSMETIC MICROBIOLOGY	2	2	100	-	100

Course Outcomes

At the end of this course, students will be able to

1. Grasp the knowledge on Cosmetic Microbiology.
2. Explicit the various product forms in cosmetics.
3. Acquire the knowledge on cosmetic ingredients.
4. Investigate the antimicrobial preservative testing in cosmetics.
5. Describe the Cosmetic product regulations.

UNIT I

6 Hours

Introduction to Cosmetic Microbiology: Regulatory definition of Cosmetics. History of cosmetic microbiology- Microbiology as a scientific discipline, Biology of microbes. Broad classification of cosmetic products for skin, hair and oral care.

UNIT II

6 Hours

Application of Cosmetics Products: Solutions, creams, lotions, ointment, paste, gels, sticks, tablets, capsules, powders and aerosols. Product Development: Defining the product, selection & sources of ingredients, formula optimization.

UNIT III

6 Hours

Cosmetic Ingredients: Classification and application in cosmetics – Foaming agents, emulsifiers, and solubilizers. Antioxidants, anti UV compounds, antimicrobial and chelating agents used as preservatives. Perfume: Classification of perfumes. Perfume ingredients listed as allergens in EU guidelines.

UNIT IV

6 Hours

Antimicrobial Preservative Testing: General product and raw materials tests -CTFA, ASTM and USP method- Microbial enumeration tests, Tests for specified microorganisms, Microbiological contamination limits for nonsterile products, D-value methods and Capacity tests.

UNIT V

6 Hours

Cosmetic Product Regulation: Ingredients, Safety assessment, Efficacy data, Labeling requirements for cosmetic products. Evolution of Cosmetics to Cosmeceuticals. Environmental and safety concerns of cosmetic ingredients. Guidelines on green cosmetics and challenges in green formulation.

Self-study portion

Text Books

T.B-1. Philip A. Geis, Cosmetic Microbiology, 2nd Edition, Taylor & Francis Group, New York, London, 2006.

T.B-2. Wilkinson J.B and Moore R.J, Harry's Cosmeticology –7th edition, Chemical Publishing, New York, 2011.

T.B-3. P.P. Sharma, Cosmetics – Formulation, Manufacturing and Quality Control, 4th edition, Vandana Publications Pvt. Ltd., Delhi, 2014.

T.B-4. Hilda Butler, Poucher's Perfumes, Cosmetics and Soaps, 10th Edition, Kluwer Academic Publishers.

UNIT I	Chapter I & II	T.B-1
UNIT II	Chapter II	T.B-3
UNIT III	Chapter IV	T.B-2
UNIT IV	Chapter V	T.B-1
UNIT V	Chapter III	T.B-4

Books for Reference

1. André O. Barel, Marc Paye, Howard I. Maibach, Handbook of Cosmetic Science and Technology, 3rd Edition, Marianne Mahieu Informa Healthcare USA, Inc.
2. Zoe Diana Draelos, Lauren A. Thaman, Cosmetic formulation of skin care products.

Web Source:

1. <https://www.ceway.eu/cosmetic-products-definition-in-the-eu/#:~:text=>
2. <https://thebeautybrains.com/2014/05/understanding-the-basic-forms-of-cosmetics/>
3. <https://betaeq.com.br/index.php/en/2019/06/26/cosmetics-ii-classifications-and-applications-of-cosmetics/>
4. <https://www.pharmamanufacturing.com/articles/2014/usp-microbial-examination-nonsterile-products/#>
5. <http://www.opastonline.com/wp-content/uploads/2019/01/cosmetics-vs-cosmeceuticals>
6. <https://cosmeticsinfo.org/ingredient/uv-filter-ingredients-0>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
IV	20UMB3GE2	COSMETIC MICROBIOLOGY					2	2			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2			✓	✓	✓			✓	✓	✓	
CO3			✓		✓			✓		✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO5			✓		✓			✓		✓	
Number of Matches= 32, Relationship : Moderate											

Prepared by:
K.Vijayalakshmi

Checked by:
1.Dr.N.Packiyalakshmi
2.Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

B.Sc. MICROBIOLOGY (THIRD YEAR 2022-2023)

SEM	COURSE CODE	PART	COURSE	COURSE TITLE	Ins. Hrs /Week	CREDITS	MARKS		TOTAL
							CIA	ESE	
I	20U1LT1/LA1/LF1/LH1/LU1	I	Language – I		6	3	25	75	100
	20UCN1LE1	II	English - I		6	3	25	75	100
	20UMB1CC1	III	Core – I	Introduction to Microbiology and Microbial Diversity	5	5	25	75	100
	20UMB1CC2P		Core – II	Introduction to Microbiology and Microbial Diversity Practical	3	2	20	80	100
	20UMB1AC1		Allied –I	General BiochemistryI: Biomolecules	5	4	25	75	100
	20UMB1AC2P		Allied –II	General BiochemistryI: Biomolecules Practical	3	2	20	80	100
	20UCN1AE1	IV	AEC-I	Value Education	2	2	100	-	100
		TOTAL			30	21			700
II	20U2LT2/LA2/LF2/LH2/LU2	I	Language – II		6	3	25	75	100
	20UCN2LE2	II	English – II		6	3	25	75	100
	20UMB2CC3	III	Core – III	Bacteriology and Virology	6	5	25	75	100
	20UMB2CC4P		Core – IV	Bacteriology and Virology Practical	3	2	20	80	100
	20UMB2AC3		Allied – III	General BiochemistryII: Bioenergetics and Enzymology	4	3	25	75	100
	20UMB2AC4P	Allied –IV	General BiochemistryII: Bioenergetics and Enzymology Practical	3	2	20	80	100	
	20UCN2SE1	IV	Skill Enhancement Course- I @	Soft Skills Development	2	2	100	-	100
		TOTAL			30	20			700
III	20U3LT3/LA3/LF3/LH3/LU3	I	Language– III		6	3	25	75	100
	20UCN3LE3	II	English – III		6	3	25	75	100
	20UMB3CC5	III	Core– V	Microbial Physiology and Metabolism	4	4	25	75	100
	20UMB3CC6P		Core– VI	Microbial Physiology and Metabolism Practical	3	2	20	80	100
	20UMB3AC5		Allied– V	ImmunologyI:Principles of Immunology	4	3	25	75	100
	20UMB3AC6P	Allied–VI	ImmunologyI:Principles of Immunology Practical	3	2	20	80	100	
	20UMB3GE1	IV	Generic Elective I#		2	2	-	100	100
	20UCN3AE2		AEC-II	Environmental Studies	2	2	100	-	100
		TOTAL			30	21			800
IV	20U4LT4/LA4/LF4/LH4/LU4	I	Language–IV		6	3	25	75	100
	20UCN4LE4	II	English– IV		6	3	25	75	100
	20UMB4CC7	III	Core– VII	Clinical Microbiology	5	5	25	75	100
	20UMB4CC8P		Core - VIII	Clinical Microbiology Practical	3	2	20	80	100
	20UMB4AC7		Allied– VII	ImmunologyII: Immunohaematology	5	3	25	75	100
	20UMB4AC8P		Allied–VIII	ImmunologyII: ImmunohaematologyPractical	3	2	20	80	100
	20UMB4GE2	IV	Generic Elective – II#		2	2	-	100	100
	20UCN4EA	V	Extension Activities	NCC, NSS, etc.	-	1	-	-	-
		TOTAL			30	21			700
V	20UMB5CC9	III	Core – IX	Microbial Genetics	6	5	25	75	100
	20UMB5CC10		Core – X	Molecular Biology and Recombinant DNA Technology	5	5	25	75	100
	20UMB5CC11		Core – XI	Industrial Microbiology	5	5	25	75	100
	20UMB5CC12P		Core - XII	Microbial Genetics, Molecular Biology and Recombinant DNA Technology and Industrial Microbiology Practical	5	5	20	80	100
	20UMB5DE1A/B		DSE – I **		5	4	25	75	100
	20UMB5SE2A/B	IV	Skill Enhancement Course II@		2	2	-	100	100
	20UMB5SE3A/B		Skill Enhancement Course – III@		2	2	-	100	100
	20UMB5EC1		Extra Credit Course – I	General Intelligence for competitive Examination	-	4*	--	100*	100*
		TOTAL			30	28			700
VI	20UMB6CC13	III	Core– XIII	Food and Dairy Technology	5	5	25	75	100
	20UMB6CC14		Core– XIV	Environmental Microbiology	5	5	25	75	100
	20UMB6CC15		Core - XV	Soil and Agricultural Microbiology	5	5	25	75	100
	20UMB6CC16P		Core - XVI	Food and Dairy Technology Environmental Microbiology, Soil and Agricultural Microbiology Practical	5	5	20	80	100
	20UMB6DE2A/B		DSE II **		5	4	25	75	100
	20UMB6DE3A/B		DSE III **		4	4	25	75	100
	20UCN6AE3	IV	AEC-III	Gender Studies	1	1	100	-	100
	20UMB6EC2		Extra Credit Course – II	Microbiology for competitive examinations	-	4*	--	100*	100*
20UMB6ECA		Extra Credit Course for all	Online Course	-	1*	--	-	-	
		TOTAL			30	29			700
		GRAND TOTAL			180	140			4300

Not Considered for Grant Total and CGPA.

Generic Electives for other major electives

SEMESTER	COURSE CODE	COURSE TITLE
III	20UMB3GE1	Microbial Food Products
IV	20UMB4GE2	Cosmetic Microbiology

@Skill Enhancement Courses

SEMESTER	ELECTIVE NO	COURSE CODE	COURSE TITLE
V	II	20UMB5SE2A	Biofertilizers and Biopesticides
		20UMB5SE2B	Analytical Techniques
V	III	20UMB5SE3A	Textile Microbiology
		20UMB5SE3B	Mycology

****Discipline Specific Electives**

SEMESTER	DS	COURSE CODE	COURSE TITLE
V	I	20UMB5DE1A	Bioinformatics and Biostatistics
		20UMB5DE1B	Medical Entomology
VI	II	20UMB6DE2A	Plant Pathology
		20UMB6DE2B	Applied Phycology
	III	20UMB6DE3A	Social and Preventive Medicine
		20UMB6DE3B	Biosafety and Intellectual property rights

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
V	20UMB5CC9	Core -IX	MICROBIAL GENETICS	6	5	100	25	75

Course outcomes:

At the end of the course, students will be able to

1. Explicit the historical inventions and the basic concept of genetics
2. Explain the system of replication methods on DNA.
3. Describe the gene transfer mechanisms and its regulations.
4. Acquire the knowledge on transcription and translation process.
5. Describe the molecular approaches on Gene regulation.

