## **DEPARTMENT OF MICROBIOLOGY**

### **COURSE STRUCTURE & SYLLABI** (For the students admitted from year 2023-2024 onwards)

### **Programme : B.Sc. Microbiology**





### JAMAL MOHAMED COLLEGE (AUTONOMOUS)

Accredited with A++ Grade by NAAC (4<sup>th</sup> Cycle) with CGPA 3.69 out of 4.0 (Affiliated to Bharathidasan University) TIRUCHIRAPPALLI – 620 020

### **B.SC. MICROBIOLOGY**

_	Sem Course Code					a	Marks				
Sem			Course Category	Course Title	Hrs/	Credit	CIA	ESE	Total		
					Week	ļ!		LOL			
	23UILTI/LAI/LFI	Ι	Language - I		6	3	25	75	100		
	/LHI/LUI								100		
	23UCNILEI	Ш	English - I	English for Communication - I	6	3	25	75	100		
т	23UMB1CC1		Core - I	Fundamentals of Microbiology	5	5	25	75	100		
1	23UMB1CC2P	ш	Core - II	Fundamentals of Microbiology - Practical	3	3	20	80	100		
	23UMB1AC1		Allied - I	General Biochemistry	5	4	25	75	100		
	23UMB1AC2P		Allied - II	General Biochemistry - Practical	3	2	20	80	100		
	23UCN1AE1	IV	AECC - I	Value Education	2	2	-	100	100		
				Total	30	22			700		
	23U2LT2/LA2/LF2	_									
	/LH2/LU2	I	Language - II		6	3	25	75	100		
	23UCN2LE2	П	English - II	English for Communication - II	6	3	25	75	100		
	23UMB2CC3		Core – III	Bacteriology	5	5	25	75	100		
	23UMB2CC4P		Core - IV	Bacteriology - Practical	3	3	20	80	100		
п	23UMB2AC3	III	Allied III	Haamatology	5	4	25	75	100		
- 11	23UMB2AC3			Haematology	5	4	23	75	100		
	23UMB2AC4P	13.7		Haematology - Practical	3	2	20	80	100		
	23UCN255	IV	Soft Skills Development	Soft Skills Development	2	2	-	100	100		
	23UCN2CO	V	Community Outreach	JAMCROP	-	w	-	-	e		
	23U2BT1 /		Basic Tamil - 1/	எழுத்தும் இலக்கியமும் அறிமுகம் - 1 /	-	-	-	100 #	-		
	2302A11		Advanced Tamil - I	ഉനന് ജീരെമ്മനന്ന ബാംബിന - 1		!					
	<sup>®</sup> Only grades will b	oe givei	1	Total	30	22			700		
	23U3LT3/LA3/LF3	т	Language - III		6	3	25	75	100		
	/LH3/LU3				0		23	,5	100		
	23UCN3LE3	II	English - III	English for Communication - III	6	3	25	75	100		
	23UMB3CC5		Core - V	Microbial Physiology	4	4	25	75	100		
ш	23UMB3CC6P	ш	Core - VI	Microbial Physiology - Practical	3	3	20	80	100		
	23UMB3AC5	- 111	Allied - V	Basics of Immunology	4	4	25	75	100		
	23UMB3AC6P		Allied - VI	Basics of Immunology - Practical	3	2	20	80	100		
	23UMB3GE1		Generic Elective - I		2	2	-	100	100		
	23UCN3AE2	IV	AECC - II	Environmental Studies	2	2	-	100	100		
				Total	30	23			800		
	2311/1 T// A//I E/								000		
	/LH4/LU4	Ι	Language - IV		6	3	25	75	100		
	23UCN4LE4	П	English - IV	English for Communication - IV	6	3	25	75	100		
	23UMB4CC7		Core - VII	Medical Microbiology	6	6	25	75	100		
	23UMB4CC8P		Core - VIII	Medical Microbiology - Practical	3	3	20	80	100		
	23UMB4AC7	ш	Allied - VII	Soil and Agricultural Microbiology	4	4	20	75	100		
IV	23UMB4AC8P				Amed VII	Soil and Agricultural Microbiology	-	-	23	15	100
			Allied - VIII	Practical	3	2	20	80	100		
	23UMB4GE2		Generic Elective - II		2	2	-	100	100		
	23UCN4EL	IV	Experiential Learning	Internship	-	2	-	100	100		
	23UCN4EA	V	Extension Activities	NSS, NCC, etc.	-	1	-	-	-		
	23U4BT2 /		Basic Tamil - II /	எழுத்தும் இலக்கியமும் அறிமுகம் - II /				100 #			
	23U4AT2		Advanced Tamil – II	தமிழ் இலக்கியமும் வரலாறும் - II	-	-	-	100	-		
				Total	30	26			800		
	23UMB5CC9		Core - IX	Microbial Genetics	6	6	25	75	100		
	23UMB5CC10		Core - X	Molecular Biology	5	5	25	75	100		
	23UMB5CC11		Core - XI	Enzyme Technology	5	5	25	75	100		
	250mb30011	III		Microbial Genetics Molecular Biology and	5	5	23	15	100		
v	23UMB5CC12P		Core - XII	Enzyme Technology - Practical	5	5	20	80	100		
•	23UMR5DF14/R		Discipline Specific Elective - I	,	5	4	25	75	100		
	23UMD5SE1		Skill Enhancement Course J	Piotechniques	2	1	25	100	100		
	23UMB55E1	IV	Skill Enhancement Course - I	Dising subject Taska also	2	1	-	100	100		
	23UMD55E2		Skill Eilinancement Course - II	Orling Course	Z	1	-	100	100		
	23UMB5ECI		Extra Credit Course - 1*	Unline Course	-	*	-		-		
				Total	30	27	L		700		
	23UMB6CC13		Core - XIII	Environmental Microbiology	6	6	25	75	100		
	23UMB6CC14		Core - XIV	Food Microbiology	6	6	25	75	100		
	23UMB6CC15P		Core XV	Environmental Microbiology and Food	5	5	20	80	100		
	250MIDUCCIJF	III		Microbiology - Practical	5	5	20	00	100		
	23UMB6PW		Project Work	Project Work	3	2	-	100	100		
VI	23UMB6DE2A/B		Discipline Specific Elective - II		5	4	25	75	100		
	23UMB6DE3A/B		Discipline Specific Elective - III		4	4	25	75	100		
	23UCN6AE3	IV	AECC - III	Gender Studies	1	1	-	100	100		
	23UMB6EC2		Extra Credit Course - II*	Online Course	-	*	-	-	-		
	23UMBECA	1	Extra Credit Course for all**	Online Course	-	**	-	-	-		
	23UCN6ECA1	1	Extra Credit Course for all <sup>+</sup>	Entrepreneurship Development	-	+	-	_	-		
	* Programme Speci	ific On	line Course for Advanced Learners	T	20				<b>F</b> 0.0		
	** Any Online Cou	rse for	Enhancing Additional Skills	Total	30	28			700		
	+ Course for Enhan	cing E	ntrepreneurial Skills								
				Gran	d Total	148			4400		

#### **GENERIC ELECTIVE COURSES**

Semester	Course Code	Course Title
III	23UMB3GE1	Food Process Technology
IV	23UMB4GE2	Dairy Microbiology

#### #Self-Study Course – Basic and Advanced Tamil (Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

Semester	Course Code Course Title							
п	23U2BT1	Basic Tamil – I (எழுத்தும் இலக்கியமும் அறிமுகம் - I)						
11	23U2AT1	Advanced Tamil – I (தமிழ் இலக்கியமும் வரலாறும் - I)						
IV	23U4BT2	Basic Tamil – II (எழுத்தும் இலக்கியமும் அறிமுகம் - II)						
1 V	23U4AT2	Advanced Tamil – II (தமிழ் இலக்கியமும் வரலாறும் - II)						

#### Mandatory

Basic Tamil Course - I and II are offered for the students who have not studied Tamil Language in their schools and college.

Advanced Tamil Course - I and II are offered for those who have studied Tamil Language in their schools but have opted for other languages under Part - I.

Semester	Course Code	Course Title
N/	23UMB5DE1A	Introduction to Virology
v	23UMB5DE1B	Textile Microbiology
	23UMB6DE2A	Fermentation Technology
VI	23UMB6DE2B	Medical Entomology
VI	23UMB6DE3A	Recombinant DNA Technology
	23UMB6DE3B	Bioinformatics and Biostatistics

#### DISCIPLINE SPECIFIC ELECTIVES

Somester	Course Code	Course Cotogony	Hours/	Cradita	Marks for Evaluation			
Semester	Course Coue	Course Category	Week	Creatis	CIA	ESE	Total	
Ι	23UMB1CC1	Core – I	5	5	25	75	100	
	•							

#### Course Title FUNDAMENTALS OF MICROBIOLOGY

	SYLLABUS	
Unit	Contents	Hours
I	<b>Introduction</b> - Definition, Scope and Landmark discoveries relevant to the field of microbiology; *Germ theory of disease*, Theory of spontaneous generation. Biogenesis and abiogenesis. Microscopy: Introduction, Principle – Bright field, dark field, phase contrast, confocal, fluorescent and electron microscope-TEM and SEM. Specimen preparation of Electron Microscopy.	15
II	<b>Taxonomy</b> : Types of classification (artificial, natural, phylogenetic); #binomial nomenclature#. Haeckel's three kingdom, Whittaker's five kingdom concept – merits, demerits and status of virus in five kingdom concept. Carl Woes's three kingdom classification systems and their utility. *Eight kingdom concept*. Outline classification based on Bergey's manual of systemic Bacteriology (9th edition).Difference between the prokaryotic and eukaryotic microorganisms.	15
III	<b>Characterization of microbes:</b> 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.	15
IV	<b>Measurement of Microbes:</b> Microscopic measurements of microorganisms and spores using stage and ocular micrometer. Quantitative Measurement – Direct Microscopic Count, Electronic Enumeration of Cell Numbers, *Plate count method*, Membrane – Filter Count, Turbidometric methods and determination of dry weight of the cell.	15
V	<b>Sterilization and disinfection techniques:</b> Definition and concept of Sterilization, Physical methods- Moist heat (Tyndallisation, Pasteurization), Dry heat (incineration, hot air over) and Moist heat under pressure (Autoclave), Filtration (Membrane filter, HEPA filter) Radiation (UV- rays, X- rays, ultrasonic rays). Chemical methods- disinfection, sterilants sanitization, antisepsis and fumigation. *Phenol coefficient of disinfectant*.	15
VI	<b>Current Trends (For CIA only)</b> - Burping bacteria: Identifying Arctic microbes th greenhouse gases.	at produce

\*.....\* Self Study

#### **Text Book(s):**

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

2. Lansing M. Presscott, John P. Harley and Donald A. Klein's, Microbiology, 7<sup>th</sup>edition, McGrawHill, 2008.

3. Roger Y. Stainer, John L. Ingraham, Mark L, Wheelis and Page R. Painter, General Microbiology, 5<sup>th</sup> Edition, Macmillan Press Ltd, London,1992.

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

#### **Reference Book(s):**

1. Ananthanarayan R. and Jayaram Paniker C.K., Textbook of Microbiology, 8<sup>th</sup>edition, Universities Press (India) Private Limited, 2009.

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

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

#### Web Resource(s):

1. <u>https://www.studyandscore.com/studymaterial-detail/phylum-protozoa-general-characters-and-classification</u>

2.<u>http://ecoursesonline.iasri.res.in/mod/page/view.php?id=5205</u>

3. <u>https://microbeonline.com/maintenance-and-preservation-of-pure-cultures-of-bacteria/</u>

#### **Course Outcomes** Upon successful completion of this course, the student will be able to: **Cognitive Level** CO No. **CO Statement** (K-Level) Describe the knowledge on historical inventions, scope and Principles CO1 **K1** of Microscopy. Explain the classification and nomenclature of bacterial taxonomy. **K2** CO2Determine the characterization and their economic importance of CO3 **K3** microbes. Analyze the microbes by using various measurement techniques. CO<sub>4</sub> **K4** CO5 Summarize the methods of sterilization and disinfection techniques. **K5**

#### **Relationship Matrix:**

Course	Pro	gramm	e Outco	omes (P	Os)	Progra	Mean Score of				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	3	3	2	3	1	2	2	3	1	1	2.1
CO2	2	2	2	2	1	3	2	1	2	2	1.9
CO3	3	2	3	1	2	3	2	2	3	1	2.2
CO4	2	2	2	1	2	1	1	2	1	2	1.6
CO5	2	3	2	2	2	2	1	2	2	1	1.9
Mean Overall Score											
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Somester	Course Code	Course Cotogory	Hours/	Cradita	Marks for Evaluation				
Semester	Course Coue	Course Category	Week	Creatis	CIA	ESE	Total		
Ι	23UMB1CC2P Core - II		3	3	20	80	100		
				•					

#### **Course Title FU**

#### FUNDAMENTALS OF MICROBIOLOGY- PRACTICAL

SYLLABUS							
S. No	Contents	Hours					
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.	45					
7.	Isolation of Actinomycetes.	45					
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.						
12.	Microscopic examination of the Amoeba and <i>Plasmodium</i> using permanent mounts						

#### Text Book(s):

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 Livingston, 1989.

#### **Reference Book(s):**

1.K.R. Aneja, Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
2.B.K. Khuntia, Basic Microbiology – An Illustrated Laboratory Manual, 2<sup>nd</sup> Edition, Daya Publishing House, New Delhi, 2013.

#### Web Reference:

1. <u>https://www.pharmaguideline.com/2007/02/isolation-and-preservation-methods-for-pure-cultures.html</u>

2.https://ocw.ehu.eus/file.php/253/Temas/2\_BASIC\_METHODS\_FOR\_THE\_ENUMERATION\_OF\_MICROORGANISMS.pdf 3. https://microbiologyinfo.com/gram-staining-principle-procedure-interpretation-examples-and-animation/

	Course Outcomes									
Upon suc	Upon successful completion of this course, the student will be able to:									
CO No.	CO Statement	Cognitive Level (K-Level)								
CO1	Describe the biosafety measures and aseptic techniques.	K1								
CO2	Illustrate the methods of sterilization, media preparation and pure culture techniques.	K2								
CO3	Determine the microorganisms from various samples.	К3								
CO4	Analyze the bacteria by counting methods.	K4								
CO5	Summarize the various staining techniques.	K5								

Course	Pro	gramm	e Outco	omes (P	Os)	Progra	Mean Score of				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	2	3	2	2	2	2	3	3	1	1	2.1
CO2	3	2	2	2	1	3	2	2	1	1	1.9
CO3	2	3	2	2	2	3	2	2	1	1	2.0
CO4	3	3	2	2	1	3	2	2	2	1	2.1
CO5	3	3	2	2	2	3	2	2	1	1	2.1
Mean Overall Score											
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and $<$ 2.5	Medium
≥ 2.5	High

Course Coordinator: A. SWEDHA

Semester	Course Code	Course Cotogony	Hours/	Credita	Marks for Evaluation			
	Course Code	Course Category	Week	Creans	CIA	ESE	Total	
Ι	23UMB1AC1	Allied - I	5	4	25	75	100	

Course Title GENI

### GENERAL BIOCHEMISTRY

SYLLABUS						
Unit	Contents	Hours				
I	<b>Basics in Biochemistry</b> : Structure of atoms, molecules and chemical bonds. Units of measurement of solutes- Normality, molality and morality. Water as a biological solvent. Acids and bases, * pH, pK *and Preparation of buffers and their importance in biological systems.	15				
II	<b>Carbohydrates:</b> Structure, Classification and functions of carbohydrates- Monosaccharides-Glucose, Fructose and Galactose. Disaccharides -Maltose, Lactose and Sucrose. Trisaccharides- *Raffinose*. Polysaccharides- Homo and Heteropolysaccharides.	15				
III	Amino acids and proteins: Structure, Classifications and types of amino acids. Proteins- Classification, Structure of Primary, Secondary, Tertiary and Quaternary Structure. *Biological functions of Fibrous and Globular proteins* - forces stabilizing the structure of proteins.	15				
IV	<b>Lipids:</b> Structure and classification and function of lipids. Simple lipids- Fats and Waxes. Compound lipids- Phospholipids, Glycolipids and *Lipoproteins*. Derived lipids- Fatty acid-saturated and unsaturated.	15				
V	<b>Nucleic acid and Vitamins</b> : Nucleic acid: Structure, Types and composition of nucleic acids- *Nucleotides and Nucleosides* and its importance. Vitamins: Sources, structure and physiological functions of Fat soluble and Water soluble vitamins.	15				
*	* Self Study					

#### **Text Book(s):**

 David L. Nelson and Michael M.Cox, Lehniger Principles of Biochemistry, 7<sup>th</sup> Edition, W.H. Freeman and Company, New York, 2017.

