HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)

Uthamapalayam, Theni District. Pin Code: 625 533.

DEPARTMENT OF MICROBIOLOGY

BACHELOR OF SCIENCE – MICROBIOLOGY

SYLLABUS

Choice Based Credit System – CBCS

(As per TANSCHE/MKU Guidelines)

with

Outcome Based Education (OBE)

(Academic Year 2020 -2021 onwards)

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)

Uthamapalayam, Theni District. Pin Code: 625 533.

Name of the Programme: B.Sc. Microbiology

Choice Based Credit System (CBCS)
(As per TANSCHE/MKU Guidelines)

with
Outcome Based Education (OBE)

(with effect from the Academic Year 2020 – 2021)

College Vision and Mission

Vision

Our vision is to provide the best type of higher education to all, especially to students hailing from minority Muslim community, rural agricultural families and other deprived, under privileged sections of the society, inculcating the sense of social responsibility in them. Our college is committed to produce talented, duty-bound citizens to take up the challenges of the changing times.

Mission

Our mission is to impart and inculcate social values, spirit of service and religious tolerance as envisioned by our beloved Founder President Hajee Karutha Rowther.

The Vision beckons ..... the Mission continues forever.

Programme Educational Objectives (PEO)

Our graduates will be progressive, efficient, value based, academically excellent, creative, collaborative, empowered and globally competent literates with the skills required for societal change.

They will demonstrate

PEO1	Comprehensive knowledge and expertise, employability, the acumen of creative and critical thinking, the spirit of enquiry and professional attitude required for a successful career
PEO2	Accountability, linguistic competence and communication skills in the work environment and beyond
PEO3	Perseverance, effective collaboration, team spirit, leadership and problem solving skills
PEO4	Keen sense of civility, professional ethics, receptivity and moral righteousness
PEO5	Commitment to address social and environmental threats and to act as responsible service-minded, duty-bound global citizens

Department Vision and Mission

Vision

The Department of Microbiology envisions inculcating in students right skills oriented towards self development and as a center for academic, research and extension activities, who can realize the need for the value of dignity of labor and the attitude and proper community orientation and civic responsibilities in their outlook.

Mission

- Create a centre of Academic Excellence in the field of education and research in Microbiology.
- Provide a sound academic background for overall development of personality for a successful career in Microbiology.
- Provide an environment that fosters continuous improvement and innovation in the subject.

Programme Outcomes (PO)

On completion (after three years) of B.Sc. Microbiologyprogramme, the students are able to

PO1	To promote the students to understand the impact of Microbiology in life.
PO2	To develop practical skills in Microbiology for their job oriented career.
PO3	To promote the students to be self-employed in the field of Microbiology such as mushroom farming, Dairy etc
PO4	To enable the students to apply Microbiology to the various fields such as agriculture, industries, clinical, genetic engineering etc
PO5	To insist the golden opportunities for their career in research and job in the field of Microbiology.

Programme Specific Outcomes (PSO)

A graduate of B.Sc. Microbiology after three year will

PSO1	Apply knowledge of molecular mechanism and cellular process in microbes.
PSO2	Our graduate will able to analyze be the problem in basic and current area of industrial microbiology, fermentation technology, environmental and agricultural microbiology are included to train the students and also sensitize them to scope for research
PSO3	Our graduate of the programme will serve as a successful microbiologist and apply the fundamentals concepts of Microbiology and laboratory technology in the agriculture, industry, health care, societal related emerging application areas
PSO4	The graduate will be equipping themselves in higher studies, entrepreneur and applying new ideas and technologies in Microbiology
PSO5	Our graduate will able to practicing excellent to their experience which addresses issues in a responsive ethical and innovative manner

Programme Scheme

Eligibility

A pass in +2 examination conducted by the board of higher secondary education, Government of Tamilnadu with Biology as one of the subject or any other examination accepted by the syndicate as equivalent.

For Programme Completion

A Candidate shall complete:

- Part I - Language papers – Tamil/Arabic/Malayalam in semesters I, II, III and IV respectively
- Part II - Language papers - English in semesters I, II, III, IV respectively
- Part III - Core papers in semesters I, II, III, IV, V and VI respectively
- Part III - Allied papers in semesters I, II, III, and IV respectively
- Part III - Elective papers in semesters V and VI respectively
- Part IV - Non- Major Elective papers in semesters I and II respectively
- Part IV - Skill based Subject papers in semesters III, IV, V and VI respectively
- Part IV - Value Education paper in semester I
- Part IV - Environmental Studies paper in semester II
- Part V - Extension activity in semester IV

Scheme of Examinations under Choice Based Credit System

Term End Examinations (TEE)	- 75 Marks
Continuous Internal Assessment Examinations (CIAE)	- 25 Marks
Total	- 100 Marks

Pattern of Continuous Internal Assessment Examinations (CIAE)

Average of Two Internal Tests (each 20 marks)	- 20 Marks
Assignment	- 05 Marks
Total	- 25 Marks

Pattern of Term End Examinations
(Max. Marks: 75 / Time: 3 Hours)

External Examinations Question Paper Pattern for Part I & III and Part IV (Non- Major Elective & Skill based Subject)

Section – A (10 X 1 = 10 Marks)
Answer ALL questions.

- Questions 1 - 10
- Two questions from each unit
- Multiple choice questions and each question carries Four choices

Section – B (5 X 7 = 35 Marks)
Answer ALL questions choosing either A or B.

- Questions 11 - 15
- Two questions from each unit (either…. or…. type)
- Descriptive Type

Section – C (3 X 10 = 30 Marks)
Answer any THREE out of five questions.

- Questions 16 - 20
- One question from each unit
- Descriptive Type

External Examinations Question Paper Pattern for Part IV (Environmental Studies and Value Education)

Section – A: (5 X 6 = 30 Marks)
Answer ALL questions choosing either A or B.

- Questions 1 - 5
- Two questions from each unit (either…. or…. type)
- Descriptive Type

Section – B (3 X 15 = 45 Marks)
Answer any THREE out of five questions.

- Questions 6 – 10
- One question from each unit
- Descriptive Type

Part V (Extension Activities)

- Internal Evaluation

Passing Marks

Minimum 27 for External Exam

Eligibility for the degree – passing minimum is **40%**

Practical Examination

Internal – 40 marks

External – 60 marks

Total – 100 marks

Passing minimum is **40%**

Weightage

Weightage for Bloom's Taxonomy	Percentage	Marks	
		CIAE	TEE
Knowledge (Remembering) – K1	40	10	30
Understanding – K2	40	10	30
Applying – K3	20	5	15
Gross Total	**100**	**25**	**75**

Assessment

Distribution of questions and marks for Continuous Internal Assessment Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge(K1)	2 (2)	1 (a or b) (3)	1 (5)	**25 marks**
Understanding(K2)	2 (2)	1 (a or b) (3)	1 (5)	
Apply(K3)	**Assignment (5)**			

Distribution of questions and marks for Term End Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge(K1)	2 (2)	4 (a or b) (28)	-------	**Total 75 Marks**
Understanding(K2)	3 (3)	1 (a or b) (7)	2 out of 3 (20)	
Apply(K3)	5 (5)	-------	1 out of 2 (10)	

Note: Figures in parenthesis are Marks

Credits Distribution

Part	Course Category	Courses	Credits	Total Marks
I	Tamil/ Arabic/ Malayalam	4	12	400
II	English	4	12	400
III	Core, Elective & Allied	25	98	2500
IV	Non- Major Elective	2	4	200
	Skill based Subject	4	8	400
	Value Education	1	2	100
	Environmental Studies	1	2	100
V	Extension Activities	1	2	100
		42	**140**	**4200**

Details of Course Category, Code, Credits & Title

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester - I							
Part - I							
Language - I	20UTAL11/ 20UARL11/ 20UMLL11	Tamil / Arabic / Malayalam	6	25	75	100	3
Part - II							
English - I	20UENL11	English for Enrichment - I	6	25	75	100	3
Part – III (OBE)							
Core – I	20UMBC11	General Microbiology	5	25	75	100	5
Core – III	20UMBC2P	Basic Microbiology Practical	3	-	-	-	-
Allied – I	20UCHA11	Organic, Inorganic & Physical Chemistry - I	4	25	75	100	3
Allied – III	20UCHA2P	Volumetric Analysis	2	-	-	-	-
Part - IV							
NME – I	20UMBN11	Mushroom Technology	2	25	75	100	2
VED	20UVED11	Value Education	2	25	75	100	2
		Total	**30**			**600**	**18**
Semester - II							
Part - I							
Language - II	20UTAL21/ 20UARL21/ 20UMLL21	Tamil / Arabic / Malayalam	6	25	75	100	3
Part - II							
English - II	20UENL21	English for Enrichment - II	6	25	75	100	3
Part – III (OBE)							
Core – II	20UMBC21	Biochemistry	5	25	75	100	5
Core – III	20UMBC2P	Basic Microbiology Practical	3	40	60	100	3
Allied – II	20UCHA21	Organic, Inorganic & Physical Chemistry - II	4	25	75	100	3
Allied – III	20UCHA2P	Volumetric Analysis	2	40	60	100	2
Part - IV							
NME – II	20UMBN21	Food and Dairy Microbiology	2	25	75	100	2
EVS	20UEVS21	Environmental Studies	2	25	75	100	2
		Total	**30**			**800**	**23**

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester - III							
Part - I							
Language- III	20UTAL31/ 20UARL31/ 20UMLL31	Tamil / Arabic / Malayalam	6	25	75	100	3
Part - II							
English - III	20UENL31	English for Enlightenment - I	6	25	75	100	3
Part – III (OBE)							
Core – IV	20UMBC31	Immunology	5	25	75	100	4
Core – V	20UMBC32	Cell Biology	4	25	75	100	4
Core – VIII	20UMBC4P	Immunology and Molecular Biology Practical	3	-	-	-	-
Allied - IV	20UMBA31	General Biology	4	25	75	100	3
Allied - VI	20UMBA4P	Biology Practical - I	2	-	-	-	-
		Total	**30**			**500**	**17**
Semester – IV							
Part - I							
Language - IV	20UTAL41/ 20UARL41/ 20UMLL41	Tamil / Arabic / Malayalam	6	25	75	100	3
Part - II							
English - IV	20UENL41	English for Enlightenment - II	6	25	75	100	3
Part – III (OBE)							
Core – VI	20UMBC41	Molecular Biology and Microbial Genetics	5	25	75	100	4
Core - VII	20UMBC42	Microbial Physiology	4	25	75	100	4
Core - VIII	20UMBC4P	Immunology and Molecular Biology Practical	3	40	60	100	4
Allied - V	20UMBA41	Genetics and Biostatistics	4	25	75	100	3
Allied - VI	20UMBA4P	Biology Practical - I	2	40	60	100	2
Part - V							
EA		Extension Activities**	--	100	--	100	2
		Total	**30**			**800**	**25**

Part – V
Extension Activities**

S. No.	Course Code	Course Title	Max. Marks	Credits
1.	20UNCC41	National Cadet Corps (Army)	100	2
2.	20UNCC42	National Cadet Corps (Navy)	100	2
3.	20UNSS41	National Service Scheme	100	2
4.	20UPED41	Physical Education	100	2
5.	20UYRC41	Youth Red Cross	100	2
6.	20URRC41	Red Ribbon Club	100	2
7.	20UHRC41	Human Rights Club	100	2
8.	20UCOC41	Consumer Club	100	2
9.	20UYOC41	Yoga Club	100	2
10.	20UHFC41	Health and Fitness Club	100	2
11.	20UECC41	Eco Club	100	2
12.	20ULIC41	Library & Information Science Club	100	2
13.	20USCC41	Science Communication Club	100	2
14.	20UFAC41	Fine Arts Club	100	2

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester - V							
Part – III (OBE)							
Core - IX	20UMBC51	Medical Microbiology	5	25	75	100	5
Core - X	20UMBC52	Agriculture & Environmental Microbiology	4	25	75	100	4
Core – XI	20UMBC53	Biochemical Techniques	4	25	75	100	4
Core – XV	20UMBC6P	Agriculture and Environmental Microbiology Practical	3	-	-	-	-
Core – XVI	20UMBC6Q	Recombinant DNA technology and Industrial Microbiology Practical	3	-	-	-	-
Core – XVII	20UMBC6R	Medical Microbiology and Food Microbiology Practical	3	-	-	-	-
Elective - I	20UMBE51	Bioinformatics	4	25	75	100	4
	20UMBE52	Medical Lab Technology					
	20UMBE53	Virology					
Part - IV							
SBS - I	20UMBS51	Diagnostic Microbiology	2	25	75	100	2
SBS - II	20UMBS52	Microbiology for Competitive Examination Paper – I	2	25	75	100	2
		Total	**30**			**600**	**21**
Semester - VI							
Part – III (OBE)							
Core –XII	20UMBC61	Industrial Microbiology	5	25	75	100	5
Core – XIII	20UMBC62	Food Microbiology	4	25	75	100	4
Core - XIV	20UMBC63	Enzymology and Enzyme technology	4	25	75	100	4
Core – XV	20UMBC6P	Agriculture and Environmental Microbiology Practical	3	40	60	100	5
Core - XVI	20UMBC6Q	Recombinant DNA technology and Industrial Microbiology Practical	3	40	60	100	5
Core – XVII	20UMBC6R	Medical Microbiology and Food Microbiology Practical	3	40	60	100	5
Elective - II	20UMBE61	rDNA Technology	4	25	75	100	4
	20UMBE62	Food biotechnology					
	20UMBE63	Biofertilizer					
Part - IV							
SBS – III	20UMBS61	Diary Technology	2	25	75	100	2
SBS - IV	20UMBS62	Microbiology for Competitive Examination Paper – II	2	25	75	100	2
		Total	**30**			**900**	**36**
		Grand Total	**180**			**4200**	**140**

Course Code	Course Title	Category	Total Hours	Credits
20UMBC11	General Microbiology	Core - I	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To promote the basics of general microbiology and to understand the about the structure and features of microbes.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Demonstrate the history, scope and classification of Microbiology	**K1, K2**
CO2	Explain principle, types and application of microscope	**K1, K2**
CO3	Classify the culture media and its types	**K1, K2**
CO4	Develop the ultra-structure of bacteria and functions	**K1,K2,K3**
CO5	Identify the characteristics of bacteria, fungi and protozoa	**K1,K2,K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**1**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**1**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

History and scope of Microbiology- Contributions of Leeuwenhoek, Edward Jenner, Spallanzani, Louis Pasteur, John Needham and Robert Koch.– General principles and nomenclature. Classification of microorganisms - Haeckel's three kingdom concept, Whittaker's five kingdom concept. Difference between the prokaryotic and eukaryotic microorganisms

UNIT II 15 Hours

Microscopy– Principles and application – Bright field, dark field, phase contrast and electron microscopes and its types. Sterilization- Physical methods – Dry heat- Moist heat, Filtration (Membrane & HEPA), Radiation. Chemical method -Chemical agents

UNIT III 15 Hours

Cultivation of microbes- Solid and Liquid media- Types of culture media with specific examples for each type. Aerobic culture technique: Pure culture technique – (streak plate, spread plate, pour plate, stab culture, slant culture) Anaerobic culture technique-– Wright's tube, Mclntost fildes jar method.