UNIT I

18 Hours

Introduction to Genetics: Historical Background– Mendel’s laws of inheritance. DNA as genetic material: experiments of Griffith, Avery, #Hershey Chase experiment#. **Artificially synthesized Nucleic acid : Peptide Nucleic Acid (PNAs)** . RNA as a genetic material- Fraenkel Conrat & Singer experiment. **Organization of DNA in prokaryotes (*E. coli*) and viruses.**

UNIT II

18 Hours

DNA Replication: Semi conservative model- Meselson and Stahl experiment, **Cairns Autoradiography Experiment and Taylor’s Experiment.** Replication of circular DNA molecule-rolling circle mechanism, θ mode of replication. **Linear mode of replication. #Enzymes involved in DNA replication #. Replication of RNA – Reverse transcriptase.**

UNIT III

18 Hours

Gene Expression: concept of gene, gene structure, Molecular mechanism of Transcription and Translation of Prokaryotes and # Eukaryotes #: Transcription : Initiation, Elongation, Termination in Prokaryotes. Translation: Activation of amino acid, Initiation, Elongation, Termination in Prokaryotes. **Post transcriptional and Post translational modifications.**

UNIT IV

18 Hours

Gene Regulation in Prokaryotes: The Operon concept– lac and trp operon (induction and repression) structure of operon- role of cyclic AMP in catabolite repression, attenuation control – #promoters# – activators and repressors.

UNIT V

18 Hours

Bacterial Recombination: Concepts of haploid genomes, Transformation - Discovery, Mechanism of **natural competence - Conjugation - Discovery, F+ v/s F-, Hfr+ v/s F-** Transposable elements # **Transfection** # and Transduction (generalized and specialized). Abortive transduction.

Self-study portion

Text Books:

T.B-1 Gardner, E.J., Simmons, M.J., Snustad, D.P. Principles of Genetics. John Wiley & sons,1991.

T.B-2 DavidFrifelder. Microbial Genetics, Narosa publishing house, New Delhi,1990.

T.B-3 Daniel, L. Hartl and Elizabeth W.and Jones. Genetics-Analysis of Genes and Genomes, Jones and Bartlett publishers, UK, 2001.

T.B-4 Jeremy M. Dale. Molecular Genetics of Bacteria (3rd edition). John Wiley and sons, NewYork, 1998.

T.B-5 Old, R.S. and Primrose, S.B. Principles of Gene Manipulation, 4th Ed., Blackwell Scientific Publications, London,1989.

T.B-6 Veer balarastogi, Fundamentals of molecular biology, Ane's student edition, India, 2008.

UNIT I	Chapter VII	T.B-1
UNIT II	Chapter IX	T.B-2
UNIT III	Chapter XIV	T.B-3
UNIT IV	Chapter II	T.B-4
UNIT V	Chapter XII& XIII	T.B - 5 & 6

Books for Reference:

1. Larry Synder and Wendy Champness. Molecular Genetics of Bacteria (2nd edition).American Society for Microbiology, Washington,2003.

2. Lodish, H., Baltimore, D. Berk, A. Zipsury, S.L., Matsudaira, P. Darnell, J. Molecular Cell Biology. Scientific American Books, 1995.

3. MalorSr, Cronan Jr. JE. Freifelds D. Microbial Genetics. Jones and Bartlett Publishers, 1994.

4. Monroe W.Stickberger. Genetics (3rd edition). Prentice/Hall of India Pvt. Ltd., NewDelhi, 2003.

Web Source:

1.<http://www.biologydiscussion.com/dna/replication/dna-replication-3-possible-ways-and-experiments-with-diagram/15508>

2.<http://www.biologydiscussion.com/gene/gene-expression/regulation-of-gene-expression-in-prokaryotes-with-diagram-3/1558>

3.<https://openoregon.pressbooks.pub/mhccmajorsbio/chapter/dna-organization-inside-a-cell/>

Relationship Matrix for Course Outcomes, Programmed Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
V	20UMB5CC9	MICROBIAL GENETICS					6	5			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓			✓		✓	✓	✓	
CO2	✓	✓	✓				✓	✓	✓	✓	
CO3	✓		✓					✓	✓	✓	
CO4	✓	✓	✓	✓				✓	✓	✓	
CO5	✓					✓		✓	✓	✓	
Number of Matches= 31, Relationship :Moderate											

Prepared by:

Dr. H. Vajiha Banu

Checked by:

1. Dr.M.Mohamed Mehroop Raja
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
V	20UMB5CC10	Core – X	MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY	5	5	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Acquire the knowledge on structure and organization of nucleic acids
2. Describe the principles on mutation.
3. Explore the knowledge of DNA repair mechanism
4. Acquire the knowledge on gene cloning and DNA Analysis
5. Describe the knowledge on Genetic recombination

UNIT I

15 Hours

Introduction to Nucleic acid: DNA structure – Miescher to Watson and Crick , salient features of double helix , physical and chemical properties of DNA and its types – RNA structure- types- tRNA, mRNA and rRNA. Genetic code and wobble hypothesis. #Direction of Protein synthesis#.

UNIT II

15 Hours

Mutations: Occurrence, kinds of mutation, spontaneous and induced mutation, Mutagens, detection of mutation, Lethal mutations, Biochemical mutation, #Phenotypic effects of mutation#, Molecular basis of mutation, Significance and Practical applications of mutation.

UNIT III

15 Hours

DNA repair mechanism: Systems that safeguard DNA. DNA methylation and DNA repair mechanisms – excision repair, direct repair, mismatch repair, recombinational repair, SOS response, # photoreactivation#, recombination repair and glycosylase system.

UNIT IV

15 Hours

Gene Cloning: The basic principles of gene cloning and DNA Analysis, The advent and importance of gene cloning, Polymerase chain reaction, # Vectors for Gene cloning#, Purification of DNA from Living cells, Manipulation of purified DNA, Introduction of DNA into Living cells.

UNIT V

15 Hours

Genetic recombination: Requirements, molecular basis, genetic analysis of recombination in bacteria- site specific, homologous, non-homologous recombination, reciprocal and #nonreciprocal recombination#.

Self-study portion.

Text Books:

T.B-1 Daniel L. Hartl and Elizabeth W. Jones. Genetics-Analysis of Genes and Genomes, Jones and Bartlett publishers, UK, 2001.

T.B-2. Gardner E.J., Simmons M.J., Snustad D.P. Principles of Genetics. John Wiley & sons, 1991.

T.B-3. Friedberg ,E.C., Walker, C.C., Siede, W. DNA repair and mutagenesis – ASM Press,1995.

T.B-4. Veer BalaRastogi. Fundamentals of Molecular Biology, Ane Books India, 2008

UNIT I Chapter IV & V **T.B-1**

UNIT II Chapter III **T.B- 2**

UNIT III Chapter IX **T.B-4**

UNIT IV Chapter XVI **T.B- 4**

UNIT V Chapter VI **T.B- 3**

Books for Reference:

1. Jeremy M. Dale. Molecular Genetics of Bacteria (3rd edition).John Wiley and sons,NewYork, 1998.

2. Larry Synder and Wendy Champness. Molecular Genetics of Bacteria (2nd edition).American Society for Microbiology, Washington,2003.

3. Malor, S.R., Cronan, J.E. and Freifelds, D. Microbial Genetics. Jones and Bartlett Publishers, 1994.

4. Old, R.S. and Primrose, S.B. Principles of Gene Manipulation, 4th Ed., Blackwell Scientific Publications,London,1989.

Web Source:

1.<https://www.britannica.com/science/nucleic-acid>

2.<https://www.britannica.com/science/mutation-genetics>

3.<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5474181/>

4.<https://www.cheric.org/files/education/cyberlecture/e200402/e200402-301.pdf>

5.<https://biologydictionary.net/genetic-recombination/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
V	20UMB5CC10	MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY					5	5		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓			✓	✓	✓	✓	
CO2	✓	✓	✓		✓	✓	✓	✓		✓
CO3	✓	✓	✓		✓	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO5	✓		✓	✓		✓		✓	✓	✓
Number of Matches= 39, Relationship : HIGH										

Prepared by:

1. Dr. N. Packialakshmi

Checked by

1. Dr.M.Mohamed Mahroop Raja

2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
V	20UMB5CC11	Core – X1	INDUSTRIAL MICROBIOLOGY	5	5	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Acquire the knowledge on screening techniques
2. Describe the principles of fermentation media formulation strategies.
3. Explore the knowledge of fermenter configurations and types.
4. Determine the microbes involved in Industrial products.
5. Investigate the knowledge on downstream processing.

UNIT I

15 Hours

General concepts of industrial microbiology: History and scope of industrial microbiology. Screening techniques of industrially important microorganisms – Primary screening and Secondary screening. Microbial Strain Improvement –#Mutation and Mutant selection#, RecombinationandProtoplasmic fusion.

UNIT II

15 Hours

Fermenter and types: Factors involved in fermenter design, Fermenter configurations - Batch fermenter, Continuous stirred tank fermenter, Tubular fermenter, Fluidized bed fermenter, Air-Lift Bioreactor, #Cylindro–Conical Bioreactor#, Cyclone Column Bioreactor, **Photobioreactor** Hollow–fiber Bioreactor.

UNIT III

15 Hours

Upstream Process: Principles of sterilization, Sterilization of Equipment, Production media and Air. Fermentation media formulation strategies, carbon, nitrogen, vitamin and mineral sources, role of buffers, precursors, inhibitors, inducers and antifoams, #Screening for production media#.

UNIT IV

15 Hours

Downstream Process: Intracellular product- Cell Disruption-Physical, chemical and enzymatic method. Extracellular product - Solid liquid separation – flotation, flocculation, filtration and centrifugation, Concentration- evaporation, Liquid- Liquid extraction, Membrane filtration, precipitation and adsorption, Purification by chromatography- gel filtration, #Ion exchange and affinity#, Formulation- drying, freeze drying and crystallization.