2. Eric E. Conn, Paul K. Stumpf, George Bruening and Roy H. Doi, Outlines of Biochemistry, 5<sup>th</sup>Edtion, John Wiley and Sons, New Delhi, 2006.

3. Ambika shanmugam, Fundamentals of Biochemistry for Medical students 8<sup>th</sup> Edition, Kartik offset Printers, Chennai, 2016.

4. Satyanarayana U,and Chakrapani U. Biochemistry,5<sup>th</sup> edition, Elsevier, New Delhi, 2020.

#### **Reference Book(s):**

- 1. Jeremy M. Berg, JoghnL.Tymoczko and LubertStryer, Biochemistry, 8<sup>th</sup> Edition, W.H. Freeman and Company, New York, 2015.
- 2. Donald voet and Judith voet, Biochemistry, John Wiley and Sons, New York, 2010.
- 3. Dawn, B. Markus, Biochemistry, Harwal Publishing, New York, 1998.

#### Web Resource(s):

- 1. https://www.onlinebiologynotes.com/biological-significance-of-water/
- 2. <u>https://biologydictionary.net/polysaccharide/</u>
- 3. <u>https://studymind.co.uk/notes/protein-structures-globular-and-fibrous-proteins/#</u>:
- 4. <u>https://www.britannica.com/science/lipoprotein</u>
- 5. https://www.toppr.com/guides/chemistry/biomolecule/nucleic-acids/

	Course Outcomes							
Upon suc	Upon successful completion of this course, the student will be able to:							
CO No.	CO No. CO Statement							
CO1	Relate the structure of atoms, unit concentrations and stabilizing interactions of Biomolecules.	K1						
CO2	Explain the structure, classification, function and sources of Carbohydrates.	K2						
CO3	Articulate the classification, structure, properties of Amino acids and Proteins.	K3						
CO4	Analyse the classification, structure and functions of Lipids.	K4						
CO5	Evaluate the structure and functions of Vitamins and Nucleic acids.	К5						

Course	Pro	gramm	e Outco	omes (P	Os)	Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	2	3	2	2	2	2	3	3	1	1	2.1
CO2	3	2	2	2	1	3	2	2	1	1	1.9
CO3	2	3	2	2	2	3	2	2	1	1	2.0
CO4	3	3	2	2	1	3	2	2	2	1	2.1
CO5	3	3	2	2	2	3	2	2	1	1	2.1
Mean Overall Score											10.2/5= 2.04
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥2.5	High

### Course Coordinator: K. Vijayalakshmi

Semester	Course Code	Course Cotogomy	Hours/ Week	Credits	Marks for Evaluation			
	Course Coue	Course Category			CIA	ESE	Total	
Ι	23UMB1AC2P	Allied - II	3	2	20	80	100	

#### Course Title GENERAL BIOCHEMISTRY- PRACTICAL

SYLLABUS				
S.No	Contents	Hours		
1.	Preparation of Normal, Molar and Percentage solutions.			
2.	Preparation of Buffers.			
3.	Qualitative Analysis of sugars- Fehling's Test and Benedict's Test.			
4.	Estimation of Glucose – Anthrone method.			
5.	Qualitative Analysis of Amino acids- Millon's test	]		
6.	Estimation of Amino acid - Ninhydrin test.	45		
7.	Estimation of Protein by Lowry's method.			
8.	Qualitative Analysis of Fats - Huble's test.			
9.	Estimation of Ascorbic acid from biological sample - Biuret method.			
10	Qualitative Analysis of Vitamins- Spectrophotometric method.	]		

#### **Text Book(s):**

1. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry,4<sup>th</sup> Edition, Cambridge University press, Britain, 1995.

2. Strolv B.A and Makavora V.C, Laboratory manual in Biochemistry, MIR Publisher, Moscow, 1989.

#### **Reference Book(s):**

1. Joy P P, Surya S and Aswathy C, Laboratory manual of Biochemistry, Pineapple Research Station (Kerala Agricultural University), Vazhakulam, Ernakulam, Kerala, 2015.

2. Vasudevan DM, Subir Kumar Das, Practical Textbook of Biochemistry for Medical Students, 2<sup>nd</sup> Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, 2013.

#### Web Reference:

- 1. https://www.egyankosh.ac.in/bitstream/123456789/68524/1/Exercise-2.pdf
- 2. http://chem.boun.edu.tr/wp-content/uploads/2014/04/Chem-415-Experiment-2.pdf
- 3. https://www.iitg.ac.in/biotech/BTechProtocols/Ascorbic.pdf

	Course Outcomes						
Upon suce	Upon successful completion of this course, the student will be able to:						
CO No.	CO Statement	Cognitive Level (K-Level)					
CO1	Prepare different Buffers.	K1					
CO2	Perform qualitative analysis of sugars and Amino acids.	K2					
CO3	Demonstrate the qualitative analysis of Vitamins and Fats.	K3					
CO4	Estimate the amino acid and ascorbic acid quantitatively.	K4					
CO5	Predict the amount of proteins	K5					

Relationship Matrix:											
Course	Pro	gramm	e Outco	omes (P	Os)	Progra	Programme Specific Outcomes (PSOs)				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	2	3	2	2	2	2	3	3	1	1	2.1
CO2	3	2	2	2	1	3	2	2	1	1	1.9
CO3	2	3	2	2	2	3	2	2	1	1	2.0
CO4	3	3	2	2	1	3	2	2	2	1	2.1
CO5	3	3	2	2	2	3	2	2	1	1	2.1
Mean Overall Score											10.2/5= 2.04
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: K. VIJAYALAKSHMI

Semester	Course Code	Course Cotogory	Hours/	Cradita	Marks for Evaluation			
	Course Code	Course Category	Week	Creans	CIA	ESE	Total	
II	23UMB2CC3	Core - III	5	5	25	75	100	

Course Title BAC

#### BACTERIOLOGY

	SYLLABUS	
Unit	Contents	Hours
I	<b>Cell structure and Subcellular organelles of Bacteria:</b> Morphology and Ultra- structure of Bacterial cells - cell wall, cell membrane, ribosomes, capsule, flagella, pili, fimbriae plasmid, mesosomes and cytoplasmic inclusions, Mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, *peroxisomes*, chloroplast and endospore formation.	15
II	<b>Stains and Staining reactions</b> – Types of stains – Acid, base and Neutral. Principles of staining – Simple staining, Differential staining – Grams and acid fast staining, Special staining - Endospore, negative, Capsule staining, *Nuclear and Flagella staining*.	15
III	<b>Cultivation of Bacteria</b> : Types of growth media. Definition and examples of natural, synthetic, complex, enriched, selective media, Pure culture techniques – pour plate, spread plate, *streak plate, stab and slant culture*. Anaerobic culture techniques– Wright's tube, Roll tube, McIntosh Fildes jar method.	15
IV	<b>Bacterial nutrition and Reproduction:</b> Nutritional requirements, Nutritional Types of bacteria- Phototrophs, Chemotrophs, Autotrophs, Heterotrophs and *Obligate parasites*. Bacteria reproduction- Fission, Budding, endospore formation and Fragmentation. Maintenance and preservation of pure cultures of bacteria.	15
V	Archaebacteria & Extremophiles: General characteristics, Diversity, Structure, cell wall, types, evolutionary developments, and economic importance of Archaebacteria. Metabolism and energetics of Archaea- <i>Thermoplsma, Sulfolobus</i> . Growth of Bacteria under extreme condition- Psychrophiles, acidophiles, *thermophiles* and halophiles.	15
VI	<b>Current Trends</b> (For CIA only) – Shining a light on how Bacteria interact	

\*.....\* Self Study

#### **Text Book(s):**

1. Michael, J. R. Pelczar, Chan Jr.E.C.S and Kreig N. R., Microbiology, 5<sup>th</sup>edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.

2. Bilgrami K. S and Sinha R. K, Essentials of Microbiology, SK Jain for CBS publishers and distributors, 1<sup>st</sup> edition, 2005.

3. Prescott L. M, Harley J. P and AKlein D., Microbiology, Mc Grow Hill, 7<sup>th</sup> edition, 2007.

#### **Reference Book(s):**

1. Holt J.G, Kreig N.R, Sneath P.H.A, and Williams S.T., Bergey's Manual of Systematic Bacteriology, 9<sup>th</sup> edition, Williams and Wilkins, Baltimore, 1994.

2. Madigan M.T, Martinko J.M and Parker J, Brock Biology of microorganisms, 11<sup>th</sup> edition, Pearson Education international, USA, 2006.

3. Tortora G. J, Funke B.R and Case C. L, Microbiology an Introduction, 8<sup>th</sup> edition, LPE-Pearson Education, Inc, 2005.

#### Web Resource(s):

1.http://www.scientistcindy.com/ex-12--8203-pure-culture-technique.html

2.https://courseware.cutm.ac.in/wp-content/uploads/2020/06/isolation-preservation-.pdf

3. https://microbenotes.com/microbiology-of-extreme-environments/

Course Outcomes									
Upon successful completion of this course, the student will be able to:									
CO No.	CO Statement	Cognitive Level (K-Level)							
CO1	Describe the structure and organelles of bacterial cell	K1							
CO2	Identify the bacteria using different staining techniques	K2							
CO3	Illustrate different types of media and pure culture techniques used for bacterial cultivation	К3							
CO4	Categorize the nutritional types of bacteria, their reproduction and preservation	K4							
CO5	Summarize about the diversity of Archaebacteria and extremophiles	K5							

#### **Relationship Matrix:**

Course	Pro	gramm	e Outco	omes (P	Os)	Progra	Mean Score of					
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs	
CO1	1	1	2	2	2	2	2	3	1	1	1.7	
CO2	2	3	2	3	2	2	3	3	3	2	2.5	
CO3	3	2	1	2	1	1	2	3	3	1	1.9	
CO4	3	2	2	2	2	3	2	3	3	1	2.3	
CO5	2	2	2	1	2	3	1	3	2	2	2.0	
Mean Overall Score												
									Cor	relation	Medium	

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Ms. A. Fasila Begum

Somoste		ourse Code	Course Cotogomy	Hours/	Credita	Mar	ks for Ev	aluation			
Semeste	er C	ourse Code	Course Calegory	Week	Creatis	CIA	ESE	Total			
II	23	UMB2CC4P	CORE - IV	3	3	20	80	100			
Course	se Title BACTERIOLOGY - PRACTICAL										
			SYLLAB	US							
S.No			Contents					Hours			
1.	Prepa	ration of cultu	re media for bacterial cultiv	ation.							
2.	Enun	neration of bac	teria from soil and water sai	nple.							
3.	Isolat	ion of bacteria	from air by settle plate me	thod.							
4.	Isolat	ion of pure cu	ltures of bacteria by streak p	late meth	od.						
5.	Nega	tive staining.						_			
6.	Caps	ule staining.						45			
7.	Endo	spore staining									
8.	Meas	urement of siz	e of microbes using microm	etry meth	od.						
9.	Determination of bacterial growth by turbidity method.										
10.	Prese	rvation of bact	terial cultures by mineral oil	•							
11.	Exam	nination of bac	terial motility by Hanging d	rop metho	od						

#### **Text Book(s):**

1. James G. Cappuccino, Natalie Sherman. Microbiology - A laboratory manual, The Benjamin

(Cummings Publishing Company, Inc.). 1996.

2. Aneja K.R. Experiments in Microbiology Plant Pathology and Biotechnology. New Age International Limited. 2005.

#### **Reference Book(s):**

1. Jeffrey Pommerville, Laboratory Fundamentals of Microbiology 11<sup>th</sup> Edition, Jones and Bartlett Learning,2017.

2. Davis W. Pritchett, Pritchett-Gilbert, Microbiology: A PET Based Approach Introductory Laboratory Manual,2nd Edition, Kendall Hunt Publishing Company, 2007.

#### Web Reference:

1. https://www.sigmaaldrich.com/IN/en/technical-documents/technical-article/microbiological-testing/microbial-culture-media-preparation/media-preparation

2. https://microbiologynote.com/isolation-of-microorganism-from-air/

 $3.\ https://www.biologydiscussion.com/micro-biology/preserving-microbial-cultures-top-5-methods/17821$ 

	Course Outcomes									
Upon suc	Upon successful completion of this course, the student will be able to:									
CO No.	CO No. CO Statement									
CO1	Describe the methods of sterilization, media preparation and pure culture techniques.	K1								
CO2	Identify microorganisms from various samples.	K2								
CO3	Illustrate the different staining techniques and preservation of culture.	K3								
CO4	Analyse the bacterial growth by different methods.	K4								
CO5	Predict the motility of bacteria.	K5								

Course	Pro	gramm	e Outco	omes (P	Os)	Progra	Mean Score of					
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs	
CO1	3	3	2	2	1	1	2	3	3	2	2.2	
CO2	2	3	2	2	2	3	3	3	2	1	2.3	
CO3	2	3	2	2	2	2	3	2	1	1	2.0	
CO4	2	3	1	2	1	2	3	2	2	1	1.9	
CO5	2	2	2	1	1	2	3	2	2	1	1.8	
Mean Overall Score												
									Cor	relation	Medium	

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and $<$ 2.5	Medium
≥ 2.5	High

### Course Coordinator: Ms. A. Fasila Begum

Semester	Course Code	Course Cotogory	Hours/	Hours/ Credits		Marks for Evaluation			
	Course Coue	Course Category	Week	Creats	CIA	ESE	Total		
II	23UMB2AC3	Allied - III	5	4	25	75	100		

Course Title HAEMATOLOGY

SYLLABUS								
Unit	Contents	Hours						
I	<b>Introduction to Haematology:</b> Definition, History and discovery of blood group system. ABO and Rhesus blood group system. Formation of Blood. Composition and functions of blood. Normal hematological indices (MCV, MCH, MCHC, PCV) and methods of estimation -Hb and *ESR*.	15						
п	<b>Blood Processing and preservation of blood:</b> Different methods of collection and Preservation, changes in stored blood. Blood Banking and Process of blood transfusion. Various anticoagulants, their uses, mode of action * their merits and demerits*.	15						
ш	<b>Erythrocytes and Leucocytes:</b> Erythropoiesis: structure and function of RBCs: formation of Haemoglobin. Leukopoiesis: General characteristics, properties of WBCs: classification and functions of each type of WBC. *Normal and absolute values*	15						
IV	<b>Blood Smear and Culture:</b> Different types, Methods of preparation, Theory of staining – Physical and Chemical, Types of Stains- Acidic, Basic and Neutral. Mechanism of staining, Dyes: Natural, mordents, metachromatic and *metachromatic dyes*.	15						
<b>v</b>	Hematologic diseases: RBC Disorders- Anaemia, and Sickle Cell Disease. WBC Disorders- Leukemia and Leukopenia, Coagulopathy- Hemophilia and Thrombocytopenia, Hematologic malignancies- leukemia, lymphoma and *multiple myeloma*.	15						

#### **Text Book(s):**

- 1. Mary Lou Turgeon, Clinical Hematology, Theory and Procedures, Jones & Bartlett Learning, Massachusetts, 6<sup>th</sup> edition 2020.
- 2. Andrew Blann, Gavin knight and Gray Moore, Haematology, Oxford University Press, 2010.
- 3. Shirish M Kawthalkar, Essentials of Haematology, Jaypee Brothers Medical Publishers Pvt. Limited, India, 2012.
- 4. Ian Todd and Gavin Spickett, Immunology, Blackwell Publishing Ltd, Hoboken, New Jersey, 5<sup>th</sup> edition, 2005.

#### **Reference Book(s):**

- 1. Rao C.V., Immunology-A Text book, Narosa Publishing House Pvt.Ltd,2007.
- 2. Abul K. Abbas and Andrew H. Lichtman, Basic Immunology-Functions and Disorders of the Immune System, Reed Elsevier India Pvt Limited, New Delhi, India,2005.
- 3. Yadav P.R., Immunology, Discovery Publishing House, New Delhi,2004.