UNIT IV 15 Hours

Bacteria - Size, shape and arrangement of bacterial cells - Ultra structure of a bacterial cell - capsule, cell wall, cell membrane, mesosomes, Nucleoid, flagella, ribosome. Algae- structure and reproduction of Chlamydomonas. Fungi- structures and reproduction; Rhizopus.

UNIT V 15 Hours

General characteristics and nature of Actinomycetes, *Bacillus, E. coli*, *Salmonella*, and *Streptomycetes.* Viruses: T4, TMV. Protozoa: *Plasmodium*.

Text Books

Alcamo IE, ***Fundamentals of Microbiology***, Addison Wesley Longman, Inc. California, 2001, 6th edition.

Dubey RC and Maheswari DK, ***A Text Book of Microbiology***, S Chand, New Delhi, 2010.

Reference Books

Authors Name, ***Book Title***, Name of the publications, Place of publications, Year of publications, edition.

Pelczar MJ, Chan ECS and Kreig NR, ***Microbiology***, McGraw- Hill. Book Co, Singapore, 2009, 5th edition.

Prescott, L.M J.P. Harley and C.A. Klein, ***Microbiology***, McGraw Hill, Newyork, 2008, 7th edition.

Rajan S and Selvi Christy R, ***Essentials of Microbiology***, Anjanaa Book House, Chennai, 2015.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	History and scope of Microbiology.	3	E-Resources
1.2	Contributions of Leeuwenhoek, Edward Jenner, Spallanzani.	3	E-Resources
1.3	Louis Pasteur, John Needham and Robert Koch.	3	Discussion
1.4	General principles and nomenclature.	2	E-Resources
1.5	Three and five kingdom concept.	2	E-Resources
1.6	Difference between Prokaryotic and eukaryotic microbes.	2	E-Resources
UNIT - II			
2.1	Microscope- principles and application	2	Discussion
2.2	Bright field, dark field microscope	3	Chalk & Talk
2.3	Phase contrast and electron microscope	4	E-Resources

2.4	Sterilization- Physical methods	3	E-Resources
2.5	Sterilization-Chemical method	3	E-Resources
UNIT - III			
3.1	Solid and liquid media	3	E-Resources
3.2	Types of culture media	4	E-Resources
3.3	Aerobic culture technique	4	Discussion
3.4	Anaerobic culture technique	4	E-Resources
UNIT - IV			
4.1	Arrangement of bacterial cells	3	Discussion
4.2	Ultra structure - capsule, cell wall, cell membrane	3	E-Resources
4.3	Mesosomes, nucleoid, flagella, ribosome	3	Chalk & Talk
4.4	Structure and reproduction of Chlamydomonas	3	E-Resources
4.5	Structures and reproduction of Rhizopus	3	E-Resources
UNIT - V			
5.1	General character of Actinomycetes	3	E-Resources
5.2	*Bacillus, E. coli*	3	Chalk & Talk
5.3	*Salmonella*, and *Streptomycetes*	3	Discussion
5.4	T4, TMV	3	E-Resources
5.5	Protozoa - *Plasmodium*	3	E-Resources
	Total	**75**	

Course Designer
Dr. P. Sivamanikandan
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UCHA11	Organic, Inorganic and Physical Chemistry - I	Allied-IV	60	3

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To recognize the properties of hydrogen, oxides, water, colloids carbohydrates, stereoisomerism, amino acids, proteins and dyes.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	List the preparation and properties of hydrides, oxides, hardness of water and its implications.	K1
CO2	Classify the colloidal states of matter and its applications	K1, K2
CO3	Demonstrate the reactions of glucose, fructose and sucrose and relate their uses	K1, K2
CO4	Explain the concept of enantiomers, diastereoisomers and geometrical isomers	K1, K2
CO5	Identify the properties, classification and functions of proteins and dyes	K1, K2, K3

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	3	3	2	2	2
CO3	3	2	2	3	2
CO4	3	2	2	3	2
CO5	3	3	2	2	2

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2
CO2	3	3	2	2	2
CO3	3	2	2	3	2
CO4	3	2	2	3	2
CO5	3	3	2	2	2

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Hydrogen: Isotopes of hydrogen – preparation, properties and uses of heavy hydrogen – hydrides – definition – classification – examples - Oxides – Definition – classification – examples. Water: Hardness of water – types of hardness – removal of hardness – industrial implications of hardness in water – estimation by EDTA method (outline only) - Units of hardness of water.

UNIT II 12 Hours

Colloids: Colloidal states of matter – various types – classification - Sols – dialysis – electro osmosis – electrophoresis – stability of colloids – protective action – Hardy Schulze law – gold number - Emulsion: Types of emulsions – emulsifier with examples - Gels: Classification, preparation - Applications of colloids.

UNIT III 12 Hours

Carbohydrates: Definition – classification – monosaccharides – properties and uses of glucose and fructose – Haworth structure (glucose only) – conversion of glucose to fructose and vice versa, mutarotation - Disaccharides: Sucrose – structure – distinction between sucrose, glucose and fructose - Polysaccharides: Starch and cellulose (Structure only) – cellulose derivatives.

UNIT IV 12 Hours

Stereoisomerism – chiral center – optical activity of compounds containing one or two chiral centers (lactic and tartaric acid) – R-S notation – enantiomers – diastereoisomers – racemization – resolution - Geometrical isomerism of maleic and fumaric acids - E-Z notation of geometrical isomers.

UNIT V 12 Hours

Amino acids and proteins: Classification – synthesis – properties of amino acids – action of heat, dipolar ion, iso-electric point, and Ruhemann's purple - polypeptides – proteins – classification and biological functions.

Dyes: Definition – theory of colour and constitution – classification based on structure and applications – preparation of methyl orange – Bismark brown, malachite green – vat dye – indigo.

Reference Book

B. S. Bahl & Arun Bahl, ***Advanced Organic Chemistry***, S. Chand & Company, New Delhi, 2009.

B.R. Puri and L.R. Sharma and Madan S. Pathania, ***Principles of Physical Chemistry***, Vishal Publishing Co., Jalandhar, 2005.

R.D. Madan, ***Modern Inorganic Chemistry***, S. Chand, 2013, revised edition,

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Isotopes of hydrogen – preparation, properties and uses of heavy hydrogen	2	Chalk & Talk
1.2	Hydrides – definition – classification – examples	2	E-Resources
1.3	Oxides – Definition – classification – examples	2	E-Resources
1.4	Hardness of water – types of hardness	2	Chalk & Talk
1.5	Removal of hardness - industrial implications of hardness in water	2	E-Resources
1.6	Estimation by EDTA method - Units of hardness of water.	2	E-Resources

UNIT - II			
2.1	Colloidal states of matter – various types – classification	2	E-Resources
2.2	Sols – dialysis – electro osmosis – electrophoresis	2	Chalk & Talk
2.3	Stability of colloids – protective action – Hardy Schulze law – gold number	2	E-Resources
2.4	Types of emulsions – emulsifier with examples	3	E-Resources
2.5	Classification, preparation - Applications of colloids	3	E-Resources
UNIT - III			
3.1	Carbohydrates: Definition – classification – monosaccharides – properties and uses of glucose and fructose	4	E-Resources
3.2	Haworth structure of glucose mutarotation	2	E-Resources
3.3	Conversion of glucose to fructose and vice versa,	2	Chalk & Talk
3.4	Sucrose – structure – distinction between sucrose, glucose and fructose	2	E-Resources
3.5	Starch and cellulose – cellulose derivatives	2	Chalk & Talk
UNIT - IV			
4.1	Stereoisomerism – chiral center – optical activity of compounds containing one or two chiral centers (lactic and tartaric acid)	4	E-Resources
4.2	R-S notation – enantiomers – diastereoisomers – racemization – resolution	4	Chalk & Talk
4.3	Geometrical isomerism of maleic and fumaric acids	2	Chalk & Talk
4.4	E-Z notation of geometrical isomers	2	E-Resources

UNIT - V			
5.1	Amino acids and proteins: Classification – synthesis	2	E-Resources
5.2	Properties of amino acids – action of heat, dipolar ion, iso-electric point, and Ruhemann's purple	3	Chalk & Talk
5.3	Polypeptides – proteins – classification and biological functions	2	E-Resources
5.4	Dyes: Definition – theory of colour and constitution – classification based on structure and applications	2	E-Resources
5.5	Preparation of methyl orange – Bismark brown, malachite green – vat dye – indigo	3	Chalk & Talk
	Total	**60**	

Course Designer
Dr. S. Sivakumar
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UMBC21	Biochemistry	Core - II	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To promote the importance of Biomolecules and to understand about the importance of metabolism.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Discuss the basics of carbohydrates and pathway	**K1, K2**
CO2	Classify the structure and nomenclature of lipids	**K1,K2**
CO3	Outline of the structure and classification of Protein	**K1, K2**
CO4	Identify the nucleic acids and its types	**K1,K2,K3**
CO5	Develop the vitamins and its types	**K1,K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**1**	**3**	**3**
CO3	**3**	**2**	**3**	**2**	**2**
CO4	**2**	**3**	**2**	**3**	**2**
CO5	**3**	**3**	**2**	**1**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**1**	**3**	**3**
CO3	**3**	**2**	**3**	**2**	**2**
CO4	**2**	**3**	**2**	**3**	**2**
CO5	**3**	**3**	**2**	**1**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Introduction – Water, pH and Buffers. Carbohydrates- Classification- Monosaccharide's (glucose, fructose), Disaccharides (lactose, sucrose) Polysaccharides (starch, cellulose). Metabolism- Embden- Meyerhof-Parnas, Entner-Doudoroff, Pentose Phosphate pathways - TCA cycle.

UNIT II 15 Hours

Lipids: Physical and Chemical properties of fatty acids- Nomenclature of fatty acids- Phospholipids- Sphingolipids- Lipoproteins, Oxidation of fatty acids (β-Oxidation)

UNIT III 15 Hours

Proteins: Structure, Classification, properties of proteins. Primary, secondary, tertiary and quaternary structures of proteins.

UNIT IV 15 Hours

Nucleic acids – Definition, structure, forms of DNA. Structure and Types of RNA (mRNA, tRNA, rRNA).

UNIT V 15 Hours

Vitamins – Definition, sources, deficiency syndromes and functions of Fat soluble vitamins (A, D, E and K) and Water soluble vitamins. (B complex and C).

Text Books

Deb AC, ***Fundamentals of Biochemistry***, New Central Book Agency (p) ltd, London, 2011, 10th edition.

Reference Books

Albert L Lehninger, David L Nelson and Michael M Cox, ***Principles of Biochemistry***, Wiley publisher, 2010, 2nd edition.

Rajagopal G, ***Concise textbook of biochemistry***, Ahuja Publishing House, 2010, 2nd edition.