UNIT V

15 Hours

Microbial products: **Microbial production - Organic acids – Citric acid and Lactic acid.** Antibiotics- Penicillin and Streptomycin. Enzymes- Amylases and Proteases. **Vitamins – Riboflavin and L- Ascorbic acid.** **Yeast and its uses.** Production of Single cell proteins - #Bacterial proteins# and Algal proteins.

Self-study portion.

Text Books:

T.B-1 Patel, A.H. Industrial Microbiology. Macmillan India Ltd, 2005.

T.B-2 Stanbury, P.F., Whitaker A and Hall S.J. Principles of Fermentation Technology, Butterworth- Heinemann Press, 2003.

UNIT I	Chapter III	T.B-1
UNIT II	Chapter VII	T.B-1
UNIT III	Chapter X & XII	T.B-1
UNIT IV	Chapter XVI & XVII	T.B-1
UNIT V	Chapter X	T.B-2

Books for Reference:

1. Demain, A.L and Davies, J.E. Manual of Industrial Microbiology & Biotechnology, ASM press, 1999.
2. Prescott and Rehm. Industrial Microbiology. Wiley and Sons, 1979.
3. Sikyta, B. Methods in Industrial Microbiology, Ellis Horwood Limited, 1983.
4. Casida, L. E. Industrial Microbiology. New Age International Publishers, 1968.

Web Source:

1. <http://www.generalmicroscience.com/industrial-microbiology/screening-techniques-and-its-details/>
2. <http://courseware.cutm.ac.in/wp-content/uploads/2020/06/large-scale-sterilization.pdf>
3. <https://biologyease.com/types-of-fermentors/>
4. <https://www.vedantu.com/biology/microbes-in-industrial-products>
5. https://www.mt.com/in/en/home/applications/L1_AutoChem_Applications/fermentation/downstream-processing-in-biotechnology.html

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
V	20UMB5CC11	INDUSTRIAL MICROBIOLOGY					5	5		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓				✓	✓	✓	✓	✓
CO3	✓	✓	✓			✓	✓	✓	✓	
CO4	✓	✓	✓	✓		✓	✓		✓	✓
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓
Number of Matches= 40, Relationship : HIGH										

Prepared by:

1. Dr. N. Packialakshmi

Checked by:

1. Dr.N.Reehana

2.Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
V	20UMB5CC12P	Core – XII	MICROBIAL GENETICS, MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY AND INDUSTRIAL MICROBIOLOGY - PRACTICAL	5	5	100	20	80

Course Outcomes:

At the end of the course, students will be able to

1. Extract the Genomic DNA and Plasmid DNA.
2. Determine the DNA by DPA method.
3. Examine the differentiation of Protoplast and Spheroplast.
4. Acquire the knowledge on screening technique.
5. Determine the mechanism of Citric acid production.

List of Practicals

1. Isolation of bacterial Genomic DNA.
2. Isolation of Plasmid DNA.
3. Electrophoretic analysis of DNA.
4. Quantitative estimation of DNA by DPA method.
5. Restriction digestion and analysis.
6. Scoring of auxotrophic mutants.
7. Isolation of Protoplast.
8. Isolation of Spheroplast.
9. Isolation and Screening of antibiotic producers by crowded plate technique
10. Secondary Screening Protocols – Kirby – Bauer method
11. Isolation of cellulase producing Microorganisms.
12. Production of Citric acid.
13. Industrial / Institute visit.

Practical manual

1. Aurubels . Current protocols in Molecular Biology, John Wiley, 1998.
2. Sambrook, J. Fritsch, E. F. And Maniatis, T. Molecular cloning- A Laboratory Manual 2nd edition. Cold Spring Harbor Laboratory press, USA, 1989
3. James G. Cappuccino, Natalie Sherman. Microbiology- A laboratory manual. 6th edition.
4. Nupur Mathur. Industrial Microbiology a Laboratory Manual. Aaviskar publishers, 2007.
5. Richard H.Baltz, Arnold L.Demain, JulianE.Davies. Manual of Industrial Microbiology and Biotechnology. 3rd edition. 2010.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
V	20UMB5CC12P	MICROBIAL GENETICS, MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY AND INDUSTRIAL MICROBIOLOGY - PRACTICAL					5	5		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓				✓	✓	✓
CO2	✓	✓	✓					✓	✓	✓
CO3	✓	✓	✓				✓	✓	✓	✓
CO4	✓	✓	✓	✓			✓	✓	✓	✓
CO5	✓	✓	✓	✓				✓	✓	✓
Number of Matches= 35, Relationship : HIGH										

Prepared by:

Dr. N. Packialakshmi

Checked by:

1. Dr.N.Reehana
2.Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
V	20UMB5DE1A	DSE-I	BIOINFORMATICS AND BIOSTATISTICS	5	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Acquire the knowledge on basic principles and concepts of bioinformatics.
2. Gain the knowledge on biological databases.
3. Examine the essential existing bioinformatics software effectively.
4. Describe the variables in a dataset, and classify variables as quantitative.
5. Acquire the relevant knowledge on statistical inference

UNIT I

15 Hours

Basic of Bioinformatics : Internet Perception- Internet Service Providers, WWW, #Search Engines#. **Data Mining.** Database - Introduction and overview of biological database-Nucleic acid database : Primary-NCBI, DDBJ and EMBL . **Secondary- UNIGENE and EMI Genomes.**

UNIT II

15 Hours

Protein Sequence Database: SWISS PROT/TrEMBL, PIR. **Sequence motif database-Pfam, PROSITE.** Protein structure database-PDB, SCOP, CATH. **Other relevant database-KEGG, PQS.Finding Scientific articles- #Pubmed, Highwire,# Press, Plos.**

UNIT III

15 Hours

Sequence and Alignment :Pairwise alignment: – local, Global, dotplot, dynamic programming. Heuristic method-BLAST and #FASTA#. Multiple Sequence Alignment. Phylogeny and Phylogenetic trees- Types , Different approaches of phylogenetic tree construction - Neighbour joining, Maximum Parsimony and Maximum likelihood.

UNIT IV

15 Hours

Statistics for biology: Introduction to Biostatistics, Frequency distribution, #Variable and attribute#, Line diagram, Bar diagram, Pie chart, Histogram, Mean, Median and Mode, Variance, Standard deviation, Standard error of mean.

UNIT V

15 Hours

Inference : Comparison of variance. Student's t-test, Fisher's t- test, Chi-square test, Analysis of Variance (ANOVA) - One way and two way, multiple comparisons # Correlation and Linear regression #.

Self-study portion.

Text Books:

- T.B-1** Attwood, T.K. and Parry-Smith, D.J. Introduction to Bioinformatics, Pearson Education Ltd., New Delhi, 2004.
- T.B-2** David W. Mount (2001) Bioinformatics: Sequence and Genome Analysis. Cold Spring harbor Press
- T.B-3** Baxevanis, A.D. and Ouellette, B.F.F.(2004). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, John Wiley & Sons
- T.B-4** Basic Bioinformatics,(2005)S.Ignacimuthu, Narosa publishing house
- T.B-5** Daniel, W.W. (2005) Biostatistics: A foundation for analysis in the Health Sciences. 8th Edition, John Wiley & Sons Inc

UNIT I	Chapter I	T.B-3
UNIT II	Chapter III & IV	T.B-2
UNIT III	Chapter XII,IX	T.B-1
UNIT IV	Chapter I &III	T.B-4
UNIT V	Chapter XVIII	T.B-5

Books for Reference:

1. Westhead, DR. Paris, JH. and Twyman, RM. Instant Notes: Bioinformatics – Viva Books Private Ltd, New Delhi, 2003.
2. Arthur M. Lesk. Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003
3. Bernard Rosner : Fundamentals Of Biostatistics 8th Edition. Cengage Learning, 2015.

Web Source:

1. <https://www.bits.vib.be/training-list/111-bits/training/previous-trainings/122-basic-bioinformatics>
2. <https://www.bioalternatives.com/en/bioinformatics-basic-functional-data-processing/>
3. <https://www.ncbi.nlm.nih.gov/guide/howto/learn-basics/>
4. <http://biostatcourse.fiu.edu/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
V	20UMB5DE1A	BIOINFORMATICS AND BIOSTATISTICS					5	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓		✓	✓		✓			
CO2	✓	✓			✓	✓	✓			✓	
CO3	✓		✓	✓	✓	✓		✓	✓		
CO4		✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓		✓	✓	✓	✓		✓	✓	✓	
Number of Matches= 35, Relationship : High											

Prepared by:
Dr.P.Sivalingam

Checked by:
1.Dr.N.Reehana
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External Marks
V	20UMB5DE1B	DSE-I	MEDICAL ENTOMOLOGY	5	4	100	25	75

Course outcomes:

At the end of the course, students will be able to

1. Explain the history, classification and distinguished features of Arthropods.
2. Examine the role of insects as vectors of diseases and their effects on human populations
3. Summarize the structure, morphology and anatomy of insects.
4. Analyze the public health importance and the epidemiology of the disease pathogens
5. Describe the integrated pest management (IPM) techniques that are helpful in diagnosing, preventing, and controlling disease vectors.

UNIT I

15 hours

Arthropods: History of Medical Entomology – Definition and Scope- Arthropods of Public Health importance – Taxonomy, classification – order- family – general characters. Modes of disease transmission: vertical and horizontal transmission. #Introduction to ecology and ecosystem of vectors#.

UNIT II

15 hours

Anthroponotic diseases: Malaria, filariasis, visceral leishmaniasis, onchocerciasis, trypanosomiasis, # Chagas disease #, scrub typhus, tick typhus. Bacterial and rickettsial pathogens.

UNIT III

15 hours

Physiology of Insects: Insect Morphology – General structure and metamorphosis- Insect internal anatomy and physiology - Insect external anatomy. Insects Digestive System and Nervous System -Insects – Reproductive System.

UNIT IV

15 hours

Zoonotic Diseases: Cutaneous leishmaniasis, Schistosomiasis, plague, Kyasanur Forest Disease (KFD), #Leptospirosis#, Dracunculiasis - Disease vectors - distribution and transmission - socio-economic impact on human population.

UNIT V

15 hours

Insects: Insect Biodiversity; Collecting and preserving insects. Disease caused by Insects: Houseflies, lice, bugs, #wasps, bees, beetles#, spiders, ants - distribution and impact on human health - toxins, venoms - allergy, asthma. **Integrated Pest Management Techniques (IPM).**

Self-study portion.