#### Web Resource(s):

- 1. https://www.vedantu.com/biology/blood-cell-formation
- 2. <u>https://pathlabs.ufl.edu/client-services/specimen-shipping/blood-collection-process-venipuncture/</u>
- 3. https://my.clevelandclinic.org/health/articles/24407-erythropoiesis
- $4. \ \underline{https://stainsfile.info/theory/metachromasia.htm}$
- 5. https://my.clevelandclinic.org/health/diseases/14430-thrombocytopenia

	Course Outcomes									
Upon suc	Upon successful completion of this course, the student will be able to:									
CO No.	CO No. CO Statement									
CO1	Recite the historical inventions in Immunohematology and blood grouping.	K1								
CO2	Extend the knowledge on collection, preservation, storage of blood and its normal values.	K2								
CO3	Articulate the structure and function of erythrocytes and leucocytes.	К3								
CO4	Assess the methods for preparation and staining of blood films.	K4								
CO5	Explain the causes and treatment of various hemolytic diseases.	K5								

#### **Relationship Matrix:**

Course	Pro	gramm	e Outco	omes (P	Os)	Progr	Mean Score of					
Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs	
CO1	3	3	2	2	2	2	1	3	3	2	2.2	
CO2	2	3	2	2	2	3	3	3	2	1	2.3	
CO3	2	3	2	2	2	2	3	2	1	1	2.0	
CO4	2	3	1	2	1	2	3	2	2	1	1.9	
CO5	2	2	2	1	1	2	3	2	2	1	1.8	
Mean Overall Score												
									Cor	relation	Medium	

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

#### Course Coordinator: K.Vijayalakshmi

Semester	Course Code	Course Cotogomy	Hours/	Credita	Marks for Evaluation			
	Course Coue	Course Category	Week	Creatis	CIA	ESE	Total	
П	23UMB2AC4P	Allied - IV	3	2	20	80	100	

#### Course Title HAEMATOLOGY - PRACTICAL

	SYLLABUS	
S.No	Contents	Hours
1.	Blood collection – Vein puncture, Finger stick and Heel stick procedure.	
2.	Separation of serum and plasma from whole blood.	
3.	Preparation of Peripheral blood smear.	
4.	Determination of bleeding time and clotting time.	
5.	Total count of Red Blood Cells.	
6.	Total count of White Blood Cells.	
7.	Differential count of White Blood Cells.	45
8.	Total Platelet count.	
9.	Estimation of hemoglobin content.	
10.	Erythrocyte Sedimentation Rate.	
11.	Separation of Hemoglobin by Cellulose Acetate Electrophoresis.	
12.	Visit to nearby Hematology laboratory.	

#### Text Book(s):

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, Tamil Nadu.

2. Rajan S and Selvi Christy, Experimental procedures in life sciences, Anjana Book House publishers and distributors, Chennai, 2011.

#### **Reference Book(s):**

**1.** Sri Nageswari, K and Anamika Kothari, Practical Manual of Haematology, Jaypee Brothers Medical Publishers Pvt. Limited, 2007.

## 2. Kamat Girish, Practical Manual of Hematology, Jaypee Brothers Medical Publishers Pvt. Limited, 2010.

#### Web Reference:

1. https://pathlabs.ufl.edu/client-services/specimen-shipping/blood-collection-procedure-capillary/

- 2. https://labpedia.net/white-blood-cell-part-2-total-leukocytes-
- count/#:~:text=Number%20of%20WBC%20in%201%C2%B5L,x%2050%20%3D%20TLC%2Fcmm.
  3. https://tmc.gov.in/tmh/PDF/Hemato%20Pathology%20Course/Rashida%20Ansari%20ESR.pdf

	Course Outcomes						
Upon suc	cessful completion of this course, the student will be able to:						
CO No.	CO Statement	Cognitive Level (K-Level)					
CO1	Quote the collection and separation of components of blood.	K1					
CO2	Discuss the methods for counting of blood cells.	K2					
CO3	Determine the amount of hemoglobin in blood.	К3					
CO4	Illustrate the Peripheral blood smear preparation.	K4					
CO5	Evaluate the Hemoglobin by Electrophoresis.	K5					

Course	Pro	gramm	e Outco	omes (P	Os)	Progra	Mean Score of				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	3	3	2	2	1	1	2	3	2	2	2.1
CO2	2	3	2	2	2	1	1	3	2	1	1.9
CO3	2	3	1	2	2	1	1	3	2	1	1.8
CO4	2	3	2	1	2	2	3	2	1	1	1.9
CO5	3	2	2	2	2	1	2	2	2	2	2.0
Mean Overall Score											9.7/5= 1.94
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Ms. A. Fasila Begum

Semester		0 0 4	Hours/	<b>a 1</b> '	Marks for Evaluation			
	Course Code	Course Category	Week	Credits	CIA	ESE	Total	
III	23UMB3CC5	Core - V	4	4	25	75	100	
			•	•	-	•	•	

**Course Title** 

#### MICROBIAL PHYSIOLOGY

	SYLLABUS	
Unit	Contents	Hours
I	<b>Transport of nutrients and biosynthesis:</b> 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.	12
II	<b>Microbial growth:</b> 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.	12
III	<b>Metabolism:</b> Anabolism, catabolism, primary and secondary metabolites. Sugar degradation pathways - Embden–Meyerhof pathway, *Entner–Doudoroff pathway* and Pentose phosphate pathway, Kreb's cycle (TCA) - Electron transport system and ATP production. Photosynthesis-Light and dark reaction.	12
IV	<b>Metabolism of proteins and lipids:</b> Metabolic pathways of nitrogen utilization, Biosynthesis of amino acids, peptides, and proteins. *Degradation of amino acids*. Anabolic and catabolic processes of lipids.	12
V	Anaerobic respiration and Nitrogen fixation: Nitrate, sulphate and methane respiration – Fermentations- alcohol, mixed acid, lactic acid fermentation – Nitrogen Fixation – Physiology of nitrogen cycle. *Nitrogen fixers*.	12
VI	Current Trends (For CIA only) – Therapeutics applications of pigment producing m	nicrobes.

#### \*.....\* Self Study

#### **Text Book(s):**

1. A.G. Moat, J.W. Foster and M.P. Spector, Microbial Physiology. 4th edition, A Johan Wiley and sonsinc., publication, 2002.

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

3.J. Michael J.R. Pelczar, E.C.S. Chan, Noel Krieg. Microbiology, 5<sup>th</sup>Edition, Tata McGraw Hill, 2010.
4. L.M. Presscott, J.P. Harley and C.A. Klein's. Microbiology, 10th edition, McGraw Hill, 2017.

#### **Reference Book(s):**

1. J.M. Willey, L.M. Sherwood and C.J. Woolverton, Prescott's Principles of Microbiology. McGraw-Hill Higher Educationp.969, 2009.

2. D.R. Caldwell. 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 Resource(s):

 $1. \underline{https://spot.colorado.edu/~schmidts/Teaching/EPOB3400/microPhys.html}$ 

2. <u>https://courses.lumenlearning.com/microbiology/chapter/introduction-to-microbial- metabolism/</u>

 $3. \underline{https://www.wur.nl/en/research-results/chair-groups/agrotechnology-and-food-chair-groups/agrotechnology-agrotechnology-and-food-chair-groups/agrotechnology-agrotechnology-and-food-chair-groups/agrotechnology-agrotechn$ 

sciences/biomolecular-sciences/laboratory-of-microbiology/thesis-projects/thesis-projects-microbial-physiology.htm

	Course Outcomes							
Upon suc	cessful completion of this course, the student will be able to:							
CO No.	CO Statement	Cognitive Level (K-Level)						
CO1	Describe the knowledge on biosynthesis of bacterial structural components and their nutrition's transport.	K1						
CO2	Explain the microbial growth and generation time.	K2						
CO3	Determine the characterization of carbohydrates metabolism.	К3						
CO4	Analyze the biosynthesis of proteins.	K4						
CO5	Assess the anaerobic respiration and nitrogen fixation.	K5						

Course	Pro	gramm	e Outco	omes (P	'Os)	Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	3	1	3	2	2	3	1	3	1	3	2.2
CO2	3	3	1	1	3	3	3	1	2	2	2.2
CO3	2	1	3	1	3	3	1	3	2	1	2.0
CO4	1	2	3	1	1	3	2	2	3	1	1.9
CO5	1	1	1	2	3	3	1	2	3	3	2.0
Mean Overall Score											10.3/5= 2.06
									Cor	relation	Medium

Mean Overall Score	Correlation			
< 1.5	Low			
$\geq$ 1.5 and < 2.5	Medium			
≥ 2.5	High			

Course Coordinator: A. Swedha

Semester	C	ourse Code	Course Cotogory	Hours/	Crodite	Marks for Evaluation			
	C	Juise Coue	Course Category	Week	Creuits	CIA	ESE	Total	
III	230	JMB3CC6P	Core - VI	3	3	20	80	100	
Course Ti	tle	MICROBIA	AL PHYSIOLOGY - PRA	CTICAL					

SYLLABUS								
Unit	Contents	Hours						
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.	15						
7.	Voges-Proskauer test.	43						
8.	Citrate utilization test.							
9.	Catalase test.							
10.	Oxidase test.							
11.	TSI test.							
12.	ONPG Test.							

#### **Text Book(s):**

- 1. G. Cappuccino and James, Microbiology a laboratory manual. Addison Wesley Publishing Company Inc., England, California. 2013.
- 2. K.R. Aneja. Experiments in Microbiology, Plant pathology and Biochemistry, New age International publishers, India. (4th Edition). 2003.
- 3. M. Abid Nordin and Liana A.B. Samad, Microbial Physiology Manual, Biological Sciences Department of California State Polytechnic University, Pomona 2003.

#### **Reference Book(s):**

- 1. K.R. Aneja., Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
- B.K. Khuntia., Basic Microbiology An Illustrated Laboratory Manual, 2nd Edition. Daya Publishing House, New Delhi, 2013.
- 3. Amita Jain, Jyotsna Agarwal and Vimala Venkatesh. Microbiology Practical Manual, 2018.

#### Web Resource(s):

1.https://cevre.erciyes.edu.tr/upload/M6Z30UUmicrobiology-laboratory-manual.pdf

2. http://site.iugaza.edu.ps/mwhindi/files/Laboratory\_Manual\_And\_Workbook\_In\_Microbiology.pdf

3.https://www.teachmint.com/tfile/studymaterial/bsc/microbiology/isemestermicrobiologylabmanual/9016452f-c940-43ec-8815-2afb78a04f9b

Course Outcomes									
Upon suc	Upon successful completion of this course, the student will be able to:								
CO No.	CO Statement	Cognitive Level (K-Level)							
CO1	Describe the bacterial growth and their cell count by standard method.	K1							
CO2	Illustrate the mechanism of photosynthetic bacteria.	K2							
CO3	Determine the effect of pH and temperature on bacterial growth.	К3							
CO4	Analyze the biochemical methods to identify the bacterial species.	K4							
CO5	Summarize the thermal death time and decimal reduction time of <i>E. coli</i> .	К5							

Course	Pro	gramm	e Outco	omes (P	Os)	Programme Specific Outcomes (PSOs)					Mean	
Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Score of COs	
CO1	3	1	3	3	2	3	1	3	1	1	2.1	
CO2	2	3	1	3	3	2	1	1	2	2	2.0	
CO3	1	1	2	2	3	3	2	2	1	1	1.8	
CO4	1	2	3	1	2	2	1	1	1	3	1.7	
CO5	2	3	2	3	2	2	1	1	2	1	1.9	
Mean Overall Score											9.5/5=1.9	
	Correlation											

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

#### Course Coordinator: A. Swedha

Semester Course Code Course Category Week Creats CIA ESE	Semester	
	Semester	E <b>Total</b>
III         23UMB3AC5         Allied - V         4         4         25         75	III	100

#### Course Title BASICS OF IMMUNOLOGY

	SYLLABUS	
Unit	Contents	Hours
I	<b>Immune cells and organs of immune system:</b> 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.	12
II	<b>Immune Response:</b> Types of immunity-innate (non-specific) and adaptive immunity (specific). Antibody mediated immunity and Cell mediated immunity. Antigens- Properties of antigen, Immunoglobulins- Structure, types and clinical significance.	12
III	<b>Hypersensitivity:</b> Hypersensitivity reactions (Type I: reaction mediated by IgE antibodies. Type II: cytotoxic reaction mediated by IgG or IgM antibodies. Type III: reaction mediated by immune complexes. Type IV: delayed reaction mediated by cellular response).	12
IV	<b>Transplantation and Tumor Immunology:</b> Structure, function of Major histocompatibility complex and HLA system. Transplantation- organ transplantations in humans, Xenotransplantation HLA typing methods, Graft rejection Graft disease (GVHD). Tumor- Types, *Tumor antigens*, causes and therapy for cancers.	12
V	<b>Immunoprophylaxis:</b> Vaccine-Types – Killed, Live attenuated (bacterial and viral) Toxoid and mRNA vaccines. Principles of Precipitation, Agglutination, Immunodiffusion, Immunoturbidity, Immunoelectrophoresis, *RIA*, Immunofluoresence, ELISA, ELISPOT, Western blotting, Flow cytometry, Immunoelectron microscopy.	12

\*.....\* Self Study

#### **Text Book(s):**

1. R.A. Goldsby, T.J. Kindt and B.A. Osborne. Kuby's Immunology, 8th edition, WH Freeman and Company, New York, 2019.

2. R. Ananthanarayan and C.K.J. Paniker. Textbook of Microbiology. (Edited by CKJ Paniker). 9th edition, University Press Publication, 2013.

3. David male, Jonathan Brostoff, D.B. Roth and Ivan Roitt. Immunology, (8th edition), Mosy Elsevier publication, Canada. 2013.

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

#### **Reference Book(s):**

Ivan M. Roit. Essential Immunology. Blackwell Scientific Publications 13th Edition, Oxford, 2017.
 J. Kuby. 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.

#### Web Resource(s):

1. https://www.sciencedirect.com/topics/medicine-and-dentistry/transplantation

2. https://vk.ovg.ox.ac.uk/vk/types-of-vaccine

3. https://www.sciencedirect.com/topics/medicine-and-dentistry/immunoturbidimetry

4. https://biotechhealth.com/xenotransplantation/

					Cours	e Outco	mes					
Upon suc	cessful	complet	tion of t	his cour	se, the s	student w	ill be able	e to:				
CO No.		CO Statement									Co ] (K	ognitive Level -Level)
CO1	Descri	Describe the immune cells and organs of immune system.										K1
CO2	Comp	Compare the knowledge on different types of the immune response.										K2
CO3	Examine the mechanism of transplantation and its immunological significance.									ical		K3
CO4	Conclude the knowledge on hypersensitivity reactions and tumor immunology.									nor		K4
CO5	Evalua	Evaluate the applications of vaccine in various immunological methods .										K5
Relat	tionship	) Matrix	x:									
Course	Pro	gramm	e Outco	omes (P	Os)	Progra	amme Sp	pecific O	utcomes	(PSC	)s)	Mean Score o
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PS	05	COs
CO1	2	3	2	2	2	2	3	3	1	1	l	2.1
CO2	3	2	2	2	1	3	2	2	1	1	l	1.9
CO3	2	3	2	2	2	3	2	2	1	1	l	2.0

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

**Mean Overall Score** 

Correlation

2.1

2.1

10.2/5=

2.04 Medium

Course Coordinator: N. Vennila

**CO4** 

CO5

Semester	Course Code	Course Cotogory	Hours/	Cradita	Marks for Evaluation			
	Course Code	Course Category	Week	Creans	CIA	ESE	Total	
III	23UMB3AC6P	Allied - VI	3	2	20	80	100	

#### Course Title | BASICS OF IMMUNOLOGY - PRACTICAL

SYLLABUS							
S.No.	Contents	Hours					
1.	Preparation of serum and plasma.						
2.	Identification of human blood group and Rh-factor						
3.	Latex agglutination-CRP Test.						
4.	Anti Streptolysin O (ASO) test.						
5.	WIDAL Test.						
6.	VDRL Test.	45					
7.	Radial Immuno-diffusion.						
8.	Ouchterlony Double Immunodiffusion technique.						
9.	Demonstrations of Immuno-electrophoresis.						
10.	Demonstration of ELISA (Antigen/Antibody detection).						