Reginald H Garrett and Charles M Grisham, ***Biochemistry***, Brooks Cole publishers, 2012, 5th edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Water, pH and Buffers	3	Chalk & Talk
1.2	Carbohydrates and its types	4	E-Resources
1.3	Embden-Meyerhof-Parnas pathway	2	Discussion
1.4	Entner-Doudoroff pathway	2	E-Resources
1.5	Pentose Phosphate pathway	2	E-Resources
1.6	TCA cycle	2	E-Resources
UNIT - II			
2.1	Physical and chemical properties of Lipids	4	Discussion
2.2	Phospholipids and types	4	E-Resources
2.3	Sphingolipids, Lipoproteins	4	E-Resources
2.4	β-Oxidation of fatty acid	3	E-Resources
UNIT - III			
3.1	Structure of Proteins	3	E-Resources
3.2	Classification of Proteins	3	Chalk & Talk
3.3	Properties of proteins	3	Discussion
3.4	Primary and secondary structures	3	E-Resources
3.5	Tertiary and quaternary structures	3	E-Resources
UNIT - IV			
4.1	Nucleic acid	3	Discussion
4.2	Double helical structure of DNA	3	E-Resources
4.3	Types of DNA	3	E-Resources

4.4	Structure of RNA	3	E-Resources
4.5	Types of RNA	3	E-Resources
UNIT - V			
5.1	Vitamins- definition	1	E-Resources
5.2	Source and deficiency	3	E-Resources
5.3	Fat soluble vitamins	4	Discussion
5.4	Water soluble vitamins	4	E-Resources
5.5	Function of vitamins	3	E-Resources
	Total	**75**	

Course Designer
Dr. P. Sivamanikandan
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC2P	**Basic Microbiology Practical**	**Core - III**	**90**	**3**

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To introduce the basic handling techniques in Microbiology and to understand the basics techniques in biochemistry.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Demonstrate about principle and application of Microscope and sterilization method.	**K1, K2**
CO2	Illustrate about the isolation of bacteria, actinomyces and Fungi from environmental sample	**K1, K2**
CO3	Illustrate about the pure culture technique	**K1, K2**
CO4	Construct the idea of staining techniques	**K1,K2,K3**
CO5	Utilize the basics ideas on biochemical tests	**K1,K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**2**	**3**	**3**
CO2	**2**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**3**
CO5	**2**	**3**	**3**	**2**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**2**	**3**	**3**
CO2	**2**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**3**
CO5	**2**	**3**	**3**	**2**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

Parts working principle and applications of compound microscope.

Sterilization methods: moist heat, dry heat, filtration, disinfectants.

Isolation of bacteria, Actinomycetes and fungi from environmental samples.

Measurement of bacterial size by micrometry method.

Pure culture techniques: streak, spread and pour plate methods.

Staining methods: Gram-staining, endospore-staining.

Observation of bacterial motility by hanging drop method.

Biochemical tests for bacterial identification –

Carbohydrate fermentation.

IMVIC tests.

Catalase test.

Oxidase test.

Starch and Protein hydrolysis.

TSI.

Text Books

Cappuccino and Sherman, ***Microbiology – A Laboratory Manual***, Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2012, 7th Edition.

Gunasekaran P, ***Laboratory Manual in Microbiology***, New Age International (P) Ltd. Publishers, New Delhi, 2008.

Reference Books

Harry W. Seeley JR, Paul J. Van Demark and John J Lee, ***Microbes in Action – A Laboratory Manual of Microbiology***. W. H. Freeman and Company, New York, 1997.

Kanika Sharma, ***Manual of Microbiology Tools and Techniques***, Ane Books Pvt. Ltd., New Delhi. 2009, 2nd edition.

Course Designer

Dr. P. Sivamanikandan

Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UCHA21	Organic, Inorganic and Physical Chemistry - II	Allied-II	60	3

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To identify the concept of photochemistry, coordination compounds, chromatographic technique, chemotherapy and thermodynamic concepts.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Describe the physical concepts of photochemistry	**K1**
CO2	Explain the basic terms, isomerism and theories involved in coordination compound	**K1, K2**
CO3	Apply the column, thin layer and paper chromatographic techniques to separate and identify the components present in a mixture	**K1,K2, K3**
CO4	classify the chemotherapy drugs such as sulpha, antimalarials, antibiotics and arsenical drugs	**K1, K2**
CO5	Identify the concepts of thermodynamics and its significance	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**2**	**3**	**2**
CO2	**3**	**3**	**2**	**2**	**2**
CO3	**3**	**2**	**2**	**3**	**2**
CO4	**3**	**2**	**2**	**3**	**2**
CO5	**3**	**3**	**2**	**2**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**2**	**3**	**2**
CO2	**3**	**3**	**2**	**2**	**2**
CO3	**3**	**2**	**2**	**3**	**2**
CO4	**3**	**2**	**2**	**3**	**2**
CO5	**3**	**3**	**2**	**2**	**2**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 13 Hours

Photochemistry**:** Comparison of thermal and photochemical reactions – definition of photochemical reactions – laws of photochemistry – Grotthus-Draper law – Einstein law – quantum efficiency – reasons for low and high quantum yield with examples – consequence of light absorption by atoms and molecules – Jablonski diagram – fluorescence – phosphorescence photosensitization – chemiluminescence – bioluminescence – applications of photochemistry.

UNIT II 10 Hours

Coordination compounds: Definition – nomenclature – definition of various terms involved in coordination chemistry – classification of ligands-Werner's theory, EAN rule – VB theory – Nickel carbonyl – chelates.

UNIT III 10 Hours

Chromatographic technique: Principle – classification -adsorption and partition Chromatography- thin layer chromatography – column chromatography (adsorption) – paper Chromatography – gas-solid and gas-liquid chromatography- applications of each type- ion exchange chromatography.

UNIT IV 15 Hours

Sulphadiazine – Sulphanilamide – Preparation and applications. Antimalarials: chloroquine and plasmoquine. Arsenical drugs: Salvarasan – 606 and neosalvarasan. Antibiotics: Definition – classification – penicillin - amoxicillin – ampicillin – tetracyclin– streptomycin – mode of application – uses only.

UNIT V 12 Hours

Definition of thermodynamic terms-system and surrounding – isolated, closed and open systems -intensive and extensive properties**-** Thermodynamic processes – reversible and irreversible, isothermal and adiabatic – state and path functions - Second law of thermodynamics - need for second law–Concept of entropy – physical significance of entropy -Gibbs free energy and its significance.

Reference Book

B. S. Bahl & Arun Bahl, ***Advanced Organic Chemistry***, S. Chand & Company, New Delhi, 2009.

B.R. Puri and L.R. Sharma and Madan S. Pathania, ***Principles of Physical Chemistry***, Vishal Publishing Co., Jalandhar, 2005.

R.D. Madan, ***Modern Inorganic Chemistry***, S. Chand, 2013, revised edition,

J. Ghosh, ***Fundamental concepts of Applied Chemistry***, S. Chand & Co. Publishing.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Comparison of thermal and photochemical reactions – definition of photochemical reactions	2	Chalk & Talk
1.2	Laws of photochemistry – Grotthus-Draper law – Einstein law	2	E-Resources
1.3	Quantum efficiency – reasons for low and high quantum yield with examples	3	E-Resources
1.4	Consequence of light absorption by atoms and molecules – Jablonski diagram – fluorescence – phosphorescence	3	Chalk & Talk
1.5	Photosensitization – chemiluminescence – bioluminescence – applications of photochemistry	3	E-Resources
	UNIT - II		
2.1	Coordination compounds: nomenclature – definition of various terms involved in coordination chemistry	3	E-Resources
2.2	Classification of ligands-Werner's theory, EAN rule	3	Chalk & Talk
2.3	Valence Bond theory – Nickel carbonyl – chelates	4	E-Resources

UNIT - III			
3.1	Chromatographic technique: Principle – classification -adsorption and partition Chromatography	3	E-Resources
3.2	Thin layer chromatography – column chromatography (adsorption) – paper Chromatography	3	E-Resources
3.3	Gas-solid and gas-liquid chromatography- applications of each type- ion exchange chromatography	4	Chalk & Talk
UNIT - IV			
4.1	Sulpha drugs – sulphadiazine – sulphanilamide –preparation and applications	4	E-Resources
4.2	Antimalarials: chloroquine and plasmoquine –preparation and applications	3	Chalk & Talk
4.3	Arsenical drugs: Salvarasan – 606 and neosalvarasan-preparation and applications	3	Chalk & Talk
4.4	Antibiotics: Definition – classification – penicillin - amoxicillin – ampicillin – tetracyclin– streptomycin – mode of application – uses only	5	E-Resources
UNIT - V			
5.1	Definition of thermodynamic terms- system and surrounding – isolated, closed and open systems -intensive and extensive properties	4	E-Resources
5.2	Thermodynamic processes – reversible and irreversible, isothermal and adiabatic – state and path functions	4	Chalk & Talk
5.3	Second law of thermodynamics - need for second law–Concept of entropy – physical significance of entropy -Gibbs free energy and its significance	4	E-Resources
	Total	**60**	

Course Designer

Dr. M. Jannathul Firdhouse

Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHA2P	Volumetric Analysis	Allied-III	60	2

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the students to acquire the quantitative skills in volumetric analysis and to calibrate burette, pipette and standard flask.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Build basic quantitative skills in volumetric analysis with the use of burette, pipettes and standard flasks	**K1,K2, K3**
CO2	Apply acidimetric and alkalimetric method for the quantitative volumetric estimation of acids and bases	**K1,K2, K3**
CO3	Estimate the amount of inorganic compounds permanganometrically	**K1,K2, K3**
CO4	Demonstrate the quantitative estimation of Potassium dichromate iodometrically	**K1, K2**
CO5	Plan the laboratory hygiene and safety	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**1**	**3**	**3**	**1**	**2**
CO2	**1**	**3**	**3**	**1**	**2**
CO3	**1**	**3**	**3**	**2**	**2**
CO4	**1**	**3**	**3**	**2**	**2**
CO5	**1**	**3**	**3**	**2**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**3**	**3**	**2**	**1**
CO2	**2**	**3**	**3**	**1**	**1**
CO3	**2**	**2**	**3**	**1**	**1**
CO4	**2**	**2**	**3**	**1**	**1**
CO5	**2**	**1**	**1**	**1**	**1**

1-Low **2-Medium** **3-Strong**

Syllabus

A double titration involving making up of the solution to be estimated or single titration involving making up of the solution to be estimated and the preparation of a primary standard.

I. Acidimetry and Alkalimetry

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

II. Permanganimetry

1. Titrations between potassium permanganate and oxalic acid, ferrous ammonium sulphate (Mohr's salt)

III. Iodometry (Demonstration Only)

1. Titrations of sodium thiosulphate with potassium permanganate and potassium dichromate.

Reference Book

Sundaram, Krishnan, Raghavan, ***Practical Chemistry (Part II),*** S. Viswanathan Co. Pvt., 1996.

B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, ***Vogel's Text Book of Practical Organic Chemistry***. 5th Edition, Pearson Education, 2005.

Course Designer

Dr. M. Kamal Nasar
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UMBC31	Immunology	Core - IV	75	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To understand the structure and functions of immune system and to promote the knowledge of Auto immune diseases.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Illustrate the history of immunology, protective functions innate, as well as acquired body defense and Immune responsible Cells and organs	**K1, K2**
CO2	Demonstrate the structure, character and function of antigen and antibody	**K1, K2**
CO3	Demonstrate the knowledge of Humoral and cell mediated immune responses	**K1, K2**
CO4	Develop the Hypersensitivity and Immune associated diseases	**K1, K2, K3**
CO5	Develop the basics of Transplantation immunology and Tumor Immunology	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**1**	**1**	**1**	**1**	**1**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**1**	**1**	**1**	**1**	**1**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Elements of Immunity: Overview of the Immune system- Basic concepts in immunology (History), principles of innate and acquired immunity - Cells and organs of the immune system.

UNIT II 15 Hours

Antigen – structure, characters, types. Antibody structure: Classification and characterization, agglutination, complement system, immune tolerance.

UNIT III 15 Hours

Humoral and cell mediated immune response: B-cell maturation. Activation and differentiation, Major Histocompatibility complex (MHC) - antigen processing and presentation T and B cell maturation, activation and differentiation.

UNIT IV 15 Hours

Hypersensitivity: Type I, II, III, and IV reactions. Different types of auto immunity, T, B cell, Phagocyte and NK cell associated diseases.

UNIT V 15 Hours

Transplantation immunology: Basics of graft rejection, Tissue typing, Clinical transplantation, Tumor antigen, Immune response to tumor.

Text Books

Ananthanarayanan R. & Jayaram Panicker, C.K. ***Textbook of Microbiology***, Orient Longman, 2005.

Bhatia S. C, ***Textbook of Biotechnology***, Atlantic Publishers & Dist, 2005 .

Ramesh, ***Immunology***, McGraw Hill Education India Private Limited, 2017.

Reference Books

Kuby, J., ***Immunology***, W.H.Freeman and company, NY, 1997, 3rd edition.

Roitt, I.M., ***Essential of immunology***, ELBS, Blackwell scientific publication, 1998.

Travers. J, ***Immunobiology***, The immune system in health and disease-Garland publishers, NY, 1997, 3rd edition.