Text Books:

T.B-1 Roy D.N. and Brown A.W.A. 1970. Entomology (Medical and Veterinary) including insecticides & insects & Rat control; The Bangalore Printing & Publishing Co. Ltd., Bangalore

T.B-2 Harwood R.F. and James M.T. 1979. Entomology in Human and animal health. Macmillan Publishing Co., Inc, London; 7 Ed pp 548 3. Service M.W. 2000.

T.B-3 Rozendaal, J.A 1997. Medical Entomology for students 4thedn. Cambridge Univ. Press, UK.

T.B-4 Vector Control - Methods for Use by Individuals and Communities, World Health Organization, Geneva.

T.B-5 Nicholas R. H. Burgess. 1981. Arthropods of Medical importance, Published by Noble Books Ltd. Hampshire

UNIT I	Chapter I	T.B-1
UNIT II	Chapter IV	T.B-2
UNIT III	Chapter VI & VII	T.B- 3
UNIT IV	Chapter III	T.B -4
UNIT V	Chapter IV	T.B 5

Books for Reference:

1. Kenneth G. V. Smith. 1973. Insects and other Arthropods of Medical Importance.
2. Ernst Mayr, E. G. Linsley and R. L. Usinger. 1953. Methods and Principles of Systematic Zoology.

Web Reference:

- 1.<https://www.conops.gr/integrated-management-of-arthropods-of-public-health-importance/?lang=en>
- 2.https://wiki.bugwood.org/Insect_Biology
- 3.<https://extension.psu.edu/integrated-pest-management-ipm-tactics>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
V	20UMB5DE1B	MEDICAL ENTOMOLOGY					5	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓				✓	✓	✓		✓	
CO2	✓	✓			✓	✓	✓			✓	
CO3	✓	✓				✓	✓				
CO4	✓	✓	✓		✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓	✓			✓	✓	✓	
Number of Matches= 32 Relationship :Moderate											

Prepared by:

Dr. H. VajihaBanu

Checked by:

1. Dr.N.Packialakshmi
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
V	20UMB5SE2A	SEC - II	BIOFERTILIZERS AND BIOPESTICIDES	2	2	100	-	100

Course Outcomes:

At the end of the course, students will be able to

- 1.Acquire the knowledge on symbiotic Nitrogen fixers.
2. Explore the knowledge on Non-Symbiotic Nitrogen and Phosphate fixers.
3. Determine the field application of Ecto and Endo mycorrhizae.
4. Summarize the comprehensive knowledge on Mass production technology of bio-pesticides.
- 5.Analyze the importance of Impediments and limitations in production and use of Biopesticide.

UNIT I

6 Hours

General aspect and Symbiotic Nitrogen Fixers: Introduction, Scope, Importance and Classification of Biofertilizers – Microbes used as bio-fertilizer – Isolation, Identification, Field application and large-scale production of following Symbiotic fertilizers -#*Rhizobium*#, *Anabaena*, *Azolla*.

UNIT II

6 Hours

Non-Symbiotic Nitrogen and Phosphate Fixers: Isolation, Identification and large-scale production and field application of *Azospirillum*, *Azotobacter*, *Clostridium* and *Klebseilla*. Phosphate solubilizers: Isolation, characterization, # inoculum production#, field application of *Bacillus* and *Pseudomonas* - Phosphate solubilization mechanism.

UNIT III

6 Hours

Mycorrhizal Biofertilizers: Introduction, Scope and general account on mycorrhizae – Classification - Method of collection and isolation (Wed sieving and decanting method) – Culture of mycorrhizae in Modified Melin-Norkrans medium (MMN) - Field application of Ecto and Endo mycorrhizae.# National and Regional Biofertilizers production# and Development Centres.

UNIT IV

6 Hours

Biopesticides –History and concept of biopesticides. Importance, scope and potential of biopesticide.concepts and classification of biopesticides. Mass production technology of bio-pesticides. Biopesticides – #Viral origin#, fungal origin.

UNIT V

6 Hours

Bacterial origin of Biopesticides – *Bacillus thuringiensis* mechanism of action and application. Advantages of biopesticides and commercialization. #Methods of quality control# and techniques of biopesticides. Impediments and limitations in production and use of biopesticides.

Self-study portion.

Text Books:

T.B-1 SubbaRao, N.S. Advances in Agricultural Microbiology, Butterworth-Heinemann, 2016.

T.B-2 Openderkoul and Dhaliwal, G.S. Microbial Biopesticides. CRC press, New Delhi, 2001.

UNIT I	Chapter I	T.B-1
UNIT II	Chapter XI	T.B- 1
UNIT III	Chapter XII & XIII	T.B-1
UNIT IV	Chapter I& IV	T.B- 2
UNIT V	Chapter III	T.B- 2

Books for reference:

1. Mukherjee, N. and Ghosh T. Agricultural Microbiology, Kalyani Publishers, New Delhi.1998.
2. Rangaswami, G. and Bagyaraj, D.J. Agricultural Microbiology. Prentice Hall of India Pvt. Limited, New Delhi. 1993.
3. Cook RJ & Baker KF. The Nature and Practice of Biological Control of Plant Pathogens. APS, St Paul, 32 Minnesota.1983.
4. Campbell R. Biological Control of Microbial Plant Pathogens. Cambridge Univ. Press, Cambridge.1989.

Web Source:

1. <https://www.krishisewa.com/organic-agriculture/115-biofertilizers.html>
2. <https://gcwgandhinagar.com/econtent/document/1587179065unit4.1biolo.nitrio.fixation.pdf>
3. https://biocyclopedia.com/index/biotechnology/plant_biotechnology/biofertilizers/biotech_mycorrhizae_biofertilizer.php
4. <https://www.bpia.org/history-of-biopesticides/>
5. https://en.wikipedia.org/wiki/Bacillus_thuringiensis

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
V	20UMB5SE2A	BIOFERTILIZERS AND BIOPESTICIDES					2	2		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO3	✓	✓		✓		✓		✓	✓	
CO4	✓	✓	✓			✓	✓	✓	✓	
CO5	✓	✓	✓		✓	✓		✓	✓	✓
Number of Matches= 39, Relationship : HIGH										

Prepared by:

Dr. N. Packialakshmi

Checked by:

1. Dr.H.VajihaBanu
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
V	20UMB5SE2B	SEC - II	ANALYTICAL TECHNIQUES	2	2	100	-	100

Course Outcomes:

At the end of the course, students will be able to

1. Describe the working principles of microscopy.
2. Examine the principles and applications of chromatography techniques.
3. Acquire the knowledge on Electrophoresis.
4. Examine the working principles and application of spectrophotometer.
5. Gain the comprehensive knowledge on centrifugations.

UNIT I

6 hours

Microscopy: Basic Principles and Applications -Bright field , #Dark field Microscopy#, Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy, Electron Microscopy – Scanning and Transmission Electron Microscopy (SEM and TEM).

UNIT II

6 hours

Spectrophotometry: Basic Principles and Applications -UV Spectroscopy, Raman spectroscopy, # Colorimetry and Turbidimetry #, Fourier transform infrared spectroscopy (FTIR), Atomic Absorption Spectroscopy (AAS), Nuclear Magnetic Resonance (NMR).

UNIT III

6 hours

Centrifugation: Basic Principles and Applications- Preparative and Analytical centrifugation, fixed angle and #swinging bucket rotors#. Relative Centrifugal Force (RCF), sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation.

UNIT IV

6 hours

Chromatography: Basic Principles and Applications- Paper chromatography, #Thin layer Chromatography #, Gel filtration chromatography, Ion exchange Chromatography , Affinity Chromatography, Gas Liquid Chromatography and High Performance Liquid Chromatography .

UNIT V

6 hours

Electrophoresis: Basic Principles and Applications -native polyacrylamide gel electrophoresis, SDS- polyacrylamide gel electrophoresis, #2D gel electrophoresis#, Agarose gel electrophoresis.

Self-study portion.

Text Books:

T.B-1. Cooper G.M. and Hausman R.E. The Cell: A Molecular Approach. 5th Edition. ASM Press & Sunderland, Washington D.C., Sinauer Associates, MA.2009.

T.B-2. Karp G. Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.2010.

T.B-3. Wilson K and Walker J. Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.2010.

T.B-4. Willey MJ, Sherwood LM & Woolverton C J. Prescott, Harley and Klein's Microbiology. 9thEd., McGraw Hill.2013.

T.B.5. Nelson DL and Cox MM. Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.2008.

UNIT I	Chapter VII	T.B-5
UNIT II	Chapter II	T.B-2
UNIT III	Chapter V	T.B-1
UNIT IV	Chapter IV	T.B-4
UNIT V	Chapter IX	T.B-3

Books for Reference:

1. Nigam A and Ayyagari A. Lab Manual in Biochemistry, Immunology and Biotechnology. Tata McGraw Hill.2007.
2. M.H.Fulekar and BhawanaPaney. Bioinstrumentation. I K International Publishing House Pvt. Ltd.2013.

Web Source:

1. <https://www.sciencedirect.com/topics/chemistry/centrifugation>
2. <https://www.news-medical.net/health/Spectroscopy-Types.aspx>
3. <https://www.sciencedirect.com/topics/materials-science/electrophoresis-technique>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
V	20UMB5SE2B	ANALYTICAL TECHNIQUES					2	2		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓	✓		✓	✓	✓
CO2	✓	✓	✓	✓		✓	✓	✓	✓	
CO3	✓	✓	✓	✓		✓	✓	✓	✓	
CO4	✓	✓	✓	✓		✓	✓		✓	
CO5		✓	✓	✓		✓	✓	✓	✓	
Number of Matches= 34, Relationship : High										

Prepared by:
Dr.P.Sivalingam

Checked by:
1.Dr.K.Vijayalakshmi
2. Dr.J.Sirajudeen

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Note:

Semester	Code	Course	Title of the Paper	Hours	Credits	Max. marks	Internal marks	External marks
V	20UMB5SE3A	SEC - III	TEXTILE MICROBIOLOGY	2	2	100	-	100

Course Outcomes:

At the end of the course, students will be able to

1. Acquire the knowledge on microorganisms used in textile industry.
2. Describe the natural fiber types and processing on textile industry.
3. Examine the various enzymes used in the cotton textile processing.
4. Gain the knowledge on biomaterials in the healthcare textile.
5. Analyze the textile and fabric antimicrobial testing.