#### **Text Book(s):**

#### **Practical Manual:**

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

#### **Reference Book(s):**

K.R. Aneja, Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
 B.K. Khunti. Basic Microbiology – An Illustrated Laboratory Manual, 2nd Edition, Daya Publishing House, New Delhi, 2013.

3. Amita Jain, Jyotsna Agarwal and Vimala Venkatesh Microbiology Practical Manual 2018.

#### Web Resource(s):

1.https://cevre.erciyes.edu.tr/upload/M6Z30UUmicrobiology-laboratory-manual.pdf

- 2. https://microbiologynote.com/rapid-plasma-reagin-rpr-test-principle-procedure-result-applications/
- 3. https://microbiologyinfo.com/widal-test-introduction-principle-procedure-interpretation-and-limitation/
- 4. https://microbiologynote.com/latex-agglutination-test-procedure-principle-inhibition-limitation-uses/

	Course Outcomes									
Upon suc	Upon successful completion of this course, the student will be able to:									
CO No.	CO Statement	Cognitive Level (K-Level)								
CO1	Identify the human blood group.	K1								
CO2	Estimate the antibodies against the target pathogen.	K2								
CO3	Examine the immunodiffusion technique.	К3								
CO4	Analyze the process of immune-electrophoresis.	K4								
CO5	Conclude the interactions of antigen and antibody reactions.	K5								

Course	Pro	gramm	e Outco	omes (P	Os)	Progra	Mean Score of				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	3	3	2	2	1	1	2	3	3	2	2.2
CO2	2	3	2	2	2	2	3	3	2	2	2.3
CO3	2	3	2	2	2	2	3	2	1	1	2.0
CO4	2	3	1	1	1	2	3	2	2	2	1.9
CO5	2	2	2	2	2	2	3	2	2	1	1.8
Mean Overall Score											10.2/5= 2.04
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: N. Vennila

Semester	Course Code	Course Cotogowy	Hours/	Credita	Marks for Evaluation			
	Course Code	Course Category	Week	Creatis	CIA	ESE	Total	
III	23UMB3GE1	Generic Elective - I	2	2	-	100	100	
				1				

Course Title | FOOD PROCESS TECHNOLOGY

	SYLLABUS	
Unit	Contents	Hours
I	<b>Introduction to Food Processing:</b> Definition, scope and Principles of Food Processing. Food preservation- Physical (low and high temperature), Chemical (salt, sugar, propionates and benzoates). Food colour and flavouring agents.	6
II	<b>Harvesting and storage of fruits and vegetables:</b> Post-harvest processing of fruits and vegetables: Peeling, sizing, blanching, *Canning of fruits* and vegetables, Drying and freezing of fruits and vegetables.	6
III	<b>Juice processing:</b> General steps in juice processing, Juice extraction, preservation of fruit juices, fruit juice clarification, concentration of fruit juices, *fruit juice powders*.	6
IV	<b>Production of Jam and Jelly :</b> Preparation of fruit jams and jellied fruit products. Tomato based products: Juice, puree, paste, sauce, *ketchup*. Principle and Production of pickles .	6
V	<b>Beverages:</b> Coffee- Production practices, Coffee processing including roasting, grinding, brewing, extraction, dehydration, aromatization, instant coffee. Tea leaf processing, green, red, yellow,* instant tea*.	6

\*.....\*Self Study

#### **Text Book(s):**

1. P.J. Fellow. "Food Processing Technology Principles and Practice". 5th Edition, Wood head Publishing Series in Food Science, Technology and Nutrition, 2022.

2. M. Penchalaraju Yadav, B. Channabasamma, and Lakshmi Jagarlamudi. "Food Processing Technology". Pointer Publishers, Jaipur, 2017.

3. A.S. Bawa, P.S. Raju, O.P. Chauhan. "Food Science". New India Publishing agency, 2013.

#### **Reference Book(s):**

1. Mudambi, Sumati Rajagopal., Rao, M. Shalini., M V Rajagopal, "Food Science". India: New Age International Pvt Ltd, Publishers, 2015.

2. S. Roday, "Food Science", Oxford publication, 2011.

3. Mridula Mirajkar, Menon Sreelata, S. Mridula Menon Mirajkar, "Food Science and Processing Technology". Kanishka Publishing House.2010.

#### Web Resource(s):

- 1. <u>https://ebooks.inflibnet.ac.in/ftp1/chapter/principles-of-food-processing-and-preservation/</u>
- 2. <u>https://en.wikipedia.org/wiki/Maillard\_reaction#:~:text=Caramelization</u>
- 3. <u>https://www.onlinebiologynotes.com/food-borne-disease-food-poisoning-and-food-infection</u>

	Course Outcomes							
Upon successful completion of this course, the student will be able to:								
CO No.	CO Statement	Cognitive Level (K-Level)						
CO1	Describe the fundamental concepts of food processing.	K1						
CO2	Explain the processing of fruits and vegetable.	K2						
CO3	Illustrate the preparation and preservation of juice.	К3						
CO4	Analyze the production of fruit jams, jelly and pickles .	K4						
CO5	Predict the production process of coffee and tea.	K5						

Course	Pro	gramm	e Outco	omes (P	Os)	Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	2	2	1	3	3	2	3	2	1	2	2.1
CO2	1	3	2	2	1	2	2	3	2	1	1.9
CO3	2	2	3	1	2	3	2	1	2	2	2.0
CO4	2	2	2	3	1	3	2	2	2	2	2.1
CO5	3	1	2	2	2	3	2	2	1	2	2.0
Mean Overall Score											10.1/5= 2.02
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: K. Vijayalakshmi

Semester	Course Code	Course Cotogowy	Hours/	Credita	Marks for Evaluation			
	Course Code	Course Category	Week	Creans	CIA	ESE	Total	
IV	23UMB4CC7	Core - VII	6	6	25	75	100	

Course Title | MEDICAL MICROBIOLOGY

	SYLLABUS	
Unit	Contents	Hours
I	<b>Introduction to Medical Microbiology:</b> Scope and applications. Disease prevalence and incidence. Epidemiology and Infection – stages and transmission. Normal microflora of human body. Host defense against microbial invasion and *Nosocomial infections*.	15
п	<b>Bacterial pathogens:</b> Morphology, cultural characteristics, pathogenesis, diagnosis and prophylaxis of <b>Gram positive bacteria</b> : <i>Staphylococcus, Streptococcus, Bacillus, Mycobacterium</i> and <i>Corynebacterium</i> . <b>Gram negative bacteria</b> : <i>E.coli, Klebsiella, Bordetella pertussis, Vibrio, Salmonella, Neisseria</i> and * <i>Proteus</i> *.	15
III	<b>Fungal pathogens:</b> General characteristics, morphology, pathogenesis, laboratory diagnosis and prophylaxis of Superficial- Dermatophytes- <i>Microsporum</i> , <i>Trichophyton</i> and <i>*Epidermophyton*</i> . Subcutaneous- <i>Sporothrix</i> and Mycetoma. Systemic- <i>Histoplasma</i> , <i>Coccidioides</i> and <i>Blastomyces</i> . Opportunistic fungal infections- <i>Candida</i> , <i>Cryptococcus</i> and <i>Aspergillus</i> .	15
IV	<b>Viral disease:</b> Characteristics, morphology, pathogenesis, clinical manifestations, diagnosis and prophylaxis of Measles, Mumps, Herpes virus, Pox virus, *Polio virus*, Rabies, Chikungunya, Ebola, Dengue, Swine flu, Hepatitis B and HIV, Corona and Nipah Virus.	15
V	<b>Parasitic infections</b> : General characteristics, structure, life cycle, pathogenesis, epidemiology, clinical manifestations and laboratory diagnosis of Amoebiasis, *Giardiasis*, Trypanosomiasis, Leishmaniasis, Malaria, Ascariasis and Filariasis, Cryptosporidiosis.	15
VI	<b>Current Trends (For CIA only)</b> – Opportunistic infections, Daily news and resear collection and recording of recent outbreak of bacterial, fungal, viral, protozoan dise	ch paper eases.
*	*Self Study	

Text Book(s):

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.

2. C.K. Jeyaram Paniker, Text Book of Parasitology Jay Pee Brothers, New Delhi, (2006).

3. S. Rajan, Medical microbiology, MJP publisher, (2007).

#### **Reference Book(s):**

1. J. Michael J.R. Pelczar, E.C.S. Chan, Noel R. Krieg, Microbiology, 5th edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2010.

2. Mark Gladwin, William Trattler, and C. Scott Mahan, Clinical Microbiology made ridiculously simple, 6th edition, Med Master, Inc., USA, 2014.

3. S.M. Finegold, Diagnostic Microbiology. 10th Edition. CV Mosby Company, St. Louis. 2000.

#### Web Resource(s):

1.https://www.microrao.com/micronotes/hpylori.htm

2.https://www.onlinebiologynotes.com/nipah-virus-structure-and-genome-mode-of-transmission-pathogenesis-symptoms-prevention-and-treatment/

3. <u>https://my.clevelandclinic.org/health/diseases/24885-parasitic-infection</u>

	Course Outcomes							
Upon successful completion of this course, the student will be able to:								
CO No.	CO Statement	Cognitive Level (K-Level)						
CO1	Describe the normal microflora of the human body and host pathogen interaction.	K1						
CO2	Summarize the pathogenesis and laboratory diagnosis of several human diseases caused by bacteria .	K2						
CO3	Illustrate the pathogenesis, laboratory diagnosis of fungal pathogens.	К3						
CO4	Explain the knowledge on pathogenicity, treatment, and prevention of viral diseases.	K4						
CO5	Conclude the pathogenesis, laboratory diagnosis of parasitic infections.	К5						

Course	Pro	gramm	e Outco	omes (F	POs)	Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	2	3	2	1	3	2	2	3	1	2	2.1
CO2	3	2	3	1	2	1	2	1	2	2	1.9
CO3	2	2	1	2	2	3	2	2	2	1	1.9
CO4	2	3	1	2	2	2	2	3	2	1	2.0
CO5	2	1	2	3	1	3	3	1	2	2	2.0
Mean Overall Score										9.9/5= 1.98	
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: K. Vijayalakshmi

Semester	Course Code	Course Cotogory	Hours/ Week	Credits	Marks for Evaluation			
	Course Coue	Course Category			CIA	ESE	Total	
IV	23UMB4CC8P	Core - VIII	3	3	20	80	100	

**Course Title** 

#### MEDICAL MICROBIOLOGY - PRACTICAL

SYLLABUS					
S.No.	Contents	Hours			
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 lactophenol cotton blue stain.	45			
6.	Demonstration of blood parasites by Giemsa staining and Leishman staining.	] •3			
7.	Estimation of serum sugar.				
8.	Estimation of serum cholesterol.				
9.	Estimation of AST.				
10.	Estimation of ALT.				

#### **Text Book(s):**

1. James G. Cappuccino, Natalie Sherman, Microbiology - A laboratory manual, The Benjamin Cummings Publishing Company, Inc, 2005.

2. H.J. Benson, Microbiological Applications: A Laboratory Manual in General Microbiology, The McGraw-Hill Companies, 2015.

3. C.P. Prince, Practical Manual of Medical Microbiology, Ist edition, Jaypee digital publishing, ,2009. **Reference Book(s):** 

1. R. Ananthanarayan and C.K.J. Paniker, Textbook Of Microbiology, 11th edition, Universities Press Pvt. Ltd, 2020.

#### Web Resource(s):

1. https://bio.libretexts.org/Learning\_Objects/Laboratory\_Experiments/Microbiology\_

Labs/Microbiology\_Labs\_I/09%3A\_Kirby-Bauer\_(Antibiotic\_Sensitivity)

2. https://paramedicsworld.com/hematology-practicals/leishman-staining-principle-procedure-

interpretation/medical-paramedical-studynotes

3. https://microbeonline.com/giemsa-stain-principle-procedure-and-results/

	Course Outcomes						
Upon suc	Upon successful completion of this course, the student will be able to:						
CO No.	CO Statement	Cognitive Level (K-Level)					
CO1	Examine the clinical samples collected from patients.	K1					
CO2	Interpret the knowledge on antimicrobial susceptibility test .	K2					
CO3	Report the medically important fungi by lacto phenol cotton blue stain.	К3					
CO4	Focus the blood parasites by giemsa stain and leishman stain.	K4					
CO5	Estimate the level of AST and ALT in bloodstream.	K5					

Course	Pro	gramm	e Outco	omes (P	Os)	Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	2	2	1	3	3	2	3	2	1	2	2.1
CO2	1	3	2	2	1	2	2	3	2	1	1.9
CO3	2	2	3	1	2	3	2	1	2	2	2.0
CO4	2	2	2	3	1	3	2	2	2	2	2.1
CO5	3	1	2	2	2	3	2	2	1	2	2.0
Mean Overall Score									10.1/5= 2.02		
	Correlation									Medium	

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: K. Vijayalakshmi

Semester	Course Code	Course Category	Hours/	Credita	Marks for Evaluation			
			Week	Creans	CIA	ESE	Total	
IV	23UMB4AC7	Allied - VII	4	4	25	75	100	
				•			•	

#### Course Title | SOIL AND AGRICULTURAL MICROBIOLOGY

SYLLABUS					
Unit	Contents	Hours			
I	<b>Soil Microbiology:</b> Soil as Microbial Habitat, Soil profile and properties, Soil formation, Diversity, and distribution of major group of microorganisms in soil. Quantification of soil microflora, *role of microorganism in soil fertility*. Mineralization of organic and Inorganic Matter in Soil.	12			
II	<b>Nutrient Cycling Processes:</b> Carbon cycle, Phosphorous cycle, Nitrogen cycle Oxygen cycle, Sulphur cycle and *Iron cycle*. Biological nitrogen fixation – nitrogen fixer, root nodule formation, nitrogenase and hydrogenase.	12			
III	<b>Microbial Interaction:</b> Neutralism, Commensalism, Synergism, Mutualism, Amensalism, Competition, Parasitism, *Predation*. Interaction of microbes with plants – Rhizosphere, Phyllosphere, Spermosphere, Mycorrhizae. Rumen flora. Insect symbiosis.	12			
IV	<b>Plant Diseases:</b> Types, transmission and control measures. Bacterial diseases – Bacterial blight of paddy ,Citrus canker and Bacterial wilt - Fungal diseases – Red rot of sugar cane; Powdery mildew of cucurbits and *Blast of Rice*- Viral diseases –TMV, Cauliflower mosaic, Vein clearing disease of Bhendi ( <i>Abelmoschus esculentus</i> ).	12			
V	<b>Plant Growth Promoting Bacteria:</b> 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.	12			

\* .....\*Self Study

#### **Text Book(s):**

1. N.S. Subba Rao..Soil Microbiology. 4th Edition, Oxford & Ibh Publishing Co Pvt Ltd, 2020.

2.Jan Dirk van Elsas, Jack T. Trevors, Alexandre Soares Rosado, Paolo Nannipieri, Modern Soil Microbiology, Third Edition, CRC Press, 2019.

3. Singh Tanuja, S.S. Purohit, P. Parihar. Soil Microbiology (PB). Student Edition, 2018.

#### **Reference Book(s):**

- 1. N.S. Subba Rao. Soil Microbiology, 5th Edition, Med Tech Publishers. 2017.
- 2. P.D. Sharma. Microbiology and Plant pathology. 2<sup>nd</sup> Edition, Rastogi Publications, 2010.
- 3. G. Rangaswami, and D.J. Bhagyaraj, Agricultural Microbiology. 2nd Edition, Prentice, Hall, New Delhi, 2009.