Pedagogy

Chalk & Talk, E-Resources & Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Overview of the Immune system	3	Chalk & Talk
1.2	Basic concepts in immunology (History)	4	E-Resources
1.3	Principles of innate and acquired immunity	4	Discussion
1.4	Cells and organs of the immune system	4	E-Resources
UNIT - II			
2.1	Structure, characters, types of Antigen	3	E-Resources
2.2	Structure, Classification and characterization of Antibody	5	Discussion
2.3	Agglutination	3	E-Resources
2.4	Complement system	2	E-Resources
2.5	Immune tolerance	2	E-Resources
UNIT - III			
3.1	Humoral and cell mediated immune response	3	Discussion
3.2	B-cell maturation. Activation and differentiation	3	E-Resources
3.3	Major Histocompatibility complex	3	E-Resources
3.4	Antigen processing and presentation	3	E-Resources
3.5	T and B cell maturation, activation and differentiation.	3	E-Resources

UNIT - IV			
4.1	Hypersensitivity-Type I reactions	3	E-Resources
4.2	Hypersensitivity-Type II reactions	3	Discussion
4.3	Hypersensitivity-Type III reactions	3	E-Resources
4.4	Hypersensitivity-Type IV reactions	2	E-Resources
4.5	Different types of auto immunity	2	E-Resources
4.6	T Cell, B cell, Phagocyte and NK cell associated diseases	2	E-Resources
UNIT - V			
5.1	Transplantation immunology	3	Discussion
5.2	Basics of graft rejection	3	E-Resources
5.3	Tissue typing	3	E-Resources
5.4	Clinical transplantation	3	E-Resources
5.5	Tumor antigen	3	E-Resources
	Total	**75**	

Course Designer
Dr. A. Sajith Ahamed
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC32	Cell Biology	Core - V	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To understand the structure and functions of immune system and to promote the knowledge of Auto immune diseases.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Illustrate the history of immunology, protective functions innate, as well as acquired body defense and Immune responsible Cells and organs	**K1, K2**
CO2	Demonstrate the structure, character and function of antigen and antibody	**K1, K2**
CO3	Demonstrate the knowledge of Humoral and cell mediated immune responses	**K1, K2**
CO4	Develop the Hypersensitivity and Immune associated diseases	**K1, K2, K3**
CO5	Develop the basics of Transplantation immunology and Tumor Immunology	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**1**	**1**	**1**	**1**	**1**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	2	2	2	2	2
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Cell structure - Pokaryotic and eukaryotic - Plant and Animal cell – Plasmamembrane - chemistry and ultra-structure - Fluid mosaic model- Protoplasm - chemistry and organization - microtubles and microfilaments.

UNIT II 12 Hours

Cytoplasmic organells in Eukaryotes - ER, Golgicomplex, lysosomes, Mitochondria, Chloroplast, Ribosomes, mesosomes.

UNIT III 12 Hours

Nucleus - structure and functions, chromatin - Eu and Hetero chromatin, chemistry – chromosome – kinds functions, nucleolus – structure – functions -mechanism of photosynthesis and generation of ATP.

UNIT IV 12 Hours

Cell cycle - mitosis and meiosis - interphase and division phase - Cell growth -normal and cancerous.

UNIT V 12 Hours

Microscopy – Types – Light - Electron and Phase contrast microscope structure and function.

Text Books

Verma P. S. and Agarwal V. K.. ***Text book of cytology,*** S. Chand & Co., New Delhi, 1995.

Verma P. S. and Agarwal V. K, ***Text book of Cellbiology, Genetics, Evolution and Ecology***, S. chand & Co., New Delhi.

Reference Books

Albert, Bray, D. Lewis, J. Raff, M. Roberts. K and Watson, J. D, ***Molecular biology of the cell***, NewYork, Garland, 1983.

Krishnamurthy K.V, ***Methods in Plant histochemistry***, S. Viswanathan publications, 1988.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Cell structure-Pokaryotic and eukaryotic	3	Chalk & Talk
1.2	Plant and Animal cell-Plasmamembrane-chemistry and ultra-structure - Fluid mosaic model	3	E-Resources
1.3	Protoplasm-chemistry and organization	3	Discussion
1.4	Microtubles and microfilaments	3	E-Resources
UNIT - II			
2.1	Cytoplasmic organells in Eukaryotes	2	E-Resources
2.2	ER, Golgicomplex	2	Discussion
2.3	Lysosomes	2	E-Resources
2.4	Mitochondria, Chloroplast	3	E-Resources
2.5	Ribosomes, mesosomes	3	E-Resources
UNIT - III			
3.1	Nucleus - structure and functions	3	Discussion
3.2	Shromatin - Eu and chemistry	3	E-Resources
3.3	Hetero chromatin chemistry	2	E-Resources

3.4	Shromosome - kinds functions, nucleolus	2	E-Resources
3.5	Structure – functions - mechanism of photosynthesis and generation of ATP.	2	E-Resources
UNIT - IV			
4.1	Cell cycle-mitosis and meiosis	3	E-Resources
4.2	Interphase and division phase	3	Discussion
4.3	Cell growth-normal	3	E-Resources
4.4	Cell growth-cancerous	3	E-Resources
UNIT - V			
5.1	Microscopy-Types	3	Discussion
5.2	Light Microscopy	3	E-Resources
5.3	Electron Microscopy	3	E-Resources
5.4	Phase contrast microscope -structure and function	3	E-Resources
	Total	**60**	

Course Designer
Ms. M. Musbira Banu
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBA31	General Biology	Allied-IV	60	3

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To introduce about the classification and physiology of plants and understand the physiology of human system.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Discuss about the basic of plant classification.	**K1, K2**
CO2	Discuss about the various fossil genera representing different fossil groups.	**K1, K2**
CO3	Outline of the morphological diversity of bryophytes and pteridophytes.	**K1, K2**
CO4	Indicate the function of important physiological system	**K1,K2**
CO5	Develop the basics of nervous system and explain the muscle movement and sensory perception.	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**2**	**3**	**3**
CO2	**3**	**1**	**2**	**2**	**1**
CO3	**2**	**3**	**3**	**1**	**2**
CO4	**3**	**2**	**2**	**2**	**1**
CO5	**3**	**2**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**1**
CO2	**3**	**2**	**1**	**3**	**3**
CO3	**3**	**1**	**3**	**2**	**3**
CO4	**2**	**2**	**3**	**3**	**2**
CO5	**1**	**3**	**2**	**1**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Basis of classification - units of classification - Species, Genus, Family – Nomenclature - Binomial system. Bentham and hooker system of classification of plants.

UNIT II 12 Hours

Morphology, structure and reproduction of plants. Algae-General characters and classification- sargassum as an example. Fungi- General characters and classification- Yeast as an example. Bryophytes- General characters and classification- Funaria as an example.

UNIT III 12 Hours

Pteridophytes - Selaginella, heterospory and seed habit. Gymnosperm – Pinus - economic uses of gymnosperm. Angiosperm - Monocot plant - Allium sp, Dicot plant - Tribulus terrestris.

UNIT IV 12 Hours

Human physiology - Structure and function of Digestive system - Respiratory system - circulatory system-Blood and their properties - Excretory system.

UNIT V 12 Hours

Muscular system - Nervous system - Endocrine glands - Reproductive system – Hormones - menstrual cycle.

Text Books

E. L. Jordan and verma. ***Invertebrate Zoology***, S. Chandra & Co, New Delhi, 2009, Revised edition.

E. L. Jordan and verma. ***Chordate Zoology***, S. Chandra & Co, New Delhi, 2013, 14th edition.

W. T. tailor and R. J. Wehe, ***Textbook of General Biology***, East West press Pvt. Ltd. 2005, 3rd edition.

Reference Books

A. C D utta, ***Botany for Degree students***, Oxford university press, 1997, 6th edition.

Pedagogy

Chalk & Talk & E-Resources

Teaching aids

Black Board & LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Basis of classification	3	Chalk & Talk
1.2	Units of classification - Species, Genus, Family	3	E-Resources
1.3	Nomenclature - Binomial system	3	Discussion
1.4	Bentham and hooker system of classification of plants	3	E-Resources
UNIT - II			
2.1	Morphology, structure and reproduction of plants	2	E-Resources
2.2	Algae-General characters and classification	2	Discussion
2.3	Sargassum as an example	2	E-Resources
2.4	Fungi - General characters and classification	2	E-Resources
2.5	Yeast as an example	2	E-Resources
2.6	Bryophytes - General characters and classification - Funaria as an example.	2	E-Resources
UNIT - III			
3.1	Pteridophytes-Selaginella, heterospory and seed habit	3	E-Resources
3.2	Gymnosperm – Pinus - economic uses of gymnosperm	3	Chalk & Talk
3.3	Angiosperm - Monocot plant - Allium sp	3	Discussion
3.4	Dicot plant - Tribulus terrestris.	3	E-Resources

UNIT - IV			
4.1	Human physiology	2	Discussion
4.2	Structure and function of Digestive system	2	E-Resources
4.3	Respiratory system	2	E-Resources
4.4	circulatory system	2	E-Resources
4.5	Blood and their properties	2	E-Resources
4.6	Excretory system	2	E-Resources
UNIT - V			
5.1	Muscular system	2	Chalk & Talk
5.2	Nervous system	2	E-Resources
5.3	Endocrine glands	2	E-Resources
5.4	Reproductive system	2	E-Resources
5.5	Hormones	2	Discussion
5.6	menstrual cycle	2	E-Resources
	Total	**60**	

Course Designer
Ms. R. Selvakani
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC41	**Molecular Biology & Microbial Genetics**	**Core - VI**	**75**	**4**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To make the students understand the central dogma of life and to familiarize the basic concepts of Molecular Biology & Microbial Genetics.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Develop the basic composition, structure, complementary base pairing and types of DNA with its organized genomic structure	**K1, K2, K3**
CO2	Illustrate the role of complementary base pairing in the precise replication process of DNA	**K1, K2**
CO3	Illustrate the knowledge of genetic *transcription of* prokaryotes and Eukaryotes	**K1, K2**
CO4	Utilize the protein expression form the mRNA	**K1, K2, K3**
CO5	Utilize the basic studies in of environmental genomic entry in to the cell	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**3**	**2**
CO4	**2**	**2**	**2**	**1**	**3**
CO5	**3**	**3**	**1**	**2**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**3**	**2**
CO4	**2**	**2**	**2**	**1**	**3**
CO5	**3**	**3**	**1**	**2**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Structural aspects of DNA and RNA - double helical model - various forms of DNA – tRNA – rRNA - Genome organization – Eukaryotes.

UNIT II 15 Hours

Replication - Semi conservative mode of replication - Enzymology of Replication - The processes of DNA replication - Eukaryotic replication.

UNIT III 15 Hours

Transcription - prokaryotes and Eukaryotes - Enzymology of Transcription - process of transcription in prokaryotes and Eukaryotes – initiation, elongation and termination - factors involved.

UNIT IV 15 Hours

Translation - Translation in prokaryotes - Enzymology of Translation - process of translation in prokaryotes – initiation, elongation and termination - factors involved. The triplet nature of genetic codon.

UNIT V 15 Hours

Transformation – Griffith experiment - conjugation (F^+ x F^-, Hfr^+ x F^-) Transduction – generalized and specialized.

Text Books

Malathi V, ***Molecular Biology***, Pearson Education India. 2008

Agarwal V.K, ***Simplified course in Molecular Biology*** S. Chands & company ltd Publication, New Delhi, India, 2000.

Reference Books

Benjamin Lewin, ***Gene VII***, Oxford University Press, 2000.

Watson, Hopkins, Roserts, Steits and Weiner, ***Molecular biology of the Gene,*** The Benjamin/Cumming Publishing Company, Inc. 1987, 4th edition.

Larry Snyder and Wendy Champness, ***Molecular Genetics of Bacteria,*** ASM press, Washington DC, 2003, 2nd edition

David Friefelder, ***Molecular Biology***, Narosa Publishing House, 1987

Pedagogy

Chalk & Talk & E-Resources

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Double helical model	3	Chalk & Talk
1.2	various forms of DNA	3	E-Resources
1.3	tRNA structure	3	Discussion
1.4	rRNA structure	3	E-Resources
1.5	Genome organization in Eukaryotes	3	E-Resources
UNIT - II			
2.1	Semi conservative mode of replication	2	E-Resources
2.2	Enzymology of Replication	3	Discussion
2.3	The processes of DNA replication	5	E-Resources
2.4	Eukaryotic replication	5	E-Resources
UNIT - III			
3.1	Prokaryotic and Eukaryotic transcription	4	Discussion
3.2	Enzymology of Transcription	4	E-Resources
3.3	Process of transcription in prokaryotes and Eukaryotes	4	E-Resources
3.4	Factors involved in transcription	3	E-Resources
UNIT - IV			
4.1	Translation in prokaryotes	3	E-Resources
4.2	Enzymology of Translation	3	Discussion
4.3	Process of translation in prokaryotes	3	E-Resources
4.4	Factors involved in Translation	3	E-Resources
4.5	The triplet nature of genetic codon	3	E-Resources

UNIT - V			
5.1	Transformation	4	Discussion
5.2	Griffith experiment	4	E-Resources
5.3	Conjugation	4	E-Resources
5.4	Transduction	3	E-Resources
	Total	**75**	

Course Designer
Dr. A. Sajith Ahamed
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC42	Microbial Physiology	Core - VII	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To create awareness among the students about Microbial Physiology. To understand the importance of Microbial Metabolism and Bacterial life cycle.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Discuss and gain knowledge of importance of ATP and its mode of regeneration.	**K1, K2**
CO2	Determine about the Bacterial cell division and differentiation	**K1, K2, K3**
CO3	Complete Knowledge of photosynthesis and inorganic metabolism	**K1, K2, K3**
CO4	Illustrate the concept of transport of sugars and metabolites.	**K1, K2**
CO5	Apply the Morphology and life cycles of gliding and fruiting bacteria.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**1**	**3**	**1**
CO2	**3**	**2**	**1**	**2**	**3**
CO3	**3**	**1**	**2**	**2**	**3**
CO4	**3**	**2**	**1**	**3**	**2**
CO5	**3**	**3**	**1**	**2**	**1**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**1**
CO2	**3**	**3**	**2**	**3**	**3**
CO3	**2**	**3**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**1**	**3**
CO5	**1**	**2**	**3**	**3**	**2**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Generation of Energy – Entropy, generation of ATP – substrate level phosphorylation, oxidative phosphorylation, proton motif force.

UNIT II 12 Hours

Bacterial cell division and differentiation – Cell wall synthesis and cell division in Bacteria, life cycle of *Bacillus*, stages of endospore formation, germination and outgrowth-Growth curve.