UNIT I

6 Hours

Textile Industry: Introduction, types of microorganisms found on textile fibres, conditions favoring the action of microorganisms. Types of destruction caused by microorganisms (Cotton and Wool), #prevention of growth of microorganisms#.

UNIT II

6 Hours

Natural Fibres: Bioprocessing of cotton and their characteristics-Physical and Chemical properties of cotton, Desizing of cotton fabric, Scouring of Cotton fabrics. Enzymatic bleaching. Bioprocessing of wool and their characteristics. #Physical and Chemical properties of wool fibers# and wool quality assessments.

UNIT III

6 Hours

Bioprocessing of Organic Cotton Textiles: Warp yarn sizing and fabrication. Effect of biodesizing process variables- #Box Behnken design#. Bio scouring of organic cotton using enzymes. **Mercerisation of cotton material. Antimicrobial finishing of cotton.**

UNIT IV

6 Hours

Biomaterials for Health Care Textiles: health care textiles, Dressing types and usage, antimicrobial fabrics- #chitosan#. Enzymes in medical applications. **Nanofibers and Nanotechnology in textiles. Role of Microbes in textile industry.**

UNIT V

6 Hours

Textile and Fabric Antimicrobial Microbiology Testing: Antimicrobial assessment on textile materials (AATCC 30), Assessment of Antimicrobial Finishes on textile materials (AATCC 100), Parallel streak method (AATCC 147), # Microbial Enumeration test (USP 61), Test for specified microorganisms (USP 62) #.

Self-study portion.

Text Books:

T.B-1. Vigneswaran .C. Ananthasubramanian. M. and Kandhavativu,P. Bioprocessing of Textiles. Woodhead Publishing India Pvt.Ltd . 2014.

T.B-2. Jiri. M, Periyasamy A.P., Venkataraman. Textiles and Their Use in Microbial Protection. CRC Press. 2021..

T.B-3. Ibrahim Md and Mondal H. Antimicrobial textiles from natural resources. Woodhead Publishing.2021.

UNIT I	Chapter XVII	T.B-3
UNIT II	Chapter III	T.B-1
UNIT III	Chapter XII	T.B-1
UNIT IV	Chapter I	T.B-2
UNIT V	Chapter VI &XIV	T.B-1

Books for Reference:

1. Premony Ghosh, Fibre science and Technology, Tata McGraw- Hill Publishing company limited, 2004.
2. Amarjit S. Basra, Cotton Fibres- Developmental Biology, Quality Improvement and Textile Processing, CBS Publishers and Distributors, 2002
3. N.S.Kaplan N.S.A Practical Guide to Fibre Science, First Edition, Abhishek Publications, 2002.

Web Source:

1. <https://www.sciencedirect.com/topics/engineering/antimicrobial-textile>
2. <https://annalsmicrobiology.biomedcentral.com/articles/10.1007/s13213-010-0163-8>
3. <https://link.springer.com/article/10.1007/s42452-019-0937-y>
4. <https://www.sciencedirect.com/topics/engineering/antimicrobial-textile>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
V	20UMB5SE3A	TEXTILE MICROBIOLOGY					2	2			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
										5	
CO1	✓		✓	✓	✓	✓	✓	✓		✓	
CO2	✓		✓			✓	✓	✓		✓	
CO3	✓		✓			✓	✓	✓		✓	
CO4	✓	✓	✓						✓	✓	
CO5	✓		✓	✓	✓		✓		✓	✓	
Number of Matches= 32, Relationship : Moderate											

Prepared by:
Dr.P.Sivalingam

Checked by:
1.M.Mohamed Mahroop Raja
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External Marks
V	20UMB5SE3B	SEC -III	MYCOLOGY	2	2	100	-	100

Course outcomes:

At the end of the course, students will be able to

1. Summarize the history, characteristics and importance of various types of Fungi
2. Determine the metabolism, structure and life cycle of fungi
3. Acquire the knowledge on fermented products production by fungi.
4. Introspect the knowledge on nutrients transport and its growth conditions.
5. Examine the knowledge on medically important fungi and its diagnosis methods.

UNIT I

6 Hours

Introduction and History: General characteristics, Importance of fungi in Human life. Fungi—classification of fungi, Taxonomy and Systematics. #Edidermophyton and Microsporurn#. Yeasts of medical importance- Candida, Cryptococcus. (10%)

UNIT II

6 Hours

Life Cycle : General characteristics of molds, types of reproduction and spore types. Fungal Metabolism, Fungal Growth - Reproduction and Life cycles, Macro fungi- Ascomycota and Basidiomycota. Lichens, their associations and applications' #synthetic fungicides# and fungal toxins. (10%)

UNIT III

6 Hours

Nutrition and Genetics of Fungus: Absorption of nutrients, transport mechanism, chemical and physical environment for growth, and fungal attack mechanisms. #General information about genetics of fungi: Saccharomyces cerevisiae-Model organism, Mycotoxins and Mushroom poisoning Fungi- Ecological importance Mycorrhiza, Lichens: Structure and replication of Lichens.

UNIT IV

6 Hours

Mycotechnology : Fungi in the production of antibiotics, organic acids, vitamins and single cell protein, alcohols, food fermentation and solid substrate fermentation, #Mushrooms cultivation#.

UNIT V

6 Hours

Medical Mycology: Culture methods of fungi, Diagnosis, Dimorphism Mycoses –Superficial Opportunistic, #Systemic mycoses#. Host responses to fungal infection-Immunity Antifungal agents.

Self-study portion.

Text books:

- T.B-1** Alexopolous, C.J and C.W. Misra. 1972. Introductory mycology. John Wiley and Sons, New York.
- T.B-2** Burnett, J.H. 1976. Fundamentals of mycology. Edward Arnold Publishers, London.
- T.B-3** Mehrotra R.S and Aneja K.R (1990). An introduction to Mycology. New Age International Publishers.
- T.B-4** JagadishChander (1996). A text book of Medical Mycology. Interprint, New Delhi.

UNIT I	Chapter – II	T.B-1
UNIT II	Chapter – III & V	T.B-1
UNIT III	Chapter – VII	T.B-2
UNIT IV	Chapter –VI	T.B-3
UNIT V	Chapter –VIII	T.B-4

Books for Reference

1. Chakraborty P (2003). A Text book of Microbiology. 2nd Edition, Published by New Central Book Agency (P) Ltd., Kolkata.
2. Dimmock, N.J. and Pimrose, S.B. (1994) Introduction to Modern Virology, 4th Edn. Blackwell Scientific Publications, Oxford.
3. Conrat, H.F., Kimball, P.C. and Levy, J.A. (1994) Virology, 3rd Edn, Prentice Hall, New Jersey.
4. Flint, S.J., Enquist, L.W., Krung, R. Racaniello, V.R. And Skalka, A.M. (2000).
5. Principles of Virology, Molecular Biology, pathogenesis and control, ASM Press, Washinton D.C.

Web Reference:

1. <https://courses.lumenlearning.com/boundless-biology/chapter/importance-of-fungi-in-human-life/>
2. [https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_\(Boundless\)/24%3A_Fungi/24.1%3A_Characteristics_of_Fungi/24.1C%3A_A_Fungi_Reproduction](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/24%3A_Fungi/24.1%3A_Characteristics_of_Fungi/24.1C%3A_A_Fungi_Reproduction)
3. <https://www.slideshare.net/AllahDadKhan/importance-of-mushroom-cultivation-a-presentation-by-mr-allah-dad-khan-former-director-general-agriculture-extension-kpk-province-and-visiting-professor-the-university-of-agriculture-peshawar-pakistan>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
V	20UMB5SE3B	MYCOLOGY					2	2		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓	✓		✓
CO2	✓	✓	✓		✓	✓	✓	✓		✓
CO3				✓	✓				✓	✓
CO4		✓		✓	✓		✓		✓	✓
CO5	✓		✓	✓	✓	✓		✓	✓	✓
Number of Matches= 34 Relationship :Moderate										

Prepared by:

Dr. H. VajihaBanu

Note:

Checked by:

1. Dr.N.Reehana
2. Dr.J.Sirajudeen

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
VI	20UMB5CC13	Core – XIII	FOOD AND DAIRY TECHNOLOGY	5	5	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Acquire the knowledge on Microbes involved in food microbiology.
2. Explore the knowledge on Food spoilage and food poisoning.
3. Describe the physical and chemical methods of food Preservation.
4. Examine the comprehensive knowledge on quality control of milk.
5. Analyze the importance of antimicrobial substances in milk.

UNIT I

15 Hours

Microorganism in Food: Microbes involved in food microbiology- mold, yeast, bacteria. Intrinsic factors - Hydrogen ion concentration (pH), moisture requirement, concept of water activity, #oxidation reduction potential#, nutrient content, inhibitory substances and biological structure. **Extrinsic factors-storage temperature, Relative humidity, gases.**

UNIT II

15 Hours

Food Spoilage and Food Poisoning: Spoilage of canned foods, cereals, fruits, vegetables, meat **egg, butter, bread** and fish. Food poisoning: Food intoxication -#Staphylococcal poisoning# and botulism, Food infection – Salmonellosis, Mycotoxins produced by fungi - Aflatoxin in stored food and grains.

UNIT III

15 Hours

Food Preservation: Principles of food preservation, Methods of food preservation -Physical-temperature, **canning, freezing, #dehydration#, drying** and radiation. Chemical- **Class I and Class II preservatives. Microbial examination of food - viable count and Examination of faecal streptococci.**

UNIT IV

15 Hours

Microorganisms in Milk and Milk Products: koumiss, kefir, butter and cheese, **Microbiological analysis of milk: Rapid platform tests - organoleptic, Clot on boiling (COB), titratable acidity, alcohol test, DMC, sedimentation test and pH, #Standard plate count# , Dye reduction test - MBRT, Resazurin test. Methods of preservation of milk and milk products: Pasteurization, sterilization, dehydration.**

UNIT V

15 Hours

Microbiological Aspects of Quality Control: Quality assurance in production of milk and milk products – Good Manufacturing Practices (GMP) and Sanitary Standard Operating Procedure (SSOP), **#Importance of Total Quality Management (TQM) in dairy industry. Application of HACCP Programme in dairy industry, Safety concerns of bio-film formation on equipment surfaces and their control measures.**

Self-study portion.