#### Web Resource(s):

- 1. <u>https://microbenotes.com/microorganisms-in-soil/</u>
- 2. <u>https://en.wikipedia.org/wiki/Oxygen\_cycle</u>
- 3. <u>https://www.onlinebiologynotes.com/biofertilizer</u>

	Course Outcomes						
Upon suc	Upon successful completion of this course, the student will be able to:						
CO No.	CO Statement	Cognitive Level (K-Level)					
CO1	Describe diversity and significance of soil microbes .	K1					
CO2	Explain the role of microbes in nutrient cycle.	K2					
CO3	Illustrate the mechanism of microbial interactions.	K3					
CO4	Analyze the plant diseases and their control measures.	K4					
CO5	Conclude the knowledge on production and applications of plant growth promoting bacteria.	K5					

Course	Pro	gramm	e Outco	omes (P	'Os)	Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	3	2	3	2	3	3	3	2	3	1	2.5
CO2	3	2	3	2	2	3	2	2	1	2	2.2
CO3	3	2	2	3	1	3	2	2	3	2	2.3
CO4	3	3	2	2	2	3	3	2	3	2	2.5
CO5	3	2	2	2	3	2	2	1	2	3	2.2
Mean Overall Score									11.7/5 =2.34		
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: K. Vijayalakshmi

Semester	Course Code	Course Cotogory	Hours/	Credita	Marks for Evaluation			
		Course Calegory	Week	Credits	CIA	ESE	Total	
IV	23UMB4AC8P	Allied - VIII	3	2	20	80	100	

**Course Title** 

#### SOIL AND AGRICULTURAL MICROBIOLOGY - PRACTICAL

SYLLABUS					
S. No	Contents	Hours			
1.	Determination of soil pH.				
2.	Isolation of microorganisms from Rhizosphere soil.	1			
3.	Isolation of microorganisms from Phyllosphere.	1			
4.	Isolation and testing of antagonistic microorganisms from soil.	1			
5.	Isolation and culturing of <i>Rhizobium</i> from root nodules.	1			
6.	Isolation of cellulase producing microbes from soil.	45			
7.	Isolation and staining of AM fungi colonization in plant root.	1			
8.	Isolation of phosphate solubilizing bacteria.	1			
9.	Isolation of potassium solubilizing bacteria.	1			
10.	Demonstration of the plant diseases: a) Bacterial blight of paddy b) Citrus cancer c) Red rot of sugar cane d)Powdery mildew of cucurbits.				

#### **Text Book(s):**

1. Hanuman Prasad Pandey and Rajendra Krishna Pathak- A Practical Manual on Techniques of Agricultural Microbiology, Scripown Publications, 2021.

- James G. Cappucino and Natalie Sherman. Microbiology A laboratory manual. 5<sup>th</sup>Edition, The Benjamin publishing company. New York, 2016
- 3. K.R. Aneja. Experiments in Microbiology, Plant pathology and Biochemistry. 4<sup>th</sup> Edition, New age International publishers, India, 2003.

#### **Reference Book(s):**

1.Dhruti Amin, Natarajan Amaresan, Prittesh Patel-Practical Handbook on Agricultural Microbiology, Springer US Publishers, 2021.

- 2. Bharti Arora, D.R. Arora, Practical Microbiology, CBS Publishers and Distributors, 2020.
- 3. R.C. Dubey, and D.K. Maheswari. Practical Microbiology. S Chand Publishing, 2012.

#### Web Resource(s):

- 1. https://www.ncbi.nlm.nih.gov/pmc/articles
- 2. https://www.biotechnologynotes.com/soil/isolation-of-azotobacter-species-from-soil-
- 3. https://www.aloki.hu/pdf/0602\_101109.pdf

	Course Outcomes						
Upon suc	cessful completion of this course, the student will be able to:						
CO No.	CO Statement	Cognitive Level (K-Level)					
CO1	Identify the microorganisms from rhizosphere and phyllosphere.	K1					
CO2	Examine the microorganisms from soil.	K2					
CO3	Report the cellulase producing microorganism from soil.	K3					
CO4	Focus the phosphate and potassium solubilizers.	K4					
CO5	Conclude the plant diseases caused by various microorganisms and their control measures.	К5					

Course	Course Programme Outcomes (POs)				Progra	Mean Score of					
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	3	2	2	2	3	2	2	2	2	2	2.2
CO2	3	2	3	2	2	2	2	1	2	2	2.1
CO3	3	2	2	3	1	3	2	2	3	2	2.3
CO4	2	3	2	2	2	2	3	2	1	2	2.1
CO5	3	2	2	2	3	2	2	1	2	3	2.2
Mean Overall Score										10.9/5= 2.18	
	Correlation										Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

### Course Coordinator: K. Vijayalakshmi

Somostor	Course Code	Course Cotogory	Hours/	Crodite	Marks for Evaluation			
Semester	Course Coue	Course Category	Week	Creuits	CIA	ESE	Total	
IV	23UMB4GE2	Generic Elective - II	2	2	-	100	100	

#### Course Title DAIRY MICROBIOLOGY

SYLLABUS						
Unit	Contents	Hours				
I	<b>Introduction to Dairy Microbiology</b> : Definition, Concept of dairy microbiology. Role of Microbes in dairy industry. Significance of dairy products and their Health benefits. Milk Hygiene and production-clean milk management, animal management, Milking management, *hygiene of milking utensils and environment*.	6				
II	<b>Microbiology of Milk</b> : Composition of milk -sources of contamination. Biochemical changes of milk- souring, *gassy fermentation*, proteolysis, lipolysis, ropiness, discolouration and abnormal flavour. Microbiological changes in milk during production, processing and mastitis milk and significance. Preservation of milk and milk products.	6				
ш	<b>Starter Culture:</b> Definition, history, characterization of dairy of starter organisms and role of starter culture in dairy industries. Starter types- single, mixed and multiple strain starter culture. Preparation of starter culture-commercial, concentrated and *super concentrated*.	6				
IV	<b>Dairy Processing:</b> Milk Processing –Storage, Separating, Homogenizing, Pasteurizing/heat treatment, Filling. Microbiological process and therapeutic values of fermented milk and milk products- *dahi*, lassi, yoghurt, acidophilus milk, butter milk, cream and chesses. Health benefits and regulation of probiotics .	6				
V	<b>Microbiological Methods:</b> Qualitative and quantitative methods of milk testing. Methylene Blue Reduction Test (MBRT) and Resazurin Reduction Test (RRT). Standard Plate Count, *Coliform count*, Psychrophiles, Thermophilic count, Direct microscopic count and efficiency of pasteurization (phosphatase test).	6				

\*....\* Self Study

#### Text Book(s):

1. W.C. Frazier and D.C. West off. Food microbiology, TATA McGraw Hill Publishing Company Ltd. New Delhi, 1988.

M.R. Adams and M.O. Moss. Food Microbiology, The Royal Society of Chemistry, Cambridge.
 Biotechnology by R.C. Dubey, S Chand publishers 1995.

#### **Reference Book(s):**

1. J.M. Jay, M.J. Loessner and D.A. Golden. Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India 2005.

2. R.K. Robinson, Dairy Microbiology Handbook - The Microbiology of Milk and Milk Products. 3rd ed. Wiley-Interscience, New York 2002.

 G.W. Gould. New Methods of Food Preservation. Blackie Academic and Professional, London.
 J.M. Jay, M.J. Loessner and D.A. Golden. (2005). Modern Food Microbiology.7th edition, CBS Publishers and Distributors, Delhi, India 1995.

#### Web Resource(s):

- 1. https://microbiologynotes.org/milk-composition-processing-pasteurization-pathogens-andspoilage/
- 2. <u>http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=101481</u>
- 3. <u>https://www.onlinebiologynotes.com/microbial-spoilage-of-milk-and-milk-products/</u>

	Course Outcomes								
Upon suc	Upon successful completion of this course, the student will be able to:								
CO No.	CO Statement	Cognitive Level (K-Level)							
CO1	Describe the significance of dairy Microbiology.	K1							
CO2	Explain the biochemical changes in the dairy products.	K2							
CO3	Examine the characterization and role of starter culture in dairy products.	К3							
CO4	Analyse the microbiological process and therapeutic values of dairy products.	K4							
CO5	Conclude the various test used for detecting microorganisms in dairy products.	K5							

#### **Relationship Matrix:**

Course Programme Outcomes (POs)				Progra	Mean						
Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Score of COs
CO1	3	1	3	1	1	3	1	3	1	3	2.0
CO2	3	2	2	2	3	1	2	2	2	1	2.0
CO3	3	1	1	2	1	1	2	3	2	2	1.8
CO4	2	2	3	1	2	2	1	2	2	3	2.0
CO5	1	1	2	1	1	3	3	1	3	1	1.7
								Me	an Overa	all Score	9.5/5=1.9
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: A. Swedha

Semester	Course Code	Course Catagory	Hours/	Cradita	Marks for Evaluation		
	Course Coue	Course Category	Week	Creans	CIA	ESE	Total
V	23UMB5CC9	Core - IX	6	6	25	75	100

Course Title MICROBIAL GENETICS

	SYLLABUS	
Unit	Contents	Hours
Ι	<b>Introduction to Genetics:</b> Microbial genetics vs. Mendelian genetics. 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 ( <i>E. coli</i> ) and viruses.	18
II	<b>DNA Replication:</b> Semi conservative model- Meselson and Stahl experiment, Cairns Autoradiography Experiment and Taylor's Experiment. Replication of circular DNA molecule- rolling circle mechanism, $\theta$ mode of replication. Linear mode of replication. *Enzymes involved in DNA replication*. Replication of RNA – Reverse transcriptase.	18
III	<b>Mutations:</b> Occurrence of mutation – spontaneous and induced mutation. Origin of spontaneous Mutations -Luria and Delbruck's classic experiments –Fluctuation test – Newcombe experiment. Types and causes of mutation- Physical, chemical and Biological. Detection and practical application of mutation.	18
IV	<b>DNA Repair Mechanism:</b> 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	18
V	<b>Genetic Recombination in Bacteria:</b> Horizontal and vertical gene transfer. Bacterial Conjugation: Discovery, F+ v/s F-, Hfr+ v/s F. Bacterial Transformation: discovery of transformation, competence, DNA uptake, molecular mechanism of transformation, mapping by transformation. Bacterial Transduction- *DNA transfer by phages*, Specialized and generalized transduction. co- transduction and linkage, mapping by co-transduction.	18
VI	<b>Current Trends (For CIA only)</b> – Therapeutics applications of Synthetic lethality interfor cancer treatment.	ractions

\*.....\* Self Study

#### **Text Book(s):**

1. E.J. Gardner, M.J. Simmons and D.P. Snustad. Principles of Genetics. John Wiley & sons,1991. **2.** David Frifelder. Microbial Genetics. Narosa publishing house, New Delhi,1990.

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

4. W. Jeremy Dale. Molecular Genetics of Bacteria (5<sup>th</sup> edition). John Wiley and sons, NewYork, 2008.
5. R.S. Old and S.B. Primrose, Principles of Gene Manipulation. 4<sup>th</sup> Ed., Blackwell Scientific Publications, London, 1989.

#### **Reference Book(s):**

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

2.H. Lodish, D. Baltimore, A. Berk, S.L. Zipsury, P. Matsudaira and J. Darnell, Molecular Cell Biology. Scientific American Books, 2000.

3.S.R. Maloy, R. Stanley, J.E. Cronan and D. Freifelder, Microbial Genetics. Jones and Bartlett Publishers, 2004.

4. W. Monroe and Stickberger, Genetics (3rd edition). Prentice/Hall of India Pvt. Ltd., NewDelhi, 2003.5. Veer balarastogi, Fundamentals of molecular biology, Ane's student edition, India, 2008.

#### Web Resource(s):

1.<u>https://bio.libretexts.org/Bookshelves/Genetics/Online\_Open\_Genetics\_(Nickle\_and\_Barrette-Ng)/01%3A\_Overview\_DNA\_and\_Genes/1.02%3A\_DNA\_is\_the\_Genetic\_Material</u>

2.<u>https://www.khanacademy.org/science/ap-biology/gene-expression-andregulation/replication/a/</u> molecular-mechanism-of-dna-replication

3. <u>https://byjus.com/biology/mutation-genetic-change/</u>

4. https://www.cliffsnotes.com/study-guides/biology/micro

recombinations

Course Outcomes								
Upon successful completion of this course, the student will be able to:								
CO No.	CO Statement	Cognitive Level (K-Level)						
C01	Observe the historical inventions and the basic concept of microbial genetics.	K1						
CO2	Explain the methods of DNA replication.	K2						
CO3	Illustrate the occurrence types and causes of mutation.	K3						
CO4	Analyse the DNA repair mechanism.	K4						
CO5	Summarize the mechanism of genetic recombination in bacteria.	K5						
Relationship Matrix:								

Course Outcomes	P	rogramn	ne Outco	omes (PC	s)	Progra	Mean Score of				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
C01	3	1	3	2	2	3	2	3	1	3	2.3
CO2	3	3	1	2	3	3	3	1	3	2	2.4
CO3	2	3	3	1	3	3	1	3	2	2	2.3
CO4	1	2	3	2	2	3	2	2	3	1	2.1
CO5	1	1	1	2	3	3	1	2	3	3	2.0
Mean Overall Score								ll Score	11.1/5= 2.22		
Correlation									Medium		

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

#### Course Coordinator: Dr. M. Mohamed Mahroop Raja

Semester	Course Code	Course Category	Hours/	Cradita	Marks for Evaluation			
			Week	Creans	CIA	ESE	Total	
V	23UMB5CC10	Core - X	5	5	25	75	100	
	•							

#### Course Title MOLECULAR BIOLOGY

	SYLLABUS	
Unit	Contents	Hours
I	<b>Introduction to Nucleic acid:</b> Chemical structure of DNA and Base composition, biologically important nuleotides, Watson-Crick model, Supercoiled DNA, *salient features of double helix*, hydrolysis of nucleic acids, physical and chemical properties of DNA and types A, B and Z form of DNA. RNA – properties, structure, function and types- tRNA, mRNA and rRNA. Stability of nucleic acid structure.	15
II	<b>Transcription in Prokaryotes and Eukaryotes:</b> RNA polymerases and *general transcription factors*, Transcription signals, promoters- concept and strength of promoter, stages of transcription: initiation, elongation, backtrack RNA and termination: rho dependent and independent. Glimpse of alternative sigma factors and inhibitors of transcription.	15
III	<b>Genetic code:</b> Properties of Genetic code, *codons and anticodons*. Wobble hypothesis. Protein synthesis- the stages of protein synthesis- the process of translation in prokaryotes factors involved in translation- the triplet nature of genetic code- an overview of comparisons with eukaryotic translation.	15
IV	<b>Operon concept</b> : Lac and Trp operon (induction and repression) structure of operon- role of cyclic AMP in catabolite repression, attenuation control – promoters – activators, repressors and role of Lac and Trp operons.	15
V	<b>Transposable Elements:</b> IS elements and transposons – property, types and mechanism. Composite and noncomposite transposons. *transposable elements in plasmids* and phage $\mu$ . Mechanism of transposition – replicative and conservative transposition.	15
VI	<b>Current Trends (For CIA only)</b> – A new technology used in different gene expression patt between different cells.	erns

\*.....\* Self Study

#### **Text Book(s):**

1. V.B. Rastogi, Fundamentals of Molecular Biology, Ane Books India, 2008.

2. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Robersts and P. Walter, Molecular Biology of the Cell, 6<sup>th</sup> Ed. Garland Publishing, Inc., USA, 2008.

3. J.D.Watson, N.H. Hopkins, J.W. Roberts, J.A. Steitz and A.M. Weiner, Molecular Biology of the Gene, 4<sup>th</sup>Ed. Pearson Education Inc., NewYork,2004.

4. A.J.F. Griffiths, R.C. Lewontin, W.M. Gelbart, and J.H. Miller, Modern Genetic Analysis. 2<sup>nd</sup> Ed, W.H. Freeman and Company, NewYork, 2002.

#### **Reference Book(s):**

1. G.M. Malacinski, Freifelder's Essentials of Molecular biology, 4<sup>th</sup>Ed. Jones & Barlett learning, New Delhi,2015.

2.H. Lodish, A. Berk, S.L. Zipursky, P. Matsudara, D. Baltimore and J. Darnell, Molecular Cell Biology, 8<sup>th</sup>Ed. W.H.Freeman and Company, New York, 2016.

3. R.S. Larry, J.E. Peters, T.M. Henkin, and W. Champness, Molecular Genetics of Bacteria, 4<sup>th</sup> Ed. ASM Press, USA,2013.