UNIT III 12 Hours

Photosynthesis and inorganic metabolism – Photosynthesis in bacteria. Assimilation of inorganic phosphorus, sulfur and nitrogen in bacteria – sulfate reduction pathway, ammonia assimilation pathway, nitrogenase and nitrogen fixation.

UNIT IV 12 Hours

Transport of sugars and metabolites – active, passive and facilitated transport systems, chemiosmosis, ion gradients. Secretion in bacteria – Type of secretion systems.

UNIT V 12 Hours

Morphology and life cycles – *Hyphobacterium* and *Caulobacter*. Gliding bacteria and gliding motility, life cycle of fruiting bacteria – Myxobacteria. Sporulation in fungi.

Text Books

Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. ***Microbiology.*** *Tata* McGraw Hill Publishing Co., Ltd., New Delhi.1993

Reference Books

Prescott, L.M J.P. Harley and C.A. Klein, ***Microbiology,*** C.Brown publishers, 1995, 2nd edition.

Schlegel, H.G., ***General Microbiology,*** Cambridge University Press, Cambridge, 1993.

Moat AG, Foster JW and Spector MP, ***Microbial Physiology,*** Wiley-Liss, 2002, 4th edition.

Pedagogy

Chalk & Talk & E-Resources

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Entropy	1	Chalk & Talk
1.2	Generation of ATP	3	E-Resources
1.3	Substrate level phosphorylation.	3	E-Resources
1.4	Oxidative phosphorylation.	3	Discussion
1.5	Proton motif force.	2	E-Resources
UNIT - II			
2.1	Cell wall synthesis in bacteria	2	Chalk & Talk
2.2	Cell division in Bacteria.	2	E-Resources
2.3	Life cycle of *Bacillus*.	2	E-Resources
2.4	Stages of endospore formation,	2	E-Resources
2.5	Germination and outgrowth.	2	Discussion
2.6	Growth curve.	2	E-Resources
UNIT - III			
3.1	Photosynthesis in bacteria.	2	E-Resources
3.2	Assimilation of inorganic phosphorus	1	Chalk & Talk
3.3	Assimilation of sulfur in bacteria	1	E-Resources
3.4	Assimilation of nitrogen in bacteria	3	E-Resources
3.5	Sulfate reduction pathway.	1	E-Resources
3.6	Ammonia assimilation pathway.	2	Chalk & Talk
3.7	Nitrogenase and nitrogen fixation.	2	E-Resources

UNIT - IV			
4.1	Active transport system	2	Chalk & Talk
4.2	Passive transport system	2	E-Resources
4.3	Facilitated transport system	2	E-Resources
4.4	Chemiosmosis, ion gradient.	2	E-Resources
4.5	Secretion in bacteria – Type of secretion systems	4	Discussion
UNIT - V			
5.1	Life cycle of *Hyphobacterium*	2	E-Resources
5.2	Life cycle of *Caulobacter*.	2	E-Resources
5.3	Gliding bacteria and gliding motility	2	E-Resources
5.4	Life cycle of fruiting bacteria - Myxobacteria	3	Chalk & Talk
5.5	Sporulation in fungi	3	E-Resources
	Total	**60**	

Course Designer
Ms. M. Musbira Banu
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC2P	Immunology and Molecular Biology Practical	Core - VIII	90	4

Nature of Course	
Knowledge Oriented	
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To introduce the basic handling techniques in Immunology and Molecular biology.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Demonstrate about principle and estimation of carbohydrate and Protein.	**K1, K2**
CO2	Illustrate about the isolation of DNA from E. coli	**K1,K2**
CO3	Illustrate about the electrophoresis method	**K1, K2**
CO4	Construct the idea of Blood cell count method	**K1,K2,K3**
CO5	Utilize the basics ideas on Immuno electrophoresis methods	**K1,K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**
CO5	**2**	**3**	**2**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**
CO5	**2**	**3**	**2**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

pH meter- principle and measurements.
Estimation of Carbohydrates.
Estimation of Proteins (Lowry's method).
Separation of amino acids by Paper chromatography.
Isolation of DNA from *E. coli.*
Separation of DNA by Agarose gel electrophoresis.
Separation of Proteins by SDS-PAGE.
Separation of serum / plasma.
Blood cell count: RBC count.
WBC count – Total and differential.
Blood typing: ABO, Rh.
Agglutination tests: Widal test.
Precipitation: Ouchterlony's double immune diffusion.
Immuno electrophoresis.
Effect of temperature on bacterial growth.
Effect of pH on bacterial growth.

Text books

Keith Wilson and John Walker, ***Principles and Techniques of Practical Biochemistry***, Cambridge University press, Britain, 1995, 4th edition.

Reference Books

Oser BL Hawks, ***Physiological Chemistry***, TATA Mc Graw Hill, 1965.
Shawn O' Farrell and Ryan T Ranallo, ***Experiments in Biochemistry: A Hands on Approach-A manual for the undergraduate laboratory,*** Thomson Learning, Inc., Australia, 2000.

Course Designer

Dr. A. Sajith Ahamed
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBA41	Genetics and Biostatistics	Allied - V	60	3

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To introduce the importance of statistics in life science and understand the basics of Mendel genetics.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Outline the nature of genetic inheritance	**K1, K2, K3**
CO2	Discuss of DNA coding that occupies a given locus on a chromosome.	**K1, K2**
CO3	Express is no lack of data floating around most education and social programs.	**K1, K2, K3**
CO4	Discuss the assessment criteria specify the minimum requirement for the dates.	**K1, K2**
CO5	Learn about statistical analysis	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**1**	**3**	**1**
CO2	**3**	**2**	**1**	**2**	**3**
CO3	**3**	**2**	**2**	**2**	**3**
CO4	**3**	**2**	**1**	**3**	**2**
CO5	**3**	**3**	**1**	**2**	**1**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	3
CO2	3	3	3	3	1
CO3	3	1	2	2	3
CO4	3	2	3	3	2
CO5	3	3	3	1	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Mendelian Genetics - Mendel's works, experiments, observations and results -mendel'slaws – Terms - Back cross, Test cross - complete and incomplete dominance - co dominance.

UNIT II 12 Hours

Allelic interaction - Multiple Alleles - blood group inheritance - Rh factor - Multiple gene inheritance - genes and chromosomes - crossing over and linkage, chromosomal aberration.

UNIT III 12 Hours

Biostatistics – Introduction - Data collection - Types of data – Primary and secondary data - sampling and sampling designs-random and non-random sampling.

UNIT IV 12 Hours

Representation of data – Diagrammatic - Simple bar diagram, Pie diagram - graphical representation - Histogram, frequency curve, cumalative frequency curve - Measures of central tendency – Explanation - Types of average - Arithmetic mean – median – Mode - Continuous series - discrete series.

UNIT V 12 Hours

Measures of dispersion – Explanation – Types – range - Mean deviation - Standard deviation – Varience - correlation and regression, ANOVA - one way.

Text Books

N. Gurumani. ***An introduction to Biostatistics,*** Mjp publishers, 2005, 2nd edition.

Pillai. R.S.N and bhagavathi, ***Text book of Statistics.*** 2003, Elsevier India, 2nd edition.

Reference Books

Edmund. W Sinnot, Dunn, L.C ***Principles of Genetics,*** Mc Graw - Hill Inc, US, 1984, 5th edition.

David Frifielder, ***Molecular Biology***, Jones and Bartlett Publishers, 1985.

Pedagogy

Chalk & Talk & E-Resources

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Mendelian Genetics	3	Chalk & Talk
1.2	Mendel's works, experiments, observations and results	3	E-Resources
1.3	Mendel's laws	2	Discussion
1.4	Terms - Back cross, Test cross	2	E-Resources
1.5	Complete and incomplete dominance-co dominance	2	E-Resources
UNIT - II			
2.1	Allelic interaction	2	E-Resources
2.2	Multiple Alleles-blood group inheritance-Rh factor	2	Discussion
2.3	Multiple gene inheritance	2	E-Resources
2.4	Genes and chromosomes	2	E-Resources
2.5	Crossing over	2	E-Resources
2.6	Linkage,	1	E-Resources
2.7	Chromosomal aberration	1	E-Resources
UNIT - III			
3.1	Biostatistics - Introduction	3	E-Resources
3.2	Data collection - Types of data - primary and secondary data	3	Chalk & Talk
3.3	sampling and sampling designs	3	Discussion
3.4	Random and non-random sampling	3	E-Resources

UNIT - IV			
4.1	Representation of data	2	Discussion
4.2	Diagrammatic - simple bar diagram, Pie diagram	2	E-Resources
4.3	Graphical representation - Histogram	2	E-Resources
4.4	Frequency curve, cumalative frequency curve	2	E-Resources
4.5	Measures of central tendency – Explanation - Types of average - Arithmetic mean – Median – Mode - Continuous series - Discrete series	4	E-Resources
UNIT - V			
5.1	Measures of dispersion – Explanation – Types – range - Mean deviation - Standard deviation	4	Chalk & Talk
5.2	Varience - Correlation and regression	4	E-Resources
5.3	ANOVA - one way	4	E-Resources
	Total	**60**	

Course Designer
Ms. R. Selvakani
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBA4P	Allied Biology Practical -I	Allied - VI	60	2

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To introduce about the basic structure of cell and to understand the mechanism of various cell regulation.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Illustrate the section cutting of stem - Sargassum, Selaginella and Pinus needle	**K1, K2**
CO2	Demonstrate the external and digestive, reproductive and urogenital system of cockroach and frog	**K1, K2**
CO3	Demonstrate the morphology of the representative for each phylum spotters.	**K1, K2**
CO4	Experiment with mitosis by smear technique of Allium cepa root.	**K1, K2,K3**
CO5	Experiment with blood grouping, Rh factors, blood cells and blood vessels of human.	**K1, K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**1**	**1**	**1**	**1**	**1**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	1
CO2	2	2	2	2	2
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

Vegetative structure in sargassum, yeast, funaria, seleginella and pinus (section cutting of Sargassum and Selaginella, pinus stem and needles)
Structure of monocot flower - *Allium cepa*
Study of mitosis by smear technique of *Allium cepa* root.
Cockroach - external and digestive system and reproductive system.
Frog - External, digestive system, urogenital system and brain (spotters only).
Morphology of the representative for each phylum spotters only - Paramecium, Hydra, Tania, Ascaris, earthworm, Prawn, Pila, Starfish, rat.
Determination of blood groups & Rh factors.
Determination of haemoglobulin.
Law of probability.
Estimation of dissolved Oxygen in different water samples.
Estimation of Alkalinity in different water samples.
Soil testing for pH, alkalinity, nitrate and phosphates.
Problems in Measures of centrel tendencies - Mean, median and Mode.
Problems in Measures of dispersion - Standard deviation.

Text Books

George William Hunter, ***Elements of Biology; a Practical Text Book Correlating Botany, Zoology, and Human Physiology***, Creative Media Partners, LLC, 2018.

Course Designer

Ms. R. Selvakani,
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC51	Medical Microbiology	Core - IX	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To promote the basic knowledge of medically important human diseases with respect to their causative agent, clinical symptoms, pathogenesis, mode of transmission, prevention and treatment.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Discuss the basics of infection and the mechanism of pathogenesis	**K1, K2**
CO2	Discuss the diagnosis, symptoms, and treatment of microbial diseases	**K1, K2**
CO3	Outline the diseases caused by bacteria	**K1, K2**
CO4	Identify the diseases caused by Virus	**K1,K2,K3**
CO5	Determine the Fungal and protozoan diseases	**K1,K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**3**	**2**
CO4	**2**	**2**	**2**	**1**	**3**
CO5	**3**	**3**	**1**	**2**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	2	3	2	3
CO3	3	3	2	3	2
CO4	2	2	2	1	3
CO5	3	3	1	2	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Infection - sources of infections- Types of infections- epidemiology of infectious diseases – Human – microbe interactions - mechanism of pathogenesis

UNIT II 15 Hours

Diagnosis and control of microbial diseases – Collection and identification of pathogens from the specimen of Urine, sputum and throat swab. - Antimicrobial chemotherapy and susceptibility testing. Mechanism of action of β-lactams (penicillin & cephalosporin) - drugs affecting protein synthesis (Tetracycline and amino glycoside) and Sulfa drugs – Mode of action of antiviral, anti protozoan and antifungal drugs.

UNIT III 15 Hours

Bacterial diseases: Transmission, diagnosis, clinical symptoms, prophylaxis and treatment for bacterial diseases- plague, tuberculosis, cholera, typhoid, and Staphylococcal diseases

UNIT IV 15 Hours

Viral diseases: Epidemiology, prophylaxis, clinical symptoms and treatment for human viral diseases. Rabies, hepatitis, poliomyelitis, AIDS.

UNIT V 15 Hours

Fungal and protozoan diseases: Superficial mycoses, Cutaneous mycoses, systemic mycoses, opportunistic mycoses. Life cycle, diagnosis and treatment of following protozoan diseases – amoebiasis, malaria.

Text Books

Ananthanarayanan R and Jeyaram Paniker C K, ***Textbook of Microbiology***, University Press, 2013, 9th edition.

Mackie and Mc cartney, ***Medical Microbiology*** No I and II. Churchill Livingston, 1994, 14th edition.

Reference Books

Bailey and Scotts, ***Diagnostic Microbiology***, Baron and Finegold CV Mosby Publications, 1994, 9th edition.

Jawetz, E. Melnic, JL, & Adelberg, E A. ***Medical microbiology,*** McGraw Hill Companies, 2004, 22nd edition.