Textbooks:

T.B-1 Frazier, W.C, Westhoff, D.C. Food Microbiology, TATA Mc Graw Hill, 1988.

T.B-2 Adams, M.R. and Moss M.O. Food Microbiology, The Royal Society of Chemistry, Cambridge, 1995.

T.B-3 Banwart ,G.J. Basic food microbiology, Chapman & Hall, New York, 1989.

UNIT I	Chapter I	T.B-1
UNIT IV	Chapter IX	T.B- 2
UNIT V	Chapter VII	T.B- 3

Books for reference:

1. Baumberg. S., Hunter. I.S. and Rhodes, P.M. Microbial Products -New approaches. Cambridge Univ. Press. Cambridge, 1989.
2. Robinson, R.K. Dairy Microbiology, Elsevier, 1990.

Web Source:

1. https://www.canr.msu.edu/smprv/uploads/files/Safe_Practices_for_Food_Processes_Chpt._3_Factors_that_Influence_Microbial_Growth.pdf
2. <https://www.thespruceeats.com/food-poisoning-and-food-spoilage-996015>
3. <https://courses.lumenlearning.com/boundless-microbiology/chapter/food-preservation/>
4. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=65153>
5. <https://academicjournals.org/journal/IJLP/article-full-text-pdf/56F586B56464>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
VI	20UMB5CC13	FOOD AND DAIRY TECHNOLOGY					5	5		
Course Outcome s (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓			✓		✓		✓
CO2	✓		✓			✓		✓	✓	
CO3	✓		✓		✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches= 38, Relationship : HIGH										

Prepared by:

1. Dr. N. Packialakshmi

Checked by:

1. K.Vijayalakshmi
2. Dr. J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50

Semester	Code	Course	Title of the course	Hours	Credits	Max. Marks	Internal Marks	External Marks
VI	20UMB6CC14	Core XIV	ENVIRONMENTAL MICROBIOLOGY	5	5	100	25	75

Course Outcomes

At the end of the course, students will be able to

1. Describe the vital role and application of microbes in various ecosystems.
2. Identify the airborne microorganism and air sampling techniques.
3. Apply the mechanism used in water purification techniques.
4. Explain the working principles of sewage treatment.
5. Examine the process of bioleaching and treatment of waste materials.

UNIT I

15 Hours

Introduction to Microbial Ecosystems: Structure of natural environment: Ecosystem types- Natural-**Terrestrial ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Tundra ecosystem, Freshwater ecosystem and Marine ecosystem. Artificial- Aquariums, crop fields, dams, gardens.** Conventional and molecular methods of studying microbial diversity.

UNIT II

15 Hours

Microbiology of air: Source of Microorganism in air- airborne microorganism- # **airborne diseases #** - Enumeration of bacteria from air- Air sampling methods- impingement, impaction, centrifugation, filtration and deposition - Air sanitation.

UNIT III

15 Hours

Microbiology of water: Bacteriological analysis of water- MPN Technique- Eutrophication- water purification – natural- storage, oxidation and settlement- artificial- physical, chemical and filtration- #water borne disease and their control measures#.

UNIT IV

15 Hours

Treatment of Waste: Liquid waste-Chemical and biochemical characteristics of sewage – BOD and COD– Sewage Treatment – Physical, Chemical and Biological (trickling filter, activated sludge and# oxidation pond #) treatment- **Solid Waste- Composting.**

UNIT V

15 Hours

Biodegradation: stages of biodegradation- biodeterioration, bio fragmentation and assimilation. #**Biomining#**. Biodegradation of Plastics, **Microbial leaching- Copper and Uranium.** Bioconversion of cellulose to ethanol. **Application of geographic information system (GIS) in environmental monitoring.**

Self-study portion

Text Books:

T. B- 1 Atlas R.M and Bartha, R. Microbial Ecology Fundamentals and Application (4th edition)- LPE, pearson Education.Inc, 2005.

T.B- 2 Alexander, M. Microbial Ecology. John Wiley and Sons Inc, New York, 1971.

T.B- 3 Forster, C.F. Biotechnology and Wastewater Treatment. Cambridge University Press. Cambridge, 1985.

UNIT I	Chapter III	T.B-1
UNIT II	Chapter V	T.B-1
UNIT III	Chapter IV	T.B-2
UNIT IV	Chapter V	T.B-3
UNIT V	Chapter XII	T.B-3

Books for reference:

1. Grant W.D. and Long P.L. Environmental Microbiology. Blackie Glasgow. London, 1981.
2. Marshall, K.C. Advances in Microbial Ecology. Vol.8, Plenum press, 1985.

Web Source:

- 1.<https://www.healthline.com/health/airborne-diseases#types>
- 2.<https://www.americangeosciences.org/critical-issues/faq/what-biomining>
- 3.<https://microbeonline.com/probable-number-mpn-test-principle-procedure-results/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific

Outcomes:

Semester	Code	Title of the Paper	Hours	Credits						
VI	20UMB6CC14	ENVIRONMENTAL MICROBIOLOGY	5	5						
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓			✓	✓	✓		
CO2	✓	✓	✓	✓		✓	✓	✓	✓	
CO3		✓	✓				✓	✓		
CO4	✓	✓	✓		✓	✓	✓	✓		✓
CO5		✓	✓		✓		✓	✓		✓
Number of Matches= 32 Relationship :Moderate										

Prepared by:

Dr. H. VajihaBanu

Checked by:

1. Dr.N.Packialakshmi
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the course	Hours	Credits	Max. Marks	Internal Marks	External Marks
VI	20UMB6CC15	Core XV	SOIL AND AGRICULTURAL MICROBIOLOGY	5	5	100	25	75

Course outcome:

At the end of the course, students will be able to

1. Describe the distribution and association of microorganisms in various types of soil.
2. Identify the role of microbes and nutrient cycles prevailing in environment.
3. Acquire the knowledge on interaction of microbes with various regions.
4. Examine the plant diseases and their control methods.
5. Describe the production and applications of bioinoculants.

UNIT I

15 Hours

Introduction to soil Microbiology: Layers of Soil. Physical Properties of Soil - color, texture, structure, porosity, density, consistence, aggregate stability, and temperature . Chemical Properties of soil- Heavy metal, pH, carbon, nitrogen, calcium (Ca), magnesium (Mg) and potassium (K) and phosphorous (P). Micro flora of various soil types. Significance of soil microbes – bacteria, fungi, algae, protozoa, nematodes, actinobacteria, viruses #Factors affecting microbial population #.

UNIT II

15 Hours

Biogeochemical Cycles: Carbon cycle, #Phosphorous cycle#, Nitrogen cycle and Sulphur cycle. Biological Nitrogen fixation- Symbiotic and Non symbiotic – nitrogen fixer, root nodule formation, Nitrogenase and Hydrogenase.

UNIT III

15 Hours

Microbial interaction: Neutralism, Commensalism, Synergism, Mutualism, Amensalism, Competition, Parasitism, Predation. Interaction of microbes with plants – Rhizosphere, **Phyllosphere, Spermosphere, Mycorrhizae. Rumen flora. Insect symbiosis.**

UNIT IV

15 Hours

Plant diseases: Bacterial disease – Citrus canker - Fungal disease – Rust of Wheat, Tikka leaf spot of ground nut, # Blast of Rice#- Red rot of sugar cane .**Viral disease –Cauliflower mosaic , Vein clearing disease of Bhendi (*Abelmoschus esculentus*).**

UNIT V

15 Hours

Plant growth promoting bacteria: Plant growth promoting Rhizobacteria – # Disease suppressive soils # – Bioinoculants in Agriculture, Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings.

Self-study portion

Text Books

T.B-1 Atlas, R.I.M. Microbiology fundamentals and applications. Mac. Millan Publishing Co, 1989.

T.B- 2 Agrios, G.N. Plant Pathology (2nd edition). Academic Press NY, 1978.

T.B – 3 Dirk J, Elas V, Trevors JT, Wellington, EMH. Modern Soil Microbiology. Marcel Dekker INC, New York, Hong Kong, 1997.

T.B- 4 Rangaswami, G. and D.J. Bhagyaraj, 2001. Agricultural Microbiology. 2nd Edition. Prentice, Hall, New Delhi.

UNIT I	Chapter XXVII	T.B-1
UNIT II	Chapter XXXI	T.B-1
UNIT III	Chapter IV	T.B-2
UNIT IV	Chapter VII	T.B- 2
UNIT V	Chapter XII	T.B 3 & 4

Books for reference

1. Ainsworth, G.C. Introduction to the history of plant pathology Cambridge, Univ. 1981. Press, Cambridge.
2. Prescott, L.M, Harley, J.P, Klein, D.A. Microbiology, WCB Mc Graw Hill, 1999.

Web Source:

1. <https://www.britannica.com/science/Bacillus-thuringiensis>
2. <https://vikaspedia.in/agriculture/agri-inputs/bio-inputs/bioinputs-for-nutrient-management/biofertilizers>
3. <https://www.britannica.com/science/soil/Soil-behaviour>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
VI	20UMB6CC15	SOIL AND AGRICULTURAL MICROBIOLOGY					5	5		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO2	✓		✓		✓	✓	✓	✓		✓
CO3	✓	✓	✓			✓	✓	✓		✓
CO4	✓	✓	✓			✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓		✓		✓	✓	✓
Number of Matches= 39 Relationship :High										

Prepared by:

Dr. H. VajihaBanu

Checked by:

1. Dr.N.Reehana
2. Dr.J.Sirajudeen

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
VI	20UMB6CC16P	Core XVI	FOOD AND DAIRY TECHNOLOGY, ENVIRONMENTAL MICROBIOLOGY, SOIL AND AGRICULTURAL MICROBIOLOGY - PRACTICAL	5	5	100	20	80

Course outcomes:

At the end of the course, students will be able to

1. Examine the quality of Milk by Methylene blue reduction test.
2. Detect the food borne pathogens from various sample.
3. Describe the antagonistic effect of microbes.
4. Isolate the microorganisms from soil, air and plant root.
5. Predict the knowledge on algae as indicator of water pollution.