Web Resource(s):

1. https://www.britannica.com/science/nucleic-acid/Deoxyribonucleic-acid-DNA

2. https://opentextbc.ca/biology/chapter/9-3-transcription/

3. https://courses.lumenlearning.com/wm-biology1/chapter/prokaryotic-translation/

4. https://microbenotes.com/transposable-elements/

Course Outcomes							
Upon suc	Upon successful completion of this course, the student will be able to:						
CO No.	Cognitive Level (K-Level)						
CO1	Observe the knowledge on structure and organization of nucleic acids.	K1					
CO2	Explain the process of transcription in prokaryotes and eukaryotes.	K2					
CO3	Examine the nature of genetic code and protein synthesis.	K3					
CO4	Analyse the concept of operon in gene regulation systems.	K4					
CO5	Summarize the types and mechanism of transposition.	K5					
	Relationshin Matrix	•					

Course	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
C01	2	3	2	2	2	2	3	3	2	1	2.2
CO2	3	3	2	2	2	3	2	2	3	1	2.2
CO3	2	3	2	2	2	3	2	3	2	1	2.2
CO4	3	3	2	3	1	3	2	3	2	2	2.4
CO5	3	3	2	2	2	3	3	2	1	1	2.2
Mean Overall Score									11.2/5= 2.24		
	Correlation										Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Mohamed Mahroop Raja

Semester	Course Code	Course Cotogowy	Hours/	Cradita	Marks for Evaluation			
	Course Code	Course Category	Week	Credits	CIA	ESE	Total	
V	23UMB5CC11	Core - XI	5	5	25	75	100	
	•							

**Course Title** 

ENZYME TECHNOLOGY

SYLLABUS						
Unit	Contents	Hours				
I	<b>Introduction to Enzymes:</b> Historical perspectives, General characteristics, Nomenclature and classification. Holoenzyme, apoenzyme, cofactors, coenzymes, prosthetic groups, *metalloenzymes*, enzyme activity units (I.U and Katal) and specific activity. Enzymes as biocatalysts - catalytic power, activation energy, substrate specificity and active site. Coupled kinetic enzyme assay and purity of Enzymes	15				
II	<b>Mechanism of Enzymes Action</b> : Theories of mechanisms of enzyme action- Enzyme specificity- Active site- Study of Mechanism of enzyme reaction. Pathway of enzyme catalyzed reactions. Enzyme Kinetics. Mechanism of action of lysozyme, chymotrypsin and ribonuclease. *Enzyme inhibition and regulation*	15				
III	<b>Enzyme kinetics</b> : 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. Lineweaver - Burke plot, Haldane Briggs relationship	15				
IV	<b>Enzyme Preparation and Use:</b> Sources of enzymes, Microbial production of enzymes, Media for enzyme production, Preparation of enzymes- *Centrifugation, filtration*, Cell breakage and Chromatography. Safety and regulatory aspects of enzyme uses. The use of enzyme in analysis- Calorimetric and Optical biosensors.	15				
V	<b>Application of enzymes</b> : Industrial uses of enzymes- production of glucose from starch, cellulose and dextrans. *Use of lactase in dairy industry*, production of glucose fructose syrup from sucrose, use of proteases in food, leather and detergent industry. Diagnostic and therapeutic enzymes. Enzyme engineering.	15				
VI	Current Trends (For CIA only) – Therapeutic enzymes: Discoveries, production and appli	ications.				
	**Self Study					

**Text Book(s):** 

1. S. Shanmugam and T. Sathiskumar, Enzyme Technology, International Pvt Ltd, 2009.

2. L.M. Prescott, J.P. Harley, D.A. Klein, Microbiology, WCB Mc Graw Hill, 2008.

3. S.M. Bhatt, Enzymology and Enzyme Technology. S. Chand Publication, 2011.

4. Trevor Palmer and Philip Bonner, Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2<sup>nd</sup> Edition, East-west Press Pvt Ltd, India, 2008.

5. W. Aehle W, Enzymes in Industry: Production and Applications, John Wiley & Sons Inc, 2007.

#### **Reference Book(s):**

- 1. Athel Cornish Bowden, Principles of Enzyme Kinetics, Portland press, 2004.
- 2. M.F. Chaplin and C. Bucke, Enzyme Technology, Cambridge University press, 2007
- 3. Malcolm Dixon and Edwin Clifford Webb. Enzymes. 3rd Edition Academic Press, New York,2008

#### Web Resource(s):

1.https://chem.libretexts.org/Bookshelves/Biological\_Chemistry/Supplemental\_Modules\_(Biological\_Chemistry)/Enzymes/Enzymatic\_Kinetics/Enzyme\_Assays

2. https://www.inf.ed.ac.uk/teaching/courses/csb/CSB\_lecture\_enzyme\_kinetics.pdf

3. https://www.easybiologyclass.com/enzyme-cell-immobilization-techniques/

	Course Outcomes						
Upon suc	cessful completion of this course, the student will be able to:						
CO No.	CO Statement	Cognitive Level (K-Level)					
CO1	Describe the nomenclature, classification, types and purification of enzymes.	K1					
CO2	Explain the mechanism of enzyme action.	K2					
CO3	Examine the importance enzyme kinetics and mediated reactions.	К3					
CO4	Analyse the source, preparation, production and uses of enzymes.	K4					
CO5	Summarize the application of industrial enzymes.	K5					

Course	Programme Outcomes (POs)					Progr	Mean Score of				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	2	2	2	3	3	2	3	2	1	3	2.3
CO2	1	3	2	2	2	2	2	3	2	2	2.1
CO3	2	2	3	1	2	3	3	1	2	2	2.1
CO4	2	2	2	3	1	3	2	2	3	2	2.2
CO5	3	1	2	3	3	3	2	2	1	3	2.3
Mean Overall Score									11/5= 2.2		
Correlation										Medium	

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Mohamed Mahroop Raja

Semester	Course Code	Course Cotogowy	Hours/	Cradits	Marks for Evaluation			
	Course Coue	Course Category	Week	Creuits	CIA	ESE	Total	
V	23UMB5CC12P	Core - XII	5	5	20	80	100	

**Course Title** 

# MICROBIAL GENETICS, MOLECULAR BIOLOGY AND ENZYME TECHNOLOGY- PRACTICAL

SYLLABUS							
Unit	Contents	Hours					
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.	Screening of cellulase enzyme producing organisms.						
10.	Alkaline protease Enzyme assay						
11.	Isolation of amylase enzyme.						

### Text Book(s):

1. K.R Aneja , Laboratory manual of microbiology and biotechnology, 2nd edition. Scientific International Pvt Ltd, 2018.

2. J. Sambrook, E.F,Fritsch, And T. Maniatis . Molecular cloning- A Laboratory Manual 2nd edition. Cold Spring Harbor Laboratory press, USA, 2001.

3.G.James Cappuccino, Natalie Sherman. Microbiology- A laboratory manual. 6th edition.2001

4. J. Jayaraman. Laboratory Manual in Biochemistry 2nd edition. Newage publication. 2011.

#### **Reference Book(s):**

1. Nupur Mathur. Industrial Microbiology a Laboratory Manual. Aaviskar publishers, 2007.

2. Richard H.Baltz, Arnold L.Demain, JulianE.Davies. Manual of Industrial Microbiology and Biotechnology. 3rd edition. 2010.

3. <u>Amita Jain, Jyotsna Agarwal</u> and <u>Vimala Venkatesh</u>. Microbiology Practical Manual, 2018.

4. John Walker, Keith Wilson. Principles and Techniques of Biochemistry and Molecular Biology 7th edition Cambridge University Press.2010.

### Web Resource(s):

1.<u>https://cevre.erciyes.edu.tr/upload/M6Z30UUmicrobiology-laboratory-manual.pdf</u>

2. <u>http://site.iugaza.edu.ps/mwhindi/files/Laboratory\_Manual\_And\_Workbook\_In\_Microbiology.pdf</u>

3.<u>https://www.teachmint.com/tfile/studymaterial/bsc/microbiology/isemestermicrobiologylabmanual/9016452f-c940-43ec-8815-2afb78a04f9b</u>

Course Outcomes							
Upon suc	Upon successful completion of this course, the student will be able to:						
CO No.	CO No. CO Statement						
CO1	Extract the Genomic DNA and Plasmid DNA.	K1					
CO2	Determine the DNA by DPA method.	K2					
CO3	Examine the restriction digestion of DNA molecules.	К3					
CO4	Analyse the differentiation of protoplast and spheroplast.	K4					
CO5	Evaluate the application of enzymes used in industries.	K5					

Course	Pro	ogramm	ne Outco	omes (P	Os)	Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
C01	3	1	3	3	2	3	1	3	1	1	2.1
CO2	2	3	1	3	3	2	1	1	2	2	2.0
CO3	1	1	2	2	3	3	2	2	1	1	1.8
CO4	1	2	3	1	2	2	1	1	1	3	1.7
CO5	2	3	2	3	2	2	1	1	2	1	1.9
								Me	an Overa	Il Score	9.5/5=1.9
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

### Course Coordinator: Dr. H. Vajiha Banu

Somester	Course Code	Course Category Hours/ Credits Marks for Evalu						
Semester	Course Coue	Course Category	Week	Creatis	CIA	ESE	Total	
V	23UMB5DE1A	Discipline Specific Elective- I	5	4	25	75	100	
Course Ti	tle INTROD	UCTION TO VIROLOGY						
		SYLLABUS						
Unit		Contents					Hours	
I Introduction: Definition, History. *General properties of viruses* –Structure of virus- naked icosahedral, naked helical, enveloped icosahedral, helical and complex replication of viruses- Concept of Viroid, Virions, Virusoids, Prions and Satellite RNAs.								
п	<b>Viral Classification and Nomenclature:</b> Baltimore system of classification- Bacterial <b>II</b> Viruses – Structure of bacteriophage, The Lytic life cycle (T-Even coliphages) – Lysogenic life cycle ( <i>Escherchia coli</i> , *Lambda phage*). Mycophages and Phycophages							
ш	Plant Viruses: General characteristics and multiplication of Plant Viruses : TMV, Bunchy top of banana, *Potato leaf roll virus*, Turnip mosaic virus, Tomato Spotted Wilt Virus – Double stranded DNA virus							
IV	Animal Viruses: General characteristics and multiplication of animal Viruses - Adenoviruses, Herpes viruses, Poxviruses, *Rhabdo viruses*, Retrovirus and Rinderpest virus. Antiviral drugs.1							
V	Cultivation of viruses: Tissue cultures, embryonated cultures. Purification assay of virus- differential and density gradient centrifugation, precipitation of virus. Separation and characterization of viral components and *quantification of viruses*. Laboratory diagnosis of viruses.       15							

#### Text Book(s):

- 1. R. Ananthanarayan and C.K.J. Paniker. Text book of Microbiology, Orient Longman, 11th Edition, 2020.
- 2. Baijayanthi Mala Mishra. Textbook of Medical Virology, CBS Publisher and Distributor Pvt. Limited, 2018.
- 3. R.C. Dubey and D.K. Maheshwari. A Text Book of Microbiology. S.Chand & Co, 2018.
- 4. V.N. Tiwari. A Text Book of Virology, Student Edition, 2012.

#### **Reference Book(s):**

- 1. A. Maharajan. Virology, Astral International Pvt. Ltd, 2023.
- 2. Baijayantimala Mishra. Textbook of Medical Virology, CBS Publishers Pvt Ltd, India, 2022.
- 3. J.H. Martinez and C. David Camerini, Bloom. Basic Virology, 4th Edition, Wiley-Blackwell, 2021.

#### Web Resource(s):

- 1.https://www.uobabylon.edu.iq/eprints/paper\_11\_17551\_666.pdf
- 2.https://www.britannica.com/science/lambda-phage
- 3.https://www.agric.wa.gov.au/potato-leafroll-virus-potato-crops
- 4.https://www.ndvsu.org/images/StudyMaterials/Micro/Rhabdoviridae.pdf
- 5.https://www.labome.com/method/Virus-Identification-and-Quantification.html

	Course Outcomes								
Upon suc	Upon successful completion of this course, the student will be able to:								
CO No.	CO No. CO Statement								
CO1	Describe the structure of viruses.	K1							
CO2	Explain the viral classification and nomenclature.	K2							
CO3	Articulate the characteristics and multiplication of various plant viruses.	K3							
CO4	Prioritize the characteristics and multiplication of various animal viruses.	K4							
CO5	Analyze the cultivation and purification of viruses.	K5							

Course Outcomes	Pro	gramme	Outcome	es (POs)		Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	1	1	2	2	2	2	2	3	1	1	1.7
CO2	2	3	2	3	2	2	3	3	3	2	2.5
CO3	3	2	1	2	1	1	2	3	3	1	1.9
CO4	3	2	2	2	2	3	2	3	3	1	2.3
CO5	2	2	2	1	2	3	1	3	2	2	2.0
Mean Overall Score									10.4/5= 2.08		
									Corr	elation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

### Course Coordinator: K. Vijayalakshmi

			Hours		Marks for Evaluation			
Semester	Course Code	ourse Code Course Category		Credits	CIA	ESE	Total	
V	23UMB5DE1B	Discipline Specific Elective- II	5	4	25	75	100	

#### Course Title TEXTILE MICROBIOLOGY

	SILLABUS	
Unit	Contents	Hours
Ι	<b>Textile Industry</b> : 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*	15
п	<b>Natural Fibres:</b> 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.	15
ш	<b>Microbial biodegradation of natural and synthetic fibers:</b> Process and microbes involved in the biodegradation of Wool, Cotton, Silk and Polyester. <b>Textile Bio Deterioration</b> -Types and factors affecting bio deterioration of Wool, Silk and Cellulostic textiles and *Prevention of bio deterioration*.	15
IV	<b>Biomaterials for Health Care Textiles</b> : Health care textiles, dressing types and usage, antimicrobial textiles based on Ecofriendly natural products. Enzymes in medical applications-*chitosan*.Role of Microbes in textile industry. Nanotechnology Based Advanced Medical Textiles and Bio textiles for Healthcare.	15
V	<b>Textile and Fabric Antimicrobial Testing:</b> Antimicrobial assessment on textile materials (AATCC 30), Assessment of Antimicrobial Finishes on textile materials (AATCC100), Parallel streak method (AATCC 147), Microbial Enumeration test (USP 61), *Test for specified microorganisms (USP 62)*.	15

#### Text Book(s):

1.C.Vigneswaran., M. Ananthasubramanian and P. Kandhavadivu, Bioprocessing of Textiles. Wood head Publishing India PVt.Ltd. 2014.

2.Prashansa Sharma, Devsuni Singh, Suman Pant, Vivek Dave. Nanotechnology Based Advanced Medical Textiles and Bio textiles for Healthcare. CRC Press. 2024.

3.M. Ibrahim and H. Mondal. Antimicrobial textiles from natural resources. Wood head Publishing. 2021

#### **Reference Book(s):**

1. Premony Ghosh, Fibre science and Technology, Tata McGraw- Hill Publishing company limited, 2010 2. Bipin Kumar, Textiles for Functional Applications, First Edition, Intech Open Publications, 2021

2. Bipin Kumar, Textiles for Functional Applications, First Edition, Intech Open Publications, 2021

3. M. Jiri, A. Periyasamy and P. Venkataraman. Textiles and Their Use in Microbial Protection. CRC Press. 2021.

#### Web Resource(s):

1. https://www.sciencedirect.com/topics/engineering/antimicrobial-textile

2. https://textilelearner.net/physical-and-chemical-properties-of-wool-fiber/

3. https://www.sciencedirect.com/topics/materials-science/microbial-biodegradation

4. https://4spepublications.onlinelibrary.wiley.com/doi/full/10.1002/pls2.10135

5. https://annalsmicrobiology.biomedcentral.com/articles/10.1007/s13213-010-0163-8

	Course Outcomes								
Upon suc	Upon successful completion of this course, the student will be able to:								
CO No.	CO Statement	Cognitive Level (K-Level)							
CO1	Record the microorganisms used in textile industry	K1							
CO2	Describe the natural fiber types and processing on textile industry	K2							
CO3	Examine the biodegradation of natural and synthetic fibers.	К3							
CO4	Apply the biomaterials in the healthcare textile.	K4							
CO5	Summarize the textile and fabric antimicrobial testing.	K5							

Course	P	rogran	nme Ou	itcomes	(POs)	Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	3	2	3	2	3	3	3	2	3	1	2.5
CO2	3	2	3	2	2	3	2	2	1	2	2.2
CO3	3	2	2	3	1	3	2	2	3	2	2.3
CO4	3	3	2	2	2	2	3	2	3	2	2.5
CO5	3	2	2	2	3	3	2	1	2	3	2.2
Mean Overall Score								11.7/5= 2.34			
Correlation									Medium		

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: K. Vijayalakshmi

G	Course Code Course Category Hours/ Credits Marks for Ev									
Semeste	course Code	Course Category	Week	Credits	CIA	ESE	Total			
v	23UMB5SE1	23UMB5SE1Skill Enhancement Course - I21-100								
Course	ourse Title BIOTECHNIOUES									
	·	SYLLABUS	5							
Unit		Contents					Hours			
I	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).         Microscopy         Scanning         Scanning									
II	II 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									
ш	<b>Chromatography:</b> *Thin layer Chro Chromatography, High Performance	Basic Principles and App matography*, Gel filtration Affinity Chromatography, C Liquid Chromatography.	lications- chroma Gas Liqu	Paper cl tography, iid Chrom	iromatog Ion exc atograph	graphy, change iy and	6			
IV	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).       Resonance (NMR).									
V	Electrophoresis: Basic Principles and Applications -native polyacrylamide gel         electrophoresis, Agarose gel electrophoresis, SDS- polyacrylamide gel         electrophoresis, *2D gel electrophoresis*, Paper electrophoresis -         Immunoelectrophoresis- Vertical and slab gel - Horizontal and tube gel types.									
	** Self Study									

#### **Text Book(s):**

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

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

3. D.L. Nelson and Cox MM, Lehninger, Principles of Biochemistry, 5th Ed., W.H. Freemanand Company,2008.

4. M. Joanne Willey, M. Linda , Sherwood, J. Christopher, Woolverton, Prescott's, Microbiology,8th Edition, Mc Graw. Hill International Edition, 2011.