Mims, C. Playfair, J Roitt, I, Wakelin, D. & Williams, R. ***Medical Microbiology*****,** Mosby publications, 2004, 3rd edition.

Prescott, Harley and Klein, ***Microbiology*****,** The McGraw-Hill Companies, 2008, 6th edition

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Infection.	2	Chalk & Talk
1.2	Sources of infections.	2	E-Resources
1.3	Types of infections.	3	Discussion
1.4	Epidemiology of infectious diseases.	2	E-Resources
1.5	Human – microbe interactions.	3	E-Resources
1.6	Mechanism of pathogenesis.	3	Discussion
UNIT - II			
2.1	Collection and identification of pathogens from Urine, Sputum and Throat swab.	3	E-Resources
2.2	Antimicrobial chemotherapy and susceptibility testing.	3	Discussion
2.3	Mechanism of action of β-lactams (penicillin & cephalosporin).	3	E-Resources
2.4	Drugs affecting protein synthesis (Tetracycline and amino glycoside) and Sulfa drugs.	3	E-Resources
2.5	Antiviral, anti protozoan and antifungal drugs.	3	E-Resources

UNIT - III			
3.1	Transmission, diagnosis, clinical symptoms, prophylaxis and treatment for Plague	3	E-Resources
3.2	Tuberculosis	3	Chalk & Talk
3.3	Cholera	3	Discussion
3.4	Typhoid	3	E-Resources
3.5	Staphylococcal diseases	3	E-Resources
UNIT - IV			
4.1	Rabies	4	Discussion
4.2	Viral hepatitis	4	E-Resources
4.3	Poliomyelitis	3	E-Resources
4.4	AIDS	4	E-Resources
UNIT - V			
5.1	Superficial mycoses	3	Chalk & Talk
5.2	Cutaneous mycoses	3	E-Resources
5.3	Systemic mycoses and opportunistic mycoses	3	E-Resources
5.4	Amoebiasis	3	E-Resources
5.5	Malaria	3	Discussion
	Total	**75**	

Course Designer
Dr. P. Sivamanikandan
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC52	**Agriculture & Environmental Microbiology**	**Core - X**	**60**	**4**

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	✓
Regional	✓
National	
Global	

Preamble

To understand the role of microbes in agriculture and environment and to create awareness about biofertilizer and disease management.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Discuss the basics of soil microbes and plant microbe interaction	**K1, K2**
CO2	Find the plant pathogenic microbes.	**K1, K2, K3**
CO3	Apply the control of plant diseases	**K1, K2, K3**
CO4	Outline the idea of biofertilizers	**K1, K2**
CO5	Determine the role of microbes in biogeochemical cycles and waste treatment	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**3**
CO3	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**2**	**1**	**1**
CO5	**3**	**1**	**1**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3
CO2	3	3	2	2	3
CO3	2	3	3	3	2
CO4	3	2	2	1	1
CO5	3	1	1	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Soil microbes: Bacteria, Fungi and Actinomycetes (distribution)–Microbial interaction: mutualism, amensalism and commensalisms - Soil enzymes – Plant microbial interactions- N_2 fixation, symbiotic and free living- phosphate solubilization– Mycorrhizal association; ecto and Endomycorrhizae.

UNIT II 12 Hours

Plant microbe interactions - pathogenesis, mechanism of pathogen establishment and symptoms. Plant diseases caused by Bacteria, *Xanthomonas, Mycoplasma,* Fungi, *Pyricularia, Fusarium* and Viruses, TMV.

UNIT III 12 Hours

Disease control - Fungicides, Pesticides, Biological control mechanisms - Production of bioinsecticides - Bacillus thuringiensis.

UNIT IV 12 Hours

Biofertilizers: production and methods of application –Rhizobium biofertilizer, BGA biofertilizer, Azolla-Anabaena biofertilizer –microbial herbicides – Biotechnology in Agriculture: Bt. cotton and herbicide tolerant plants. PGPR.

UNIT V 12 Hours

Role of microorganisms in biogeochemical cycles (N, P and C cycles) – Biodegradation of xenobiotics (chlorinated pesticides) – MEOR - bioleaching of metals – microbes in waste treatment: solid waste (sanitary land fill and composting) and liquid waste – sewage treatment.

Text Book

Rangasami G and Bagyaraj DJ, Agricultural ***Microbiology*** Prentice - Hall publications, 1993, 2nd edition.

Reference Books

Ronald Atlas, Bartha, Richard, ***Microbial ecology***, Benjamin-Cummings publications, 1987, 2nd edition

Prescott, Harley and Klein, ***Microbiology*****,** The McGraw-Hill Companies, 2008, 6th edition

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Bacteria, Fungi and Actinomycetes (Distribution)	2	E-Resources
1.2	Microbial interaction: mutualism, amensalism and commensalisms	2	E-Resources
1.3	Soil enzymes	2	Discussion
1.4	Plant microbial interactions- N_2 fixation, symbiotic and free living	2	E-Resources
1.5	Phosphate solubilization	1	Chalk & Talk
1.6	Mycorrhizal association; ecto and Endomycorrhizae	3	Discussion
UNIT - II			
2.1	Plant microbe interactions	2	E-Resources
2.2	Pathogenesis, mechanism of pathogen establishment and symptoms.	3	Discussion
2.3	Plant diseases caused by Bacteria, *Xanthomonas, Mycoplasma,*	2	E-Resources
2.4	Fungi, *Pyricularia, Fusarium* and	3	E-Resources
2.5	Viruses-TMV.	2	Chalk & Talk
UNIT - III			
3.1	Disease control	2	E-Resources
3.2	Fungicides	2	Chalk & Talk

3.3	Pesticides, Biological control mechanisms	4	Discussion
3.4	Production of bioinsecticides - Bacillus thuringiensis.	4	E-Resources
UNIT - IV			
4.1	Production and methods of application - Rhizobium biofertilizer	2	Discussion
4.2	BGA biofertilizer	3	E-Resources
4.3	Azolla - Anabaena biofertilizer	2	E-Resources
4.4	Microbial herbicides	3	E-Resources
4.5	Biotechnology in Agriculture: Bt. cotton and herbicide tolerant plants. PGPR.	2	Discussion
UNIT - V			
5.1	N, P and C cycles	2	Discussion
5.2	Biodegradation of xenobiotics (chlorinated pesticides)	3	E-Resources
5.3	MEOR	2	E-Resources
5.4	Bioleaching of metals	3	E-Resources
5.5	Microbes in waste treatment: solid waste (sanitary land fill and composting) and liquid waste – sewage treatment.	2	Discussion
	Total	**60**	

Course Designer
Mr. RM. Lakshmanan
Associate Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC53	Biochemical Techniques	Core - XI	60	4

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To introduce the basic principles and applications of various techniques. To understand the working mechanisms of the instruments.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Discuss about basics of Chromatography	**K1, K2**
CO2	Identify about the Advanced biochemical Techniques	**K2, K3**
CO3	Determine the Knowledge of Electrophoresis Techniques	**K1, K3**
CO4	Explain the idea of Centrifugation	**K1,K2**
CO5	Apply the role of PCR and Spectrophotometer	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**3**
CO3	**2**	**2**	**3**	**3**	**2**
CO4	**2**	**3**	**3**	**1**	**1**
CO5	**3**	**1**	**2**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3
CO2	3	3	2	2	3
CO3	2	2	3	3	2
CO4	2	3	3	1	1
CO5	3	1	2	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Chromatography: Paper Chromatography, Thin Layer Chromatography, Column Chromatography, gel filtration Chromatography and Affinity Chromatography.

UNIT II 12 Hours

Advanced biochemical Techniques: Gas Chromatography, HPLC, Ion exchange Chromatography and Dialysis.

UNIT III 12 Hours

Electrophoresis - Principle and application of electrophoresis - Agarose Gel electrophoresis, SDS-PAGE.2D Gel electrophoresis.

UNIT IV 12 Hours

Centrifugation-Principle and application-Types of centrifugation – Differential centrifugation and Density gradient centrifugation

UNIT V 12 Hours

PCR and Spectrophotometer - Principles and applications of PCR- Real Time -PCR, Gradient PCR, Spectrophotometer - Simple Spectrophotometer, UV Spectrophotometer, NMR.

Text Book

Palanivelu. P ***Analytical Biochemistry and separation Techniques***, 21st century publications, Palkalai nagar, Madurai, 2000

Reference Books

John F. Robyt, Bernard J. White, ***Biochemical Techniques***, CBS Publishers & Distributors, 2015.

Wilson and Walkers, ***Practical Biochemistry,*** 2018

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Paper Chromatography	2	Discussion
1.2	Thin Layer Chromatography	2	E-Resources
1.3	Column Chromatography	2	E-Resources
1.4	Gel filtration Chromatography	3	E-Resources
1.5	Affinity Chromatography	3	Discussion
UNIT - II			
2.1	Gas Chromatography	3	E-Resources
2.2	HPLC	3	E-Resources
2.3	Ion exchange Chromatography	3	E-Resources
2.4	Dialysis	3	Chalk & Talk
UNIT - III			
3.1	Principle and application of electrophoresis	3	E-Resources
3.2	Agarose Gel electrophoresis	3	E-Resources
3.3	SDS-PAGE	3	E-Resources
3.4	2D Gel electrophoresis	3	Chalk & Talk
UNIT - IV			
4.1	Principle and application of Centrifugation	3	E-Resources
4.2	Types of centrifugation	3	E-Resources
4.3	Differential centrifugation	3	E-Resources
4.4	Density gradient centrifugation	3	Chalk & Talk
UNIT - V			
5.1	Principles and applications of PCR	2	Chalk & Talk
5.2	Real Time -PCR	2	E-Resources
5.3	Gradient PCR	2	E-Resources
5.4	Simple Spectrophotometer	2	E-Resources
5.5	UV Spectrophotometer	2	E-Resources
5.6	NMR	2	E-Resources
	Total	**60**	

Course Designer

Mrs. M. Musbira Banu

Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBE51	Bioinformatics	Elective - I	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To promote the basics of computer and to understand the applications of computer in life science.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Demonstrate about the computer, its basic hardware and software devices.	**K1, K2**
CO2	Illustrate about the basic MS office software	**K2**
CO3	Illustrate knowledge of DNA and Protein databases and its downloading systems	**K1, K2**
CO4	Construct the idea of DNA sequencing methods and Computational knowledge in functional regions of DNA and proteins	**K1,K2,K3**
CO5	Utilize the basics of sequence alignment and Phylogenetic analysis including its related soft wares	**K1,K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Components of computers input/output devices, Storage devices, Graphic devices, Operations system- MS DOS & WINDOWS - Networks-HTTP, HTML, Internet

UNIT II 12 Hours

Use of commercial software: MS word, Windows, Power Point, MS Excel

UNIT III 12 Hours

Biological databases- DNA databases-NCBI, DDBJ and protein databases – PIR, SWISS PROT. Collection and downloading information from databases –SRS

UNIT IV 12 Hours

DNA sequencing methods - Maxum gilbert and Sanger coulsan methods. Pattern, motifs and profiles

UNIT V 12 Hours

Sequence alignment –Pairwise and multiple sequence alignment, FASTA, BLAST and CLUSTAL. Phylogenetic analysis

Text Books

Anonymous, ***A directory – DBT, Data basis in life sciences and Biotechnology: Govt. of India*****,** India, March 1995, 1st edition.

Sharma V, Munjal A, and Shanker A, ***A text book of bioinformatics*****,** Rastogi Publications, Meerut, India, 2008, 1st edition.

Reference Books

Rawlings J. C, ***Software Directory for molecular Biologists Stockton Press***, Mac Millan Publishers, New Delhi, India, 1986, 1st edition.

Kamp R. M, Choli-Papadaopoulu T, Liebold B. W, ***Protein Structure Analysis – Springer Lab Manual***. Switzerland, 1977, 1st edition.

Bryant T. N, Wimpenny J. W. T. ***Computer in microbiology - a practical approach***, IRL Press, Washington DC, 1989, 1st edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Input/output devices	2	Discussion
1.2	Storage devices	2	Discussion
1.3	Graphic devices	2	E-Resources
1.4	Operations system	2	E-Resources
1.5	MS DOS & WINDOWS – Networks	2	E-Resources
1.6	HTTP, HTML, Internet	2	E-Resources
UNIT - II			
2.1	MS word	3	E-Resources
2.2	Windows	3	E-Resources
2.3	Power Point	3	E-Resources
2.4	MS Excel	3	E-Resources
UNIT - III			
3.1	DNA databases-NCBI, DDBJ	3	E-Resources
3.2	Protein databases –PIR, SWISS PROT	3	E-Resources
3.3	Collection and downloading information from databases	3	Discussion
3.4	SRS	3	Chalk & Talk
UNIT - IV			
4.1	Maxum gilbert methods	3	E-Resources
4.2	Sanger coulsan methods	3	E-Resources
4.3	Pattern	2	E-Resources
4.4	Motifs	2	E-Resources

4.5	Profiles	2	Discussion
UNIT - V			
5.1	Pairwise sequence alignment	2	E-Resources
5.2	Multiple sequence alignment	2	E-Resources
5.3	FASTA	2	E-Resources
5.4	BLAST	2	E-Resources
5.5	CLUSTAL	2	E-Resources
5.6	Phylogenetic analysis	2	E-Resources
	Total	**60**	

Course Designer
Dr. A. Sajith Ahamed
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBE52	Medical Lab Technology	Elective - I	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	✓
Regional	
National	
Global	✓

Preamble

To promote the basics of Clinical lab analysis, to understand about the Hematology and immunology.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Describe the basics of infection and mechanism of pathogenesis.	**K1, K2**
CO2	Determine the diagnosis and treatment of microbial diseases	**K2, K3**
CO3	Develop knowledge of diseases caused by bacteria	**K1, K3**
CO4	Explain the idea of diseases caused by Virus	**K1,K2**
CO5	Determine the Fungal and protozoan diseases	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**1**	**2**	**1**
CO3	**2**	**3**	**2**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**2**
CO5	**1**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**1**	**2**	**3**
CO3	**2**	**3**	**2**	**3**	**3**
CO4	**2**	**3**	**3**	**3**	**1**
CO5	**3**	**1**	**3**	**2**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Clinical Hematology: Abnormal hemoglobin: anemia, Blood clotting mechanism. Collection and preservation of blood, Anticoagulants and Normal hematological values.