List of Practicals

1. Assessment of milk quality by Methylene Blue Reduction Test.
2. Detection of food borne pathogens from spoiled tomato and Bread.
3. Water portability test Standard Plate Count (SPC).
4. Isolation and counting of faecal bacteria from water
5. Algae as indicators of water pollution
6. Isolation and staining of AM fungi colonization in plant root.
7. Isolation and culturing of *Rhizobium* from root nodules.
8. Isolation and testing of antagonistic microorganisms from soil.
9. Isolation of microorganisms from Rhizosphere and phyllosphere.
10. Microbial assessments of air quality – open plate method
11. Effect of high salt concentration on microbial growth.
12. Oligodynamic action of heavy metals on bacteria.

Practical manual

1. Aneja, KR. Experiments in Microbiology, Plant pathology and Biochemistry (4th Edition). New age International publishers, India 2003.
2. Cappuccino and James, G. Microbiology a laboratory manual (4th edition). Addison Wesley Publishing Company Inc., England, California. 1996.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific

Outcomes:

Semester	Code	Title of the Paper	Hours	Credits						
VI	20UMB6CC16P	FOOD AND DAIRY TECHNOLOGY, ENVIRONMENTAL MICROBIOLOGY, SOIL AND AGRICULTURAL MICROBIOLOGY - PRACTICAL	5	5						
Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		✓	✓			✓	✓	✓	✓	
CO2	✓	✓	✓			✓	✓	✓	✓	
CO3	✓	✓				✓	✓	✓		
CO4		✓	✓			✓	✓	✓	✓	
CO5		✓	✓			✓	✓	✓		✓
Number of Matches= 30 Relationship :Moderate										

Prepared by:

Dr. H. VajihaBanu

Checked by:

1. A.Fasila Begum
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
VI	20UMB6DE2 A	DSE II	PLANT PATHOLOGY	5	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Acquire the knowledge on economic losses and social impact of plant disease.
2. Explore the knowledge on polycyclic and polyetic diseases.
3. Describe the Virulence factors of pathogens.
4. Determine the comprehensive knowledge on concept of resistance.
5. Analyze the basic principles of the disease management.

UNIT I

15 Hours

Concept of Plant Disease: Definitions of disease, disease cycle and pathogenicity, symptoms associated with microbial plant diseases, types of plant pathogens, #economic losses and social impact of plant diseases#. Significant contributions by scientists in the field of plant pathology.

UNIT II

15 Hours

Concept of Epidemics: Infection, invasion, colonization, dissemination of pathogens and perennation. Concepts of monocyclic, polycyclic and polyetic diseases, #disease triangle# and disease pyramid, forecasting of plant diseases and its relevance in Indian context.

UNIT III

15 Hours

Virulence Factors of Pathogens: enzymes, toxins (host specific and nonspecific) growth regulators, virulence factors in viruses (replicase, coat protein, silencing suppressors) in disease development. Effects of pathogens on host physiological processes - photosynthesis, respiration, cell membrane permeability, #translocation of water and nutrients#, plant growth and reproduction.

UNIT IV

15 Hours

Disease Resistance: Concept of resistance (*r*) gene and avirulence (*avr*) gene, gene for gene hypothesis, types of plant resistance – Concepts of constitutive defense mechanisms in plants, inducible structural defenses – inducible biochemical defenses hypersensitive response (HR), #systemic acquired resistance (SAR)#, phytoalexins, pathogenesis related (PR) proteins, plantibodies, phenolics, quinones, oxidative bursts.

UNIT V

15 Hours

Basic Principles of the Disease Management: Study of important plant diseases with emphasis on its etiological agent, symptoms, epidemiology, life cycle and management: fungal diseases – diseases of phytopathogenic bacteria –# phytoplasmas# – viruses and viroids.

Self-study portion

Text Books:

T.B-1 Dube H.C. Modern Plant Pathology, Agrobios (India), 2010.

T.B-2 Ravichandra N.G. Fundamentals of Plant Pathology, PHI Learning Pvt Ltd, 2013.

UNIT I	Chapter I &II	T.B-1
UNIT II	Chapter II	T.B- 1
UNIT III	Chapter XIV	T.B-1
UNIT IV	Chapter XV	T.B- 1
UNIT V	Chapter X	T.B- 2

Books for Reference:

1. Vidhyasekaran P. Concise Encyclopedia of Plant Pathology. CRC Press, 2004.
2. Sharma J.N., Karthikeyan G. and Sh. Mohinder Singh Fundamentals of Plant pathology. ICAR E-course,2007.
3. Agrios G.N. Plant Pathology, 5thEdn. Elsevier Academic Press.2005.

Web Source:

1. <https://www.britannica.com/science/plant-disease>
2. <https://www.apsnet.org/edcenter/disimpactmngmnt/topc/EpidemiologyTemporal/Pages/Disease%20Progress.aspx>
3. <https://www.botanylibrary.com/plant-pathogens/effects-of-pathogens-on-photosynthesis-botany/15606>
4. <http://www.eagri.org/eagri50/ENTO232/lec16.pdf>
5. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=11417>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcome:

Semester	Code	Title of the Paper					Hours	Credits			
VI	20UMB6DE2A	PLANT PATHOLOGY					5	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓		✓		✓	
CO2	✓	✓	✓			✓	✓	✓	✓		
CO3	✓	✓	✓			✓	✓	✓	✓		
CO4	✓		✓		✓	✓	✓	✓	✓		
CO5	✓	✓	✓		✓	✓	✓	✓	✓		
Number of Matches= 36, Relationship : High											

Prepared by:
Dr. N. Packialakshmi

Checked by:
1. Dr.N.Reehana
2. Dr. J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. Marks	Internal Marks	External marks
VI	20UMB6DE2B	DSE II	APPLIED PHYCOLOGY	5	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Acquire the knowledge on ultra structure of prokaryotic and eukaryotic algal cells.
2. Explore the knowledge on Vegetative reproduction in algae.
3. Examine the collection and preservation of algal samples.
4. Describe the economic importance of Algae.
5. Analyze the Environmental effects on algae.

UNIT I

15 Hours

Introduction to Algae: Definition- Distribution of algae- #Classification of Algae#- Important features - Ultrastructure of prokaryotic and eukaryotic algal cells. Thallus organization among algae: Unicellular, colonial, filamentous, siphonous and parenchymatous thallus organizations with examples- pigment and reserve food material.

UNIT II

15 Hours

Vegetative reproduction in algae: Binary cell division, autocolony formation, fragmentation, Hormogones, hormocysts, planococcus, propagules, bulbils and adventitious branches. # Asexual and Sexual reproduction of algae#. Life cycles in algae: Zygotic, gametic, sporic (biphasic). Sporic (triphasic) and somatic life cycles.

Unit III

15 Hours

Collection and preservation of algal samples: Isolation, purification and maintenance of cultures. #Mass culturing methods: open and closed culture system# – Various cell harvesting strategies: centrifugation – sedimentation – flocculation – floatation – filtration methods.

UNIT IV

15 Hours

Economic importance of Algae: Primary producers – Algae as Food –Algae as source of Iodine – Pharmaceuticals and nutraceuticals – Phytohormone production: Auxins – Cytokinins - #Gibberellins#– Biofertilizers – Biofuel production: biodiesel – biohydrogen – bioethanol – biobutanol. Algae in sewage treatment.

UNIT V

15 Hours

Environmental effects of algae: CO₂ mitigation and sequestration – hydrocarbon degradation – heavy metal biosorption - #Harmful algal blooms# – phycotoxins – toxic effect to aquatic organisms and its application in biomedical field.

Self-study portion.

Text Books:

T.B-1 Barsanti, Laura and Paolo Gualtieri. Algae-Anatomy, Biochemistry and Biotechnology. Taylor & Francis, London, New York . 2005.

T.B-2 South, G.R. and A. Whittick. Introduction to Phycology. Blackwell Scientific Publications, Oxford.1987.

UNIT I	Chapter I	T.B-1
UNIT II	Chapter II	T.B- 1
UNIT III	Chapter V & VI	T.B-2
UNIT IV	Chapter VII & XI	T.B- 2
UNIT V	Chapter XI	T.B-2

Books for Reference:

1. Lobban, C.S. and M.J. Wynne (Eds.) The Biology of Seaweeds. Blackwell Scientific Publications, Oxford.
2. Fritsch, F.E. 1945 Structure and Reproduction of Algae, Vol. II, Cambridge University Press, Cambridge.

Web Source:

1. <https://istudy.pk/algae-cell-structure/>
2. <https://www.biologydiscussion.com/algae/reproduction-algae/reproduction-in-algae-botany/53445>
3. https://courses.botany.wisc.edu/botany_330/preservation.html
4. <https://www.biologydiscussion.com/algae/economic-importance-of-algae-botany-2/57866>
5. <https://www.cdc.gov/habs/environment.html>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
VI	20UMB6DE2B	APPLIED PHYCOLOGY					5	4		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓				✓	✓	✓		✓
CO2	✓	✓				✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓		✓		✓				✓
CO5	✓	✓	✓			✓	✓	✓	✓	✓
Number of Matches= 35, Relationship : HIGH										

Prepared by:

Checked by:

Dr. N. Packialakshmi

1. A.Fasila Begum
2. Dr. J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
VI	20UMB6DE3A	DSE-III	SOCIAL AND PREVENTIVE MEDICINE	4	4	100	25	75

Course outcomes:

At the end of the course, students will be able to

1. Acquire the knowledge on basic concepts of medicine, health and diseases.
2. Explain the principles and methods of Epidemiology
3. Determine the disease transmission, diagnosis, and prevention of diseases.
4. Describe the genetic diseases and methods of health management.
5. Acquire the knowledge on mental health and its preventive measures.

UNIT I

12 Hours

Man and Medicine: Medicine in antiquity- Dawn of scientific medicine- Modern medicine- Indian Medicine - Siddha, Ayurvedic, Unani, Naturopathy and Yoga .Self Medication-Medical revolution- Concepts of health and disease – Dimensions of health- # International Classification of Diseases #.

UNIT II

12 Hours

Epidemiology Principles and Methods: Aim and approach, measurement in epidemiology- mortality measurement, morbidity measurement, incidence and prevalence. Epidemiologic methods- descriptive and experimental epidemiology. #Association and causation#. Use of epidemiology.

UNIT III

12 Hours

Introduction to Infectious Disease: General mechanism of disease cycle, disease transmission- human, animal and reservoir in nonliving things- indirect transmission- vehicle borne, vector borne, air borne & fomite borne. #Disease prevention and control#.