#### **Reference Book(s):**

1. A. Nigam and A. Ayyagari , Lab Manual in Biochemistry, Immunology and Biotechnology, Tata McGraw Hill, 2007.

2.M.H. Fulekar and Bhawana Paney, Bioinstrumentation, I K International Publishing House Pvt. Ltd, 2013.

3. K. Wilson and J.Walker, Principles and Techniques of Biochemistry and MolecularBiology,7th Ed., Cambridge University Press, 2010.

4. SarojDuaand Neera Garg, Biochemical Methods of Analysis: Theory and Applications, 1st Edition. Alpha Science Intl Ltd, 2013.

#### Web Resource(s):

- 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
- 4. https://www.britannica.com/technology/microscope

	Course Outcomes									
Upon suc	cessful completion of this course, the student will be able to:									
CO No.	CO No. CO Statement									
CO1	Describe the principle and applications of microscope.	K1								
CO2	Examine the various types of centrifugations.	K2								
CO3	Classify the chromatographic techniques.	К3								
CO4	Explain the working mechanism of spectrophotometry	K4								
CO5	Summarize the knowledge of different electrophoresis techniques.	K5								

Course	Pro	ogramm	e Outco	omes (P	Os)	Prog	Mean Score				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	of COs
CO1	3	1	3	2	2	3	2	3	1	3	2.3
CO2	3	3	1	2	3	3	3	1	3	2	2.4
CO3	2	3	3	1	3	3	1	3	2	2	2.3
CO4	1	2	3	2	2	3	2	2	3	1	2.1
CO5	1	1	1	2	3	3	1	2	3	3	2.0
Mean Overall Score										11.1/5= 2.22	
	Correlation										

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

### Course Coordinator: Ms. S. Shalini

Somestar	Course Code	Course Cotogowy	Hours/	Credita	Marks for Evaluation			
Semester	Course Code	Course Category	Week	Creatis	CIA	ESE	Total	
V	23UMB5SE2	Skill Enhancement Course-II	2	1	-	100	100	

**Course Title** 

#### **BIOINOCULANT TECHNOLOGY**

	SYLLABUS	
Unit	Contents	Hours
Ι	<b>Introduction to Bioinoculants:</b> History and Scope of Bio inoculant technology, concepts– types of bio inoculants – Bacterial, Fungal, Algal and Actinorhizal. Nitrogen fixation – Biological nitrogen fixation- *Importance of biofertilizers*.	6
п	<b>Bacterial and Actinomycete Bioinoculants:</b> Isolation, Identification and large-scale production and field application of <i>Rhizobium</i> , <i>Azospirillum</i> , <i>Azotobacter</i> and <i>Glucanoacetobacter</i> . Phosphate solubilizers - <i>Bacillus</i> and * <i>Pseudomonas</i> * - Phosphate solubilization and mobilizing mechanism. Actinomycete inoculants - Frankia, Streptomyces, Nocardia, Micromonospora	6
ш	<b>Fungal Bioinoculants:</b> 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.	6
IV	<b>Algal Bioinoculants:</b> Isolation, Identification and large-scale production and field application of <i>Anabaena</i> , * <i>Azolla</i> *, <i>Cylindrospermum</i> , <i>Gloeocapsa</i> , <i>Lyngbya</i> , <i>Nostoc</i> , <i>Plectonema</i> and <i>Tolypothrix</i> .Formation of Fogg's medium - Mass cultivation of Azolla - Cyanobacterial biofertilizers - Symbiotic association of Cyanobacteria - Field application of Cyanobacterial inoculants.	6
v	Application and Quality control of inoculants: Method of application of bioinoculants – problem and constrains in production technology Quality control of different formulation BIS – standards – Economics of microbial inoculant production –marketing of bioinoculants.	6

#### Text Book(s):

- 1. Edgar Porter. Advances in Biofertilizer Technology. Ocean Press.2022.
- 2. S. Kannaiyan, K. Kumar and K. Govindarajan. Biofertilizers Technology. Scientific Publishers. 2010.
- 3. G. Rangaswami and D.J. Bhagyaraj, 2001. Agricultural Microbiology. 2<sup>nd</sup> Edition. Prentice Hall, New Delhi.
- 4. H.A.Modi. Microbial Inoculants and Biofertilizer Technology. Jaipur publication, 2012.

#### **Reference Book(s):**

- 1. N.Ramanathan, Biofertilizers Technology, Astral International Pvt. Ltd, 2023.
- 2. H.C.Lakshman. Bioinoculants for Integrated Plant Growth. MD Publications, 2010.
- 3. Wilson Muller. Biofertilizer Technology, White Press Academic, 2023.

#### Web Resource(s):

- 1. https://www.uobabylon.edu.iq/eprints/paper\_11\_17551\_666.pdf
- 2. https://www.britannica.com/science/lambda-phage
- 3. https://www.agric.wa.gov.au/potato-leafroll-virus-potato-crops
- 4. https://www.ndvsu.org/images/StudyMaterials/Micro/Rhabdoviridae.pdf
- 5. https://www.labome.com/method/Virus-Identification-and-Quantification.html

	Course Outcomes									
Upon suc	Upon successful completion of this course, the student will be able to:									
CO No.	CO No. CO Statement									
CO1	Describe the concepts and types of bioinoculants	K1								
CO2	Explain the Bacterial and actinomycete bioinoculants	K2								
CO3	Articulate the fungal bioinoculants.	K3								
CO4	Prioritize the characteristics of algal bioinoculants	K4								
CO5	Assess the methods of application and quality control of inoculants	K5								

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
C01	1	1	2	2	2	2	2	3	1	1	1.7
CO2	2	3	2	3	2	2	3	3	3	2	2.5
CO3	3	2	1	2	1	1	2	3	3	1	1.9
CO4	3	2	2	2	2	3	2	3	3	1	2.3
CO5	2	2	2	1	2	3	1	3	2	2	2.0
Mean Overall Score										10.4/5= 2.08	
									Corre	lation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

### Course Coordinator: K. Vijayalakshmi

a i	ester Course Code Course Category Hours/ Credits Marks for Ev										
Semest	er Co	ourse Code	Course Category	Week	Credits	CIA	ESE	Total			
VI	230	UMB6CC13	Core - XIII	6	6	25	75	100			
Course	Title	ENVIRON	MENTAL MICROBIOLO	GY							
	SYLLABUS										
Unit			Contents					Hours			
I	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*										
п	I 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 - Physical and chemical methods. Novel contaminants in the Air										
III	Microl Eutrop artificia measur	<b>biology of v</b> hication- wat al- physical, o res*. Novel co	<b>vater:</b> Bacteriological analer purification – natural- chemical and filtration- *water *water * water	lysis of storage, ater borne	water- Movidation widation disease a	IPN Tec and sett and their	chnique- tlement- control	18			
IV	measures*. Novel contaminants in the Water.         Treatment of Waste: Classification of wastes. Waste treatment - Types and characterization of liquid and solid wastes. Treatment of liquid wastes - Primary, secondary (anaerobic and aerobic) - trickling, activated sludge, oxidation pond, oxidation ditch-tertiary and disinfection. Treatment of solid wastes - composting, vermiform composting silage pyrolysis and saccharifications							18			
V	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 biosensors for environmental monitoring.										
VI	Curren synthet	nt Trends (F tic consortia a	<b>for CIA only</b> ) – Engineerir nd ecosystems.	ng microł	bes for en	vironmen	ntal appli	cations,			

\*.....\* Self Study

#### **Text Book(s):**

- 1. R.M. Atlas and R. Bartha, Microbial Ecology Fundamentals and Application, 4<sup>th</sup> edition, LPE, Pearson Education. Inc, 2005.
- 2. M. Alexander, Microbial Ecology. John Wiley and Sons Inc, New York, 1971.
- 3. C.F. Forster, Biotechnology and Wastewater Treatment. Cambridge University Press. Cambridge, 1985.
- 4. Gareth M Evans, Judith C Furlong, Environmental Biotechnology-Theory and Application, John Wiley and sons Ltd. 2003.

#### **Reference Book(s):**

1. Christon J Hurst, 2002. Manual of Environmental Microbiology, 2nd edition. American Society for Microbiology, Washington.

2. Duncan Mara, Nigel Horen, 2003. The Handbook of water and wastewater Microbiology. Academic press-An imprint of Elsevier.

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

#### Web Resource(s):

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/

- 4. http://www6.zetatalk.com/docs/Soil/Principles\_Of\_Soil\_Microbiology\_Waksman \_1927.pdf
- 5. http://site.iugaza.edu.ps/tbashiti/files/2010/02/Environmental\_Microbiology.p df

	Course Outcomes									
Upon suc	Upon successful completion of this course, the student will be able to:									
CO No.	CO No. CO Statement									
CO1	Observe the vital role and application of microbes in various ecosystems.	K1								
CO2	Explain the airborne microorganism and air sampling techniques.	K2								
CO3	Illustrate the mechanism used in water purification techniques.	К3								
CO4	Analyse the working principles of sewage treatment.	K4								
CO5	Summarize the process of bioleaching and treatment of waste materials.	K5								

Course	Pro	ogramm	ne Outco	omes (P	Os)	Progr	Mean Score of				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	3	1	3	2	2	3	2	3	1	3	2.3
CO2	3	3	1	2	3	3	3	1	3	2	2.4
CO3	2	3	3	1	3	3	1	3	2	2	2.3
CO4	1	2	3	2	2	3	2	2	3	1	2.1
CO5	1	1	1	2	3	3	1	2	3	3	2.0
Mean Overall Score											11.1/5= 2.22
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

### Course Coordinator: Dr. N. Reehana

Semester	Course Code	Course Cotogory	Hours/	Credita	Marks for Evaluation			
	Course Coue	Course Category	Week	Creans	CIA	ESE	Total	
VI	23UMB6CC14	Core - XIV	6	6	25	75	100	

#### Course Title FOOD MICROBIOLOGY

	SYLLABUS	
Unit	Contents	Hours
I	<b>Microorganism in Food:</b> 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.	18
II	<b>Food Spoilage and Food Poisoning:</b> Spoilage of canned foods, cereals, fruits, vegetables, milk, 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.	18
III	<b>Food Preservation:</b> 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.	18
IV	<b>Fermented Food:</b> Traditional probiotic foods and their importance in human health- Idli, Dosa, Kanji, Lassi, Buttermilk, Koozhu, Pazhaiya soru, Adai, Kallappam, Yogurt, Koumiss, Kefir, Butter, Dhokla, Miso, Kombucha, Sauerkraut and Cheese etc.	18
V	<b>Microbiological Aspects of Quality Control</b> : Quality assurance in production of milk and milk products– GMP and *SSOP*. Ayurvedic principles of food habits and factors determining quality of food (Ahara vidhi visheshaayatana). Government regulatory practices and policies-FSSAI, FDA, EPA, HACCP, ISI. Food safety- control of hazards.	18
VI	<b>Current Trends (For CIA only)</b> – Microbiome in Food Safety and Quality, CRISPI Systems in Food Safety.	R-Cas
	** Self Study	

#### **Text Book(s):**

1. M.R., Adams, M.O. Moss, Food microbiology, 1<sup>st</sup> edition, New Age international (P) Ltd, New Delhi, 2018.

2. Chris Bell, Paul Neaves, P.W. Anthony, Food Microbiology and Laboratory Practical's, 2<sup>nd</sup> edition, Blackwell Scientific Publishers, UK, 2006.

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

4. N.L. Choudhary, Food Processing and Biotechnology Applications, Oxford Press, New Delhi, 2012.5. W.C.Frazier and D.C. Westhoff, Food Microbiology, Sixth edition, Tata McGrawHill Publishing Ltd., New Delhi, 2017.

#### **Reference Book(s):**

- 1. W.M. Foster, Food Microbiology, CBS publishers & distributors (P) Ltd., 2020.
- 2. Khetarpaul Neelam. Food Processing and Preservation, Daya Publishing House, Delhi, 2005.
- 3. K. Singh, Dairy Technology, Oxford Book Company, New Delhi, 2012.
- 4. M.N.Shakuntala, M. Shadaksharaswamy, Food Facts and Principles Paperpack, New Age International, 2020.
- 5. Subbulakshmi, G., Shobha, A. U., Padmini, S. G. Food Processing and preservation, 2<sup>nd</sup> edition, New Age international (P) Ltd., 2022.

#### Web Resource(s):

- 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. https://academicjournals.org/journal/IJLP/article-full-text-pdf/56F586B56464
- 5. https://microbenotes.com/factors-affecting-the-growth-of-microorganismsin-food/

	Course Outcomes							
Upon suc	Upon successful completion of this course, the student will be able to:							
CO No.	CO No. CO Statement							
CO1	Observe the knowledge on microbes involved in food microbiology.	K1						
CO2	Explain the knowledge about the fermented food products.	К2						
CO3	Examine knowledge on food spoilage and food poisoning.	К3						
CO4	Analyse the physical and chemical methods of food preservation.	K4						
CO5	Summarize the comprehensive knowledge on quality control.	К5						

#### **Relationship Matrix:**

Course Outcomes (COs)	Pro	ogramm	ne Outco	omes (P	Os)	Programme Specific Outcomes (PSOs)					Mean Score of
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	2	3	2	2	2	2	3	3	2	1	2.2
CO2	3	3	2	2	2	3	2	2	3	1	2.2
CO3	2	3	2	2	2	3	2	3	2	1	2.2
CO4	3	3	2	3	1	3	2	3	2	2	2.4
CO5	3	3	2	2	2	3	3	2	1	1	2.2
Mean Overall Score										11.2/5= 2.24	
	Correlation										

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr.N.Reehana

Semester	C	oursa Cada	Course Category	Hours/	Cradita	Marks for Evaluation				
	Course Coue		Course Category	Week	Creans	CIA	ESE	Total		
VI	<b>23</b> U	UMB6CC15P Core - XV		5	5	20	80	100		
Course Title		ENVIRONMENTAL MICROBIOLOGY AND FOOD MICROBIOLOGY -								

PRACTICAL

SYLLABUS						
Unit	Contents	Hours				
1.	Microbial assessments of air quality – open plate method					
2.	Isolation and counting of faecal bacteria from water-MPN method					
3.	Algae as indicators of water pollution					
4.	Water potability test Standard Plate Count (SPC).					
5.	Oligodynamic action of heavy metals on bacteria.					
6.	Effect of high salt concentration on microbial growth.	75				
7.	Isolation of Yeast from grapes.					
8.	Preparation of fermented food – Yoghurt and cheese (demonstration)					
9.	Isolation of bacteria from food by Standard Plate Count method.					
10.	Wet mount preparation of spoiled bread, tomato, grapes, potato.					
11.	Assessment of milk quality by Methylene Blue Reduction and ResazurinTest.					

#### **Text Book(s):**

1. G. Cappuccino and James, Microbiology a laboratory manual. Addison Wesley Publishing Company Inc., England, California, 2013.

2. K.R. Aneja, Experiments in Microbiology, Plant pathology and Biochemistry, New age International publishers, India, 4th Edition, 2003.

3. M. Abid Nordin and Liana A.B. Samad, Microbial Physiology Manual, Biological Sciences Department of California State Polytechnic University, Pomona 2003.