UNIT II 12 Hours

Urine analysis: Collection and preservation of urine, Macroscopic and microscopic examination of urine culture, chemical examinations of urinary calculi.

UNIT III 12 Hours

Immunological Diagnosis: Collection and preservation of serum for Immunological analysis, Measurement of Antibodies, Agglutinations reaction, Widal test, serological tests for syphilis, VDRL slide flocculation test, ELISA.

UNIT IV 12 Hours

Molecular Biology Techniques: Plasmid Analysis, Polymerase chain reaction for detection of diseases, sample processing for DNA extraction, DNA finger printing.

UNIT V 12 Hours

Blood Banking: Complete Haemogram: grouping & "Rh" typing. Blood banking: Blood collection, screening, storage, cross matching and Blood transfusion.

Text Book

M. Mukerjee, ***Medical laboratory technology*****,** McGraw Hill India publication, New Delhi, 1988, 2nd edition.

Reference Books

Carl A. Burtis, David E. Bruns, ***Clinical chemistry& Molecular Diagnostics,*** Elsevier, USA, 2017, 6th edition.

Gowenlock A. A, Valeye, ***Practical Clinical biochemistry***, New Delhi, 2006, 6th edition.

Peter J. Delves, Seamus J. Martin, Dennis SR. Burton, ***Immunology***, UK, 2016, 13th edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Abnormal hemoglobin: anemia	3	Discussion
1.2	Blood clotting mechanism	3	E-Resources
1.3	Collection and preservation of blood	3	Chalk & Talk
1.4	Anticoagulants and Normal hematological values	3	E-Resources
UNIT - II			
2.1	Collection and preservation of urine	3	E-Resources
2.2	Macroscopic examination of urine culture	3	Chalk & Talk
2.3	Microscopic examination of urine culture	3	Discussion
2.4	Chemical examinations of urinary calculi	3	E-Resources
UNIT - III			
3.1	Collection and preservation of serum for Immunological analysis	2	Discussion
3.2	Measurement of Antibodies	2	E-Resources
3.3	Agglutinations reaction, Widal test	2	E-Resources
3.4	serological tests for syphilis, VDRL	3	Chalk & Talk
3.5	Slide flocculation test, ELISA	3	Discussion
UNIT - IV			
4.1	Plasmid Analysis	3	E-Resources
4.2	Polymerase chain reaction for detection of diseases	3	Discussion
4.3	Sample processing for DNA extraction	3	Discussion
4.4	DNA finger printing	3	Chalk & Talk

UNIT - V			
5.1	Complete Haemogram: grouping & "Rh" typing	2	Discussion
5.2	Blood Banking: Blood collection	2	E-Resources
5.3	Screening	2	Discussion
5.4	Storage	3	E-Resources
5.5	Cross matching and Blood transfusion	3	Discussion
	Total	**60**	

Course Designer
Ms. R. Selvakani
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBE53	Virology	Elective - I	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To make the student and learn about the structure, classification, morphology, pathological importance of viruses and viral diseases.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Demonstrate the basics on viral history, classification, and characterization	**K1, K2**
CO2	Describe about the viral isolation, separation and Purification	**K1, K2**
CO3	Illustrate knowledge about bacteriophages	**K2,**
CO4	Apply the idea of General characteristics and multiplication of DNA and RNA containing viruses	**K2, K3**
CO5	Determine the basics of plant viruses	**K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**1**	**1**	**1**	**1**	**1**
CO4	**1**	**1**	**1**	**1**	**1**
CO5	**2**	**2**	**2**	**2**	**2**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**1**	**1**	**1**	**1**	**1**
CO4	**1**	**1**	**1**	**1**	**1**
CO5	**2**	**2**	**2**	**2**	**2**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

History of virology, terminologies, origin of viruses, occurrence, morphology of viruses, helical, icosahedral and complex viruses. Viral envelope, nucleic acids, proteins, carbohydrates, classification of viruses- LHT and ICTV system of classification.

UNIT II 12 Hours

Purification, Characterization, Separation, Assay, Cultivation and quantification of viruses, Separation and characterization of viral components.

UNIT III 12 Hours

Bacteriophages- Life Cycle, Classification, Morphological groups, T4 phage lambda phage, M13 phage, Bacteriophage typing.

UNIT IV 12 Hours

General characteristics and multiplication of DNA containing viruses- Adenoviruses, Poxviruses. RNA containing viruses- Rhabdo viruses, Reoviridae, SARS - Subviral agents - Viroids, Prions.

UNIT V 12 Hours

History, Classification and nomenclature of plant viruses, Transmission, Multiplication, symptoms and control of plant viral diseases - DNA containing virus - Cauliflower mosaic virus, RNA containing virus - Tobacco mosaic virus, Sub viral agents –Virusoids and Satellite virus.

Text Books

Cann A. J. ***Principles of Molecular Virology***, Academic press, California. 2015. 6th edition.

Fettner G. A. ***The science of viruses***, Quill, William Marrow, New York. 1990, 2nd edition.

Reference Books

Dimmock NJ and Primerose SB, ***Introduction to modern virology***. Blackwell scientific publication, Oxford London. 2007, 6th edition.

Dimmock NJ, Easton AJ and Leppard K. ***Introduction to Modern Virology***, Oxford Blackwell Publishers, London, 2007, 4th edition

Cappuccino J. G. ***Microbiology***, The Benjamin/Cummings pub.co. California, 1996, 10th edition,

Carter J and Saunders V. ***Virology Principles and applications***, John Wiley and son's publishers, USA. 2013, 2nd Edition.

Timbury M. C. ***Medical virology***, Churchill Livingston, London. 1997, 11th edition.

Cook N. J. G and Killington R. ***Instant notes in Microbiology***, Viva Books private Limited, New Delhi. 2003, 2nd Edition.

Krasner R.I. ***The Microbial challenge: Human Microbe Interaction***, American Society for Microbiology, Washington, 2002, 2nd edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	History of virology, terminologies, origin of viruses	2	Chalk & Talk
1.2	Occurrence, morphology of viruses	2	E-Resources
1.3	Helical, icosahedral and complex viruses	2	E-Resources
1.4	Viral envelope, nucleic acids, proteins, carbohydrates	3	E-Resources
1.5	Classification of viruses- LHT and ICTV system of classification	3	E-Resources
UNIT - II			
2.1	Purification, Characterization, Separation and Assay of viruses	4	E-Resources
2.2	Cultivation and quantification of viruses	4	E-Resources
2.3	Separation and characterization of viral components	4	E-Resources

UNIT - III			
3.1	Bacteriophages- Life Cycle.	2	E-Resources
3.2	Classification, Morphological groups, of T4 phage	2	E-Resources
3.3	Classification, Morphological groups, of lambda phage	2	E-Resources
3.4	Classification, Morphological groups, of M13 phage	3	E-Resources
3.5	Bacteriophage typing	3	E-Resources
UNIT - IV			
4.1	General characteristics and multiplication of DNA containing Adenoviruses	2	E-Resources
4.2	General characteristics and multiplication of DNA containing Poxviruses	2	E-Resources
4.3	General characteristics and multiplication of RNA containing Rhabdo viruses	2	E-Resources
4.4	General characteristics and multiplication of RNA containing Reoviridae	2	E-Resources
4.5	SARS -. Subviral agents	2	Discussion
4.6	Viroids and Prions	2	E-Resources
UNIT - V			
5.1	History, Classification and nomenclature of plant viruses	2	E-Resources
5.2	Transmission, Multiplication, symptoms and control of plant viral diseases	2	E-Resources
5.3	DNA containing virus - Cauliflower mosaic virus	2	Discussion
5.4	RNA containing virus - Tobacco mosaic virus,	3	Chalk & Talk
5.5	Sub viral agents –Virusoids and Satellite virus	3	Chalk & Talk
	Total	**60**	

Course Designer
Dr. A. Sajith Ahamed
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBS51	Diagnostic Microbiology	SBS - I	30	2

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	✓
National	✓
Global	✓

Preamble

To introduce laboratory principles and safety methods to the students and to familiarize the students about clinical diagnosis of diseases.

Syllabus

UNIT I 6 Hours

Lab-safety regulations. Types, collection and handling of specimens. Preparation of serum and plasma.

UNIT II 6 Hours

Laboratory identification of infectious agents. Staining techniques: simple, Gram, acid-fast and spore staining.

UNIT III 6 Hours

Diagnosis of mycotic infection- skin infection and parasitic infection- amoebiasis.

UNIT IV 6 Hours

Microbiological analysis of different types of clinical specimens: urine, stool, pus and throat swab.

UNIT V 6 Hours

Determination of minimal inhibitory concentration (MIC) of antibiotics. Antimicrobial susceptibility tests

Reference Books

Ananthanarayanan. R and Jeyaram Paniker C. K. ***Textbook of Microbiology***, University Press, 2013, 9th edition.

Mukherjee, K. L. ***Medical Laboratory Technology,*** Tata McGraw-Hill Publishing Company Limited, New Delhi, 1988

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Lab-safety regulations: Types, collection	2	Chalk & Talk
1.2	Lab-safety regulations: handling of specimens	2	E-Resources
1.3	Preparation of serum and plasma.	2	E-Resources
UNIT - II			
2.1	Laboratory identification of infectious agents	2	E-Resources
2.2	Staining techniques: simple and Gram Staining	2	E-Resources
2.3	Staining techniques: acid-fast and spore staining	2	E-Resources
UNIT - III			
3.1	Diagnosis of mycotic infection	2	E-Resources
3.2	Diagnosis of skin infection and parasitic infection	2	E-Resources
3.3	amoebiasis	2	Discussion
UNIT - IV			
4.1	Microbiological analysis of different types of clinical specimens: urine and stool	3	E-Resources
4.2	Microbiological analysis of different types of clinical specimens: pus and throat swab	3	E-Resources
UNIT - V			
5.1	Determination of minimal inhibitory concentration (MIC) of antibiotics	3	E-Resources
5.2	Antimicrobial susceptibility tests	3	E-Resources
	Total	**30**	

Course Designer

Dr. P. Sivamanikandan
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBS52	**Microbiology for Competitive Examination Paper – I**	**SBS - II**	**30**	**2**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	✓
National	✓
Global	

Preamble

To create awareness about competitive Examination and to gain knowledge about General microbiology and pure culture techniques.

Syllabus

UNIT I 6 Hours

History of Microbiology, Sterilization and culture media.

UNIT II 6 Hours

General properties of microorganisms and pure culture technique

UNIT III 6 Hours

Bacteria and Gram staining

UNIT IV 6 Hours

Bacterial nutrition and bacterial growth

UNIT V 6 Hours

Structure of DNA and RNA

Reference Book

Vidyasagar G, ***MCQs in Microbiology***, New Age International Publishers (P) limited.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	History of Microbiology	2	Chalk & Talk
1.2	Microbial Sterilization	2	E-Resources
1.3	Microbial culture media	2	E-Resources
UNIT - II			
2.1	General properties of microorganisms	3	E-Resources
2.2	Pure culture technique	3	E-Resources
UNIT - III			
3.1	Bacterial staining	3	E-Resources
3.2	Gram staining	3	E-Resources
UNIT - IV			
4.1	Bacterial nutrition	3	E-Resources
4.2	bacterial growth	3	E-Resources
UNIT - V			
5.1	Structure of DNA	3	E-Resources
5.2	Structure of RNA	3	Discussion
Total		**30**	

Course Designer
Mr. RM. Lakshmanan
Associate Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC61	Industrial Microbiology	Core - IX	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To learn the screening of industrial strains, fermenters, media, fermentation process and downstream process and to promote the applications of microbes in various industries.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Describe the basics of screening and storage of industrially important microorganisms	**K1, K2**
CO2	Demonstrate the basics of fermentor and its types	**K2**
CO3	Describe the production of industrially important fermentation medium	**K1, K2**
CO4	Develop knowledge about the industrial products and their types of the fermentation process	**K1,K2,K3**
CO5	Develop knowledge about the various biosafety levels of industrial microbiology	**K1,K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**1**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**1**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**1**	**2**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**1**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**1**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**1**	**2**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Screening of industrially important microbes - Primary and Secondary screening techniques. Strain development, preservation-mineral oil and Lyophilization. Inoculum preparation and Inoculum build-up.

UNIT II 15 Hours

Fermentor-Basic design parts and function. Types of fermentor-Batch, CSTF, Tower fermentor and packed bed bioreactor. Computer applications in fermentation technology.

UNIT III 15 Hours

Ideal production medium-raw materials-Carbon sources-molasses, cheese whey, sulfite waste liquor, Lipid source-hydrocarbons and vegetable oils-Nitrogen sources-corn steep liquor, soya bean meal.