UNIT IV

12 Hours

Genetics and Health Management: Genetic Diseases - , Role of genetic predisposition in common disorders – preventive and social measure. **Health planning – #Planning cycle# and Health management – Management method and Techniques.**

UNIT V

12 Hours

Mental Health: History-problem statement. Characteristics of mentally health person-Warning signals of poor mental health-Types of mental illness-Causes of mental ill health-Crucial points in the Life cycle of human beings- #Preventive Aspects# -Mental health services.

Self-study portion

Text Books:

T.B-1 Park, K. Text book of preventive and social medicine, M/s. BanarsidasBhanot Publishers, Jabalpur, India.

Books for Reference:

- 1.Scigerist henry, 1951.A History of medicine, Vol. Oxford university press, London.
2. Ahmed, P. I and Coelho, G.V.1979.Toward a new Definition of Health, Pleum, New Yark.
3. Roht, L.H.1982. Principles of epidemiology, a self – teaching guide .London academic press.
4. Lilienfeld, A.M. and Lilienfeld, D.E.1980.Foundations of epidemiology, (2nd edition). Oxford University.

UNIT I	Chapter I	T.B- 1
UNIT II	Chapter III	T.B-1
UNIT III	Chapter IV	T.B- 1
UNIT IV	Chapter V	T.B- 1
UNIT V	Chapter VIII	T.B- 1

Web Source :

- 1.<https://www.slideshare.net/tusharkedar2/indigenous-system-of-medicine>
- 2.<https://www.slideshare.net/RAJEEVK2010/5principles-and-methods-of-epidemiology>
- 3.https://www.medicinenet.com/genetic_disease/article.htm
- 4.<https://www.betterhealth.vic.gov.au/health/ServicesAndSupport/types-of-mental-health-issues-and-illnesses>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
VI	20UMB6DE3A	SOCIAL AND PREVENTIVE MEDICINE					4	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓			✓	✓	✓		✓	
CO2	✓	✓	✓			✓	✓	✓	✓		
CO3		✓	✓			✓	✓	✓	✓	✓	
CO4	✓	✓	✓			✓	✓	✓	✓	✓	
CO5	✓									✓	
Number of Matches= 31 Relationship : Moderate											

Prepared by:

Dr. H. VajihaBanu

Checked by:

1. K.Vijayalakshmi
2. Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
VI	20UMB6DE3B	DSE-III	BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS	4	4	100	25	75

Course Outcomes:

At the end of the course, students will be able to

1. Acquire the knowledge on Biosafety and Biohazard management.
2. Predict the knowledge on genetically modified organisms relevant to Biosafety guidelines and regulations.
3. Apply the ethical approaches during animal research.
4. Describe the knowledge on IPR and its regulation.
5. Acquire the knowledge on patent, types, guidelines and applications.

UNIT I

12 Hours

Biosafety: Good laboratory practices. Risk and safety assessment from genetically engineered organisms. Special procedures for r-DNA based products; biological containment (BC) and physical containment (PC); #Biological Safety Cabinets and their types#. Biohazard management.

UNIT II

12 Hours

Biosafety Guidelines: Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), for GMO applications in food and agriculture; #Environmental release of GMOs#; Risk Analysis; Risk Assessment; Risk management and communication.

UNIT III

12 Hours

Bioethics: Ethical considerations during research; animal testing; xenotransplantation; Embryonic and adult stem cell research. #Informed Consent#, Independent Ethics Committee, Constitution of institutional ethics committee, Conflicts of Interest.

UNIT IV

12 Hours

Intellectual Property Rights (IPRs): Concepts of IPR; Types of IP: #patents#, Trademarks, copyright & related rights, industrial design, traditional knowledge, geographical indications. Plagiarism and open access publishing. World Intellectual Property Rights Organization (WIPO).

UNIT V

12 Hours

Patenting: Basics of Patents. Patent application - forms and guidelines. Patent filing in India and abroad. Filing of a patent application. Patent Co-operation Treaty (PCT); #Gene patent#, Patenting of Living Organisms.

#Self-study portion.

Text Books:

- T. B-1.** Fleming, D.O. and Hunt, D.L. Biological Safety: Principles and Practices. American Society for Microbiology, USA. 2006.
- T. B-2.** Shannon, T.A. An Introduction to Bioethics. Paulist Press, USA.2009.
- T. B-3.** Vaughn, L. Bioethics: Principles, Issues, and Cases. Oxford University Press, UK. 2009.
- T. B-4.** Singh K K (2015). Biotechnology and Intellectual Property Rights: Legal and Social Implications, Springer India.
- T. B-5.**Goel D and Prashar S. IPR, Biosafety and Bioethics. Pearson.2013.

UNIT I	Chapter II	T.B-1
UNIT II	Chapter IV	T.B-5
UNIT III	Chapter XXV	T.B-3
UNIT IV	Chapter XIX	T.B-2
UNIT V	Chapter VII	T.B-4

Books for Reference:

1. WHO. Laboratory Biosafety Manual. World Health Organization.2005
2. Bare Act, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., New Delhi.2007.
3. P Ganguly, Intellectual Property Rights, Tata McGraw Hill, 2007.

Web Source:

1. <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/biosafety>
2. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/intellectual-property-rights>.
3. <https://www.niehs.nih.gov/research/resources/bioethics/index.cfm>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits		
VI	20UMB6DE3B	BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS					4	4		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓		✓	✓	✓			✓	✓	✓
CO3	✓	✓				✓	✓			
CO4			✓	✓	✓	✓		✓	✓	✓
CO5	✓			✓	✓	✓			✓	✓
Number of Matches= 34, Relationship : High										

Prepared by:
Dr.P.Sivalingsam

Checked by:
1. Dr.Dr.M.Mohamed Mahroop Raja
2.Dr.J.Sirajudeen

Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External Marks
VI	20UMB6EC2	EC - II	MICROBIOLOGY FOR COMPETITIVE EXAMINATIONS	-	4*	100	-	100

Course Outcomes:

At the end of the course, students will be able to

1. Describe the evolution, contribution scope and human health of Microorganisms.
2. Illustrate the properties, structure and classification of prokaryotes, Eukaryotes and Viruses.
3. Explain the chemistry of microbial growth and its measurements.
4. Acquire the knowledge on nucleic acids and its application in genetic engineering.
5. Determine the role of microbes in various fields.

UNIT I

Introductory Microbiology: History of Microbiology, Origin and evolution of life. Contribution of Pioneers with special reference to Leeuwenhoek, Pasteur, Jenner and Koch. Scope of Microbiology- Microbiology of human health (short description of causal agent, pathogenesis and diagnosis of Typhoid, Cholera, Influenza, Herpes, Malaria and Ringworm). Beneficial and harmful Microbes.

UNIT II

Prokaryotic and Eukaryotic cell: Classification of bacteria: phylogenetic and phenetic classification, numerical taxonomy, Hierarchical taxa, Nomenclature and taxonomy of bacteria. Characteristics of Cyanobacteria and Archaeobacteria. General properties of virus- ICTV-scheme for viral classification based on genome, morphology and host properties, identification of Viruses- bacteriophages- structure, replication and transmission.

UNIT III

Biochemistry of Microbes: Chemical elements, Structure of atoms, Molecules and chemical bonds, Chemical reactions, Molecules of living systems. Concepts and types of thermodynamics- Enthalpy, Entropy, Gibb's free energy. Microbial growth and multiplication- Growth curve and kinetics of bacteria, nutritional requirements, culture media, factors affecting growth; Physical and chemical measurement of Microbial growth. Chemostat and turbidostat.

UNIT IV

Genetic and Nucleic acid: Mendelian principles-Dominance, segregation, independent assortment, allele and multiple alleles. Types, structure and function- Plasmids and Transposons. DNA Types and structure- A, B and Z. RNA types and structure - mRNA, tRNA and rRNA. Restriction endonucleases - types, properties and uses. Cloning- Gene cloning and cloning vectors and Genomic libraries. PCR- types, functions, Sequencing, DNA finger and foot printing. Applications of genetic engineering- Bt cotton, Insulin production, Somatotrophin and vaccine production.

UNIT V

Application of microbiology: Role of microbes in preparation of Sauerkraut, bread and pickles. Microbes as food- Single cell protein and Mushroom production. Symbiotic and non-symbiotic biofertilizer production. Microbiology of milk- Preservation of milk and milk products. Production of fermented dairy Products-Acidophilus milk, cheese and yogurt. Industrial production of organic acid (Lactic acid), Enzymes (Amylase), Alcohol (Ethanol), Antibiotics (Penicillin).

##Self-study portion.

Text Books:

T.B-1. Lansing, M. Prescott, John P. Harley and Donald A. Klein. 2011. Microbiology, 8th edn McGraw Hill Publishing company Ltd.(2011).

T.B-2. Principles of Biochemistry – Lehninger – CBS Publishers.

T.B-3. S.S. Purohit, Microbiology- Fundamentals and Applications, 7th Edition, Agrobios (India) Jodhpur, 2008.

T.B-4. R.C. Dubey and D.K Maheswari, A Textbook of Microbiology (Revised edition), S. Chand and Company Ltd, New Delhi, 2012.

UNIT I	Chapter I	T.B-1
UNIT II	Chapter IV & XV	T.B-4
UNIT III	Chapter X & V	T.B-2
UNIT IV	Chapter IX	T.B-3
UNIT V	Chapter XX	T.B-4

Books for Reference:

1. Michael J. Pelczar, Jr. E.C.S. Chan, Noel R. Krieg, Microbiology, 5th edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.

2. David L. Nelson and Michael M. Cox, Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, 2005.

3. Old, R.W and Primrose S.B. Principles of gene manipulation-An introduction to genetic engineering. 5th edition. Blackwell scientific publications. London. (1995).

4. Jeffrey C. Pommerville, Alcamo's Fundamentals of Microbiology, 9th edition, Jones and Bartlett publishers, Massachusetts, 2011.

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Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper					Hours	Credits			
VI	20UMB6EC2	MICROBIOLOGY FOR COMPETITIVE EXAMINATIONS					-	4*			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓	✓		✓	✓	✓	
CO2	✓	✓	✓			✓	✓	✓			
CO3	✓	✓	✓		✓	✓	✓	✓		✓	
CO4	✓	✓	✓		✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓		
Number of Matches= 38, Relationship : High											

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Note:

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very poor	Poor	Moderate	High	Very high