#### **Reference Book(s):**

K.R. Aneja., Experiments in Microbiology Plant Pathology and Biotechnology, New Age International Limited, 2005.
 B.K. Khuntia., Basic Microbiology – An Illustrated Laboratory Manual, 2nd Edition. Daya Publishing House, New Delhi, 2013.

3. <u>Amita Jain, Jyotsna Agarwal</u> and <u>Vimala Venkatesh</u>. Microbiology Practical Manual, 2018.

#### Web Resource(s):

1.https://cevre.erciyes.edu.tr/upload/M6Z30UUmicrobiology-laboratory-manual.pdf

2. http://site.iugaza.edu.ps/mwhindi/files/Laboratory\_Manual\_And\_Workbook\_In\_Microbiology.pdf

3.<u>https://www.teachmint.com/tfile/studymaterial/bsc/microbiology/isemestermicrobiologylabmanual/9016452f-c940-43ec-8815-2afb78a04f9b</u>

	Course Outcomes							
Upon suc	Upon successful completion of this course, the student will be able to:							
CO No.	CO No. CO Statement							
CO1	Determine the water potability test.	K1						
CO2	Predict the knowledge on algae as indicator of water pollution.	К2						
CO3	Interpret the food borne pathogens from various sample.	К3						
CO4	Analyse the wet mount preparation technique.	K4						
CO5	Estimate the quality of milk by methylene blue reduction test.	К5						

Course	Pro	gramm	e Outco	omes (P	Os)	Programme Specific Outcomes (PSOs)					Mean
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Score of COs
CO1	3	1	3	3	2	3	1	3	1	1	2.1
CO2	2	3	1	3	3	2	1	1	2	2	2.0
CO3	1	1	2	2	3	3	2	2	1	1	1.8
CO4	1	2	3	1	2	2	1	1	1	3	1.7
CO5	2	3	2	3	2	2	1	1	2	1	1.9
Mean Overall Score											9.5/5=1.9
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. H. Vajiha Banu

Semester	C	ourse Code	Course Cotogomy	Hours/	Credita	Marks for Evaluation			
	U	ourse Code	Course Category	Week	Creatis	CIA	ESE	Total	
VI	23UMB6PW		<b>Project Work</b>	3	2	-	100	100	
Course Title Project W			rk						

Semester	Course Code		Hours/	<b>a 1</b> <sup>4</sup>	Marks for Evaluation			
		Course Category	Week	Credits	CIA	ESE	Total	
VI	23UMB6DE2A	Discipline Specific Elective-II	5	4	25	75	100	

**Course Title** 

FERMENTATION TECHNOLOGY

SYLLABUS					
Unit	Contents	Hours			
I	<b>General concepts of industrial microbiology:</b> History and scope of industrial microbiology. Screening techniques of industrially important microorganisms – Primary screening and Secondary screening. Microbial Strain Improvement – *Mutation and Mutant selection*, Recombination and Protoplasmic fusion.	15			
II	<b>Bioreactors:</b> Factors involved in bioreactor design. Bioreactor configurations - Batch bioreactor, Continuous stirred tank bioreactor, Tubular bioreactor, Fluidized bed bioreactor, Air- Lift Bioreactor, *Cylindro–Conical Bioreactor*, Cyclone Column Bioreactor, Photo bioreactor Hollow–fiber bioreactor.	15			
Ш	<b>Upstream Process:</b> 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*.	15			
IV	<b>Downstream Process:</b> 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.	15			
V	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. Production of Bacterial vaccines, Recombinant therapeutic peptides and proteins.	15			

\*.....\* Self Study

**Text Book(s):** 

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

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

3. L. E. Casida, Industrial Microbiology, New Age International Publishers, 2016.

4. K. Sukesh, Industrial Microbiology, S. Chand Publication, 2010.

**Reference Book(s):** 

1. E. M. T. El-Mansi, Jens Nielsen, David Mousdale, Ross P. Carls , Fermentation Microbiology and Biotechnology, Fourth Edition, CRC Press, 2019.

2. Prescott and Dunns. Industrial Microbiology. Wiley and Sons, 2004.

3. Syed Sajeed Ali, Fermentation and Industrial Microbiology, Neoti Book Agency Private Limited; 1st edition, 2016.

4. J. Michael Waites, L., Neil:S. John Rockey Industrial Microbiology An Introduction · 2013 Web Resource(s):

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

	Course Outcomes							
Upon suc	cessful completion of this course, the student will be able to:							
CO No.	CO Statement	Cognitive Level (K-Level)						
CO1	Describe the industrial important microorganism and on strain improvement.	K1						
CO2	Explain the fermenter configurations and its types.	K2						
CO3	Examine fermentation media, formulation strategies for fermentation process.	К3						
CO4	Record the principle and application of downstream processing.	K4						
CO5	Summarize the microbes involved in industrial products.	K5						

Course	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Cos
CO1	3	1	3	2	2	3	2	3	1	3	2.3
CO2	3	3	1	2	3	3	3	1	3	2	2.4
CO3	2	3	3	1	3	3	1	3	2	2	2.3
CO4	1	2	3	2	2	3	2	2	3	1	2.1
CO5	1	1	1	2	3	3	1	2	3	3	2.0
Mean Overall Score										11.1/5= 2.22	
	Correlation										

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

### Course Coordinator: Dr.H. Vajiha Banu

Semester	Course Code	Course Cotogory	Hours/	Cradita	Marks for Evaluation			
	Course Code	Course Category	Week	Creans	CIA	ESE	Total	
VI	23UMB6DE2B	Discipline Specific Elective – II	5	4	25	75	100	

#### Course Title MEDICAL ENTOMOLOGY

#### SYLLABUS

Unit	Contents	Hours
I	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. *Ecology of Arthropods – Public health Importance*.	15
Π	<b>Insects</b> : 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)	15
III	<b>Physiology of Insects</b> : Insect Morphology – General structure and metamorphosis. Insect internal anatomy and physiology - Insect external anatomy. Insects Digestive System and *Nervous System * -Insects – Reproductive System.	15
IV	Anthroponotic diseases: Malaria, filariasis, visceral leishmaniasis, onchocerciasis, trypanosomiasis, *Chagas disease*, scrub typhus, tick typhus. Bacterial – lyme disease and rickettsial pathogens.	15
V	<b>Zoonotic Diseases:</b> Cutaneous leishmaniasis, Schistosomiasis, plague, Kyasanur Forest Disease (KFD), *Leptospirosis, Dengue, Chikungunya, Dracunculiasis - Disease vectors - distribution and transmission - socio-economic impact on human population. Emerging Zoonotic Diseases and Public health threats.	15
	** Sell Study	

#### Text Book(s):

1. D.N Roy and A.W.A. Brown. Entomology (Medical and Veterinary) including insecticides & insects & Rat control; The Bangalore Printing & Publishing Co. Ltd., Bangalore . 2004.

2. B F. Eldrige and J D. Edman. Medical Entomology. Springer Dordrecht. 2012.

3. B. K. Tyagi Medical Entomology: A Handbook of Medically Important Insects And Other Arthropods, Scientific Publishers ,2003.

4. K.L Mukherjee and S. Ghosh. Medical Laboratory Technology Vol- I, II & III: Procedure Manual for routine diagnostic Test Fourth edition. 2022

5.John Capinera, Insects and Wildlife: Arthropods and their Relationships with Wild Vertebrate Animals, Wiley-Blackwell; 1st edition,2010

#### **Reference Book(s):**

1. Paul Hanson, Insects and Other Arthropods of Tropical America, Cornell University Press; Illustrated edition, 2016.

2. A.N Clements. Biology of Mosquitoes, Volume 3: Transmission of Viruses and Interactions with Bacteria CABI Publishing, 2011.

3. B.K Tyag, Medical Entomology, Ed 2. Scientific Publishers, India, 2022.

4. S.K. Kochchar, A Text Book of Parasitology. Wisdom Press. 2009.

#### Web Resource(s):

1.https://www.conops.gr/integrated-management-of-arthropods-of-public-healthimportance/?lang=en 2. https://wiki.bugwood.org/Insect Biology

3.https://extension.psu.edu/integrated-pest-management-ipm-tactics

	Course Outcomes						
Upon suc	cessful completion of this course, the student will be able to:						
CO No.	CO Statement	Cognitive Level (K-Level)					
CO1	Describe the classification and distinguished features of arthropods.	K1					
CO2	Identify the disease caused by insects and their effect on human population.	К2					
CO3	Explain the structure, morphology and anatomy of insects.	К3					
CO4	Analyse the various anthroponotic diseases:	K4					
CO5	Summarize the Zoonotic Diseases and its socio economic impact on human health.	К5					

Course	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	3	1	3	2	2	3	2	3	1	3	2.3
CO2	3	3	1	2	3	3	3	1	3	2	2.4
CO3	2	3	3	1	3	3	1	3	2	2	2.3
CO4	1	2	3	2	2	3	2	2	3	1	2.1
CO5	1	1	1	2	3	3	1	2	3	3	2.0
Mean Overall Score										11.1/5= 2.22	
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Ms. T. Shakena Fathima

Semester	Course Code	Course Category	Hours/	Cradita	Marks for Evaluation			
	Course Coue		Week	Creatis	CIA	ESE	Total	
VI	23UMB6DE3A	Discipline Specific Elective - III	4	4	25	75	100	

#### Course Title | RECOMBINANT DNA TECHNOLOGY

	SYLLABUS	
Unit	Contents	Hours
I	<b>Milestones in rDNA Technology:</b> Overview of key milestones in recombinant DNA technology- Definition and Principles of gene manipulation- Major steps in gene cloning- Methods for isolation and purification of chromosomal DNA, *plasmid DNA* and RNA- Chemical synthesis of DNA, Construction of genomic and cDNA libraries- applications.	12
II	<b>Enzymes of rDNA Technology:</b> Introduction, types, mechanisms of action and applications - Restriction endonucleases, Ligases, DNA polymerases, DNA-modifying enzymes and *topoisomerases*.	12
III	<b>Cloning Vectors:</b> Definition and properties of cloning vectors- Plasmid-based vectors: Natural vectors (pSC101, pSF2124, pMB1) and Artificial vectors (pBR322 and pUC)- Phage-based vectors: $\lambda$ (Lambda) phage vectors and their derivatives-Hybrid vectors: phagemids and *cosmids*, BAC (Bacterial Artificial Chromosome), and YAC (Yeast Artificial Chromosome) and expression systems in <i>E. coli</i> .	12
IV	<b>Gene Transfer Techniques:</b> Overview of gene transfer techniques: Physical methods (biolistic method using a gene gun, electroporation, microinjection)-chemical methods (calcium chloride and DEAE methods)- Biological methods ( <i>in vitro</i> packaging in viruses)- Selection and Screening of recombinants using direct methods (selection by complementation, marker inactivation) and indirect methods (immunological and *genetic techniques*).	12
V	Nucleic Acid and Protein Hybridization Techniques: Overview of blotting techniques (Southern, Western, Northern, and North-Eastern blots), Polymerase Chain Reaction (PCR): fundamental steps in DNA amplification, Random Amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphism (RFLP), *DNA fingerprinting*, DNA microarray analysis and Applications of recombinant DNA technology.	12
	**Self Study	

Text Book(s):

- 1. T.A. Brown, Gene Cloning and DNA Analysis, 7th edition, Wiley Blackwell, 2015.
- 2. K.Rajagopal, Recombinant DNA technology and genetic engineering, McGraw Hill Education, 2012.
- 3. Monika Jain. Recombinant DNA Techniques: A Textbook, Alpha Science International, 2020.
- 4. S. L. Prakash, Text book of Biotechnology, 1<sup>st</sup> edition, MJP publisher, 2019.

Reference Book(s):

- 1. A.K. Firdos, Biotechnology Fundamentals, 3<sup>rd</sup> edition, CRC Press, 2019.
- 2. H.K. Das, Text book of Biotechnology, 5<sup>th</sup> edition, Wiley, 2017.
- 3. P. Ramdass, Cloning, MJP Publishers, 2019.
- 4. S.B. Primrose, R.M.Twyman, Principles of Gene Manipulation and Genomics, 7<sup>th</sup> edition Wiley Blackwell, 2006.
- 5. Julia Lodge, Peter Lund., Steve Minchin. Gene Cloning Principles and Applications, Taylor and Francis, 2006

#### Web Resource(s):

1.https://old.amu.ac.in/emp/studym/100002855.pdf

- 2. https://microbenotes.com/restriction-enzyme-restriction-endonuclease/
- 3. https://www.mlsu.ac.in/econtents/65\_Enzymes%20used%20in%20GE.pdf
- 4. https://microbenotes.com/polymerase-chain-reaction-pcr-principle-stepsapplications/
- 5. https://microbenotes.com/western-blotting-introduction-principle-andapplications/

Course	Pro	gramm	e Outco	omes (P	Os)	Progra	Mean Score of				
(COs)	<b>PO1</b>	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	COs
CO1	1	1	2	2	2	2	2	3	1	1	1.7
CO2	1	3	2	2	2	2	2	3	2	2	2.1
CO3	2	2	3	1	2	3	3	1	2	2	2.1
CO4	2	2	2	3	1	3	2	2	3	2	2.2
CO5	3	1	2	3	3	3	2	2	1	3	2.3
								Me	an Overa	all Score	10.4/5= 2.08
									Cor	relation	Medium

Mean Overall Score	Correlation
< 1.5	Low
$\geq$ 1.5 and $<$ 2.5	Medium
≥ 2.5	High

#### Course Coordinator: Dr.N.Reehana

#### **Relationship** Matrix:

Somostor	Course Code	Course Category	Hours/	Crodite	MarksforEvaluation			
Semester	Course Coue	Course Category	Week	Creans	CIA	ESE	Total	
VI	23UMB6DE3B	Discipline Specific Elective - III	4	4	25	75	100	

#### Course Title | BIOINFORMATICS AND BIOSTATISTICS

#### SYLLABUS

Unit	Contents	Hours
I	<b>Basic of Bioinformatics:</b> 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.	12
п	<b>Protein Sequence Database:</b> 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.	12
ш	<b>Sequence and Alignment: Pairwise alignment</b> : – 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 Parsomony and Maximum likelihood.	12
IV	<b>Statistics for biology:</b> 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 and mean deviation. Degree of freedom.	12
V	<b>Population and Data Analysis</b> : 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 *. Frequency polygons and discrete variable.	12

\*....\*Self Study

#### **Text Book(s):**

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

#### **Reference Book(s):**

- 1. D.R.Westhead, J.H. Paris and R.M. Twyman. Instant Notes: Bioinformatics –Viva Books Private Ltd, New Delhi, 2003.
- 2. Arthur M. Lesk. Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003.
- 3. R. Bernard Rosner. Fundamentals of Biostatistics 8<sup>th</sup> Edition, Cengage Learning, Uttar Pradesh 2015.
- 4. P.K. Gupta, Biotechnology, Immunology, Biotechniques and Biostatistics,
- Med Tech Science Press, 2022.
- 5. Jin Xiong. Essential Bioinformatics, Cambridge Uniersity Press. New Delhi, 2020.

#### Web Resource(s):

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

	Course Outcomes							
Upon successful completion of this course, the student will be able to:								
CO No.	CO Statement	Cognitive Level (K-Level)						
CO1	Describe the basic principles and concepts of bioinformatics.	K1						
CO2	Identify the protein structure and sequence databases.	K2						
CO3	Explain the sequence alignment and construction of the phylogenetic tree.	K3						
CO4	Analyze the variables in a dataset.	K4						
CO5	Summarize the population and data analysis.	K5						

#### **Relationship Matrix:**

Course	Pro	gramm	e Outco	omes (P	Os)	Progra	Mean				
(COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Score of COs
CO1	3	1	3	1	1	3	1	3	1	3	2.0
CO2	3	2	2	2	3	1	2	2	2	1	2.0
CO3	3	1	1	2	1	1	2	3	2	2	1.8
CO4	2	2	3	1	2	2	1	2	2	3	2.0
CO5	2	1	2	2	1	3	3	1	3	1	1.9
								Me	an Overa	all Score	9.7/5=1.9
									Со	rrelation	Medium

Mean Overall Score	Correlation
<1.5	Low
$\geq 1.5$ and $< 2.5$	Medium
≥ 2.5	High

Course Coordinator: N. Vennila