UNIT IV 15 Hours

Fermentation Types: aerobic fermentation (Penicillin, Vitamin B12), anaerobic (Ethanol), solid state (Gibberellic acid) Organic acid – (Citric acid).

UNIT V 15 Hours

Detection and assay of fermentation products, physicochemical and biological assays. Biosafety levels- Type I, Type II, Type III and Type IV.

Text Books

Casida LE Jr, ***Industrial Microbiology***, Wiley Eastern Ltd, New Delhi, 1993, 5th edition.

Crueger W and Crueger A, ***Biotechnology: A Test Book of Industrial Microbiology***, Panima Publishing corporation, New Delhi, 2000, 2nd edition.

Glazer NA and Nikaido H, ***Microbial Biotechnology: Fundamentals of Applied Microbiology,*** Cambridge University Press, 2007, 2nd edition.

Reference Books

Patel AH, ***Industrial microbiology***, Published by Mac Millan India Ltd, Chennai. 2005.

Peppler HJ and Pearlman D, ***Microbial Technology – Fermentation Technology***, Academic Press, London, Vol.1 and 2, 2004, 2nd edition.

Prescott LM, Harley JP and Helin DA, ***Microbiology***, McGraw Hill, New Delhi, 2002, 5th edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Primary and screening techniques	3	E-Resources
1.2	Strain development	3	E-Resources
1.3	Preservation-mineral oil	3	Discussion
1.4	Preservation- Lyophilization	3	E-Resources
1.5	Inoculum preparation and Inoculum build-up	3	Chalk & Talk
UNIT - II			
2.1	Basic design parts and function	3	Chalk & Talk
2.2	Batch fermentor	3	E-Resources
2.3	CSTF fermentor	2	E-Resources
2.4	Tower fermentor	2	E-Resources
2.5	Packed bed bioreactor	2	E-Resources
2.6	Computer applications in fermentation technology	3	Discussion
UNIT - III			
3.1	Raw materials	3	Chalk & Talk
3.2	Carbon sources - molasses, cheese whey, and sulfite waste liquor.	4	Discussion
3.3	Lipid source-hydrocarbons and vegetable oils.	4	Discussion
3.4	Nitrogen sources-corn steep liquor, soya bean meal.	4	E-Resources

UNIT - IV			
4.1	Fermentation - Types	2	Discussion
4.2	Aerobic fermentation (Penicillin)	2	E-Resources
4.3	Aerobic fermentation (Vitamin B12)	3	E-Resources
4.4	Anaerobic (Ethanol)	3	E-Resources
4.5	Solid state (Gibberellic acid)	3	E-Resources
4.6	Organic acid – (Citric acid)	2	Discussion
UNIT - V			
5.1	Physico chemical and biological assays	3	Chalk & Talk
5.2	Biosafety levels - Type I	3	E-Resources
5.3	Biosafety levels - Type II	3	Discussion
5.4	Biosafety levels - Type III	3	E-Resources
5.5	Biosafety levels - Type IV	3	E-Resources
	Total	**75**	

Course Designer
Dr. P. Sivamanikandan
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC62	Food Microbiology	Core - X	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	✓
National	✓
Global	✓

Preamble

To promote the students in the field of Food Microbiology and to promote the applications of microbes in various food industries.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Discuss the importance of Food Microbiology	**K1, K2**
CO2	Discuss the features of food spoilage	**K2**
CO3	Outline the food preservation	**K1, K2**
CO4	Identify the food borne diseases	**K1,K2,K3**
CO5	Apply fermentation in foods	**K1,K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**2**	**3**
CO2	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**2**	**2**	**3**	**3**
CO4	**3**	**3**	**1**	**2**	**2**
CO5	**3**	**3**	**2**	**1**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	3
CO2	3	2	3	3	3
CO3	3	2	2	3	3
CO4	3	3	1	2	2
CO5	3	3	2	1	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Importance of Food Microbiology- Food as substrate for microbial growth- intrinsic and extrinsic factors affecting growth and survival of microorganism in foods - Microorganisms present in the vegetables, fruits, cereals, milk, egg, etc.

UNIT II 12 Hours

Features of food spoilage like fruits, vegetables, milk and milk products - Milk sterilization techniques, Phosphatase test- Spoilage of bread and cereals, egg, meat, fish and poultry.

UNIT III 12 Hours

Food preservation by removal of microorganisms, low temperature, high temperature, irradiation and chemical methods. Preservation of different kinds of foods meat, vegetables, cereals, poultry and its products.

UNIT IV 12 Hours

Food borne infection, food borne intoxications. Detection of food-borne pathogens.

UNIT V 12 Hours

Fermented foods–production and preservation-pickles, sauerkraut, idli, wine, beer, bread, cheese etc.

Text Book

Frazier, WC and Westhoff DC, ***Food Microbiology***, McGrawHill, NewYork, 2003, 4th edition.

Reference Books

Adams. MR and Moss, MO, ***Food Microbiology***, New Age International Pvt. Ltd publications, 2005.

Hobbs BC and Roberts D, Food ***Poisoning and Food Hygiene***, Edwards Arnold, London, 1993.

Yousef, AE and Carlstrom C, ***Food Microbiology-A Laboratory manual***, Wiley Interscience, 2003.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Food as substrate for microbial growth	2	E-Resources
1.2	Intrinsic factors affecting growth	2	Chalk & Talk
1.3	Extrinsic factors affecting growth	2	Discussion
1.4	Survival of microorganism in foods	2	E-Resources
1.5	Microorganisms present in the vegetables, fruits, cereals, milk, egg, etc.	4	E-Resources
UNIT - II			
2.1	Features of food spoilage like fruits, vegetables, milk and milk products.	2	E-Resources
2.2	Milk sterilization techniques.	2	Discussion
2.3	Phosphatase test.	2	E-Resources
2.4	Spoilage of bread and cereals.	2	E-Resources
2.5	Spoilage of egg, meat, fish and poultry.	2	E-Resources
2.6	Spoilage of fish and poultry.	2	Discussion
UNIT - III			
3.1	Removal of microorganisms	2	Chalk & Talk
3.2	Low temperature, high temperature	3	E-Resources
3.3	Irradiation and chemical methods	3	Discussion
3.4	Preservation of different kinds of foods meat, vegetables, cereals, poultry and its products.	4	E-Resources
UNIT - IV			
4.1	Food borne infection	4	Discussion
4.2	Food borne intoxications	4	E-Resources
4.3	Detection of food-borne pathogens	4	E-Resources

UNIT - V			
5.1	Production and preservation-pickles	3	E-Resources
5.2	Production and preservation- sauerkraut, idli	3	E-Resources
5.3	Production and preservation- wine, beer.	3	E-Resources
5.4	Production and preservation- bread, cheese etc.	3	Chalk & Talk
	Total	**60**	

Course Designer
Mr. RM. Lakshmanan
Associate Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC63	Enzymology & Enzyme Technology	Core – XI	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To introduce about the Enzymes and co factors and to understand the application of enzymes in various fields.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Discuss about nomenclature, classification and properties of enzymes.	**K1, K2**
CO2	Determine the extraction, purification and inhibitors of enzymes.	**K2, K3**
CO3	Develop the knowledge of mechanism of enzyme catalysis and coenzymes	**K1, K3**
CO4	Elaborate the idea of immobilization and application of enzymes.	**K1,K2**
CO5	Apply and understand the concept of nucleic acid enzymes and enzyme deficiency.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**1**	**3**	**3**	**2**
CO4	**2**	**3**	**2**	**1**	**1**
CO5	**3**	**2**	**2**	**2**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**1**	**3**	**3**	**2**
CO4	**2**	**3**	**2**	**1**	**1**
CO5	**3**	**2**	**2**	**2**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Nomenclature and Classification of enzymes (with examples)-General properties of enzymes (Optimum pH, Optimum Temp & Substrate Concentration).Steady state kinetics and derivation of Michaelis-Menten, Linweaver-Burk, equations and their plots.

UNIT II 12 Hours

Activation energy -Enzyme specificity, Extraction of enzymes-Purification of enzymes-Enzyme inhibitors. Multienzyme complexes (PDC, α-KDC, FAS Complex, etc.)

UNIT III 12 Hours

Mechanism of enzyme catalysis - Coenzymes-NAD, FAD - Metal ions in enzyme catalysis. Mechanism of action of enzyme - Lysozyme. Allosteric enzymes and feedback inhibition.

UNIT IV 12 Hours

Immobilization of enzymes, Application of enzymes- clinical diagnosis, Industrial, Enzymes in rDNA technology,

UNIT V 12 Hours

Nucleic acid enzymes- Ribozymes, DNA zymes. Enzyme deficiency and clinical manifestation, Enzymes and bioinformatics

Text Book

Palanivelu. P, Enzymes***, Ribozymes and DNAzymes***, 21st century publications, Palkalai nagar, Madurai,2017.

Reference Book

T. Palmer, ***Enzymes-Biochemistry, Biotechnology***, Clinical chemistry - EastWest press, New Delhi, 2017

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Nomenclature and Classification of enzymes (with examples)	3	E-Resources
1.2	General properties of enzymes (Optimum pH, Optimum Temp & Substrate Concentration)	3	E-Resources
1.3	Steady state kinetics and derivation of Michaelis-Menten	3	E-Resources
1.4	Linweaver-Burk, equations and its plots	3	Discussion
UNIT - II			
2.1	Activation energy-Enzyme specificity	2	E-Resources
2.2	Extraction of enzymes	2	E-Resources
2.3	Purification of enzymes	2	E-Resources
2.4	Enzyme inhibitors	3	E-Resources
2.5	Multienzyme complexes (PDC, α-KDC, FAS Complex, etc.)	3	Chalk & Talk
UNIT - III			
3.1	Mechanism of enzyme catalysis	2	E-Resources
3.2	Coenzymes-NAD	2	E-Resources
3.3	Coenzymes-FAD	3	E-Resources
3.4	Metal ions in enzyme catalysis	3	Discussion
3.5	Mechanism of action of enzyme-Lysozyme	2	Chalk & Talk
UNIT - IV			
4.1	Immobilization of enzymes	2	E-Resources
4.2	Application of enzymes	2	E-Resources
4.3	Clinical diagnosis	2	Chalk & Talk
4.4	Industrial application	3	E-Resources
4.5	Enzymes in rDNA technology	3	Discussion

UNIT - V			
5.1	Nucleic acid enzymes	3	Chalk & Talk
5.2	Ribozymes	2	E-Resources
5.3	DNAzymes	2	E-Resources
5.4	Enzyme deficiency and clinical manifestation	2	E-Resources
5.5	Enzymes and bioinformatics	3	Discussion
	Total	**60**	

Course Designer
Mrs. M. Musbira Banu
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC6P	**Agricultural and Environmental Microbiology Practical**	**Core - XV**	**90**	**5**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To skill the students towards applied microbiological techniques and to understand about the various testing of environmental samples.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Demonstrate about microbial isolation, characterization and enumeration of soil microbes.	**K1, K2**
CO2	Illustrate about the Identification of microbial pathogen in paddy and vegetable	**K2**
CO3	Illustrate about the isolation of *Rhizobium* and *Azotobacter*	**K1, K2**
CO4	Construct the idea of Isolation of phosphate solubilizing bacteria	**K1,K2,K3**
CO5	Utilize the basics ideas on Mycorrhizae and water potability test.	**K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

1. Isolation and characterization of soil microbes. Serial dilution method for enumeration of soil bacteria
2. Identification of microbial pathogen in paddy and vegetable crops (field study).
3. Isolation of symbiotic nitrogen fixing bacteria from root nodules – *Rhizobium.* Isolation of free-living nitrogen fixing bacteria from rhizosphere - *Azotobacter*
4. Isolation of phosphate solubilizing bacteria – *Pseudomonas*
5. Examination of mycorrhizae – VAM. Potability testing of water (MPN test).

Reference Books

James G Cappuccino and Natalic Sherman, ***Microbiology- A Laboratory Manual***, The Benjamin Publishing Company, New York. 1996, 4th edition.

Paul IA and Clark FE, ***Soil Microbiology and Biochemistry***, Academic press, 2000, 2nd edition.

Course Designer

Mr. RM. Lakshmanan

Associate Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC6Q	**Recombinant DNA technology and Industrial Microbiology Practical**	**Core -XVI**	**90**	**5**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To skill the students towards Advanced microbiological techniques and to motivate the students in the field of industry oriented career.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Describe the isolation, Separation and Determination of DNA	**K1, K2**
CO2	Demonstrate the Isolation and purification of a plasmid and Restriction Digestion and ligation analysis.	**K2**
CO3	Describe the Transformation techniques and its selection	**K1, K2**
CO4	Develop knowledge about the antibiotic production and enzyme isolation from microbes	**K1,K2,K3**
CO5	Develop knowledge about the alcohol production and immobilization.	**K1,K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**1**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**1**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**1**	**2**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**1**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**1**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**1**	**2**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

1. Isolation of chromosomal DNA from microbial cells. Separation of DNA by agarose gel electrophoresis. Determination of purity and quantification of DNA.
2. Isolation and purification of a plasmid DNA. Restriction Digestion Analysis Ligation.
3. Transformation of *E. coli* using plasmid (pUC18/19). Blue-white Selection of transformants.
4. Crowded plate technique for antibiotics producing microbes. Isolation of amylase and protease producing bacteria and fungi.
5. Alcohol (ethanol) production. Immobilization of yeast.

Reference books

Aneja K. R., ***Laboratory Manual of Microbiology and Biotechnology***, ED-TECH, 2018.

Benson HJ, ***Microbiological Applications***, WM.C.Brown Publishers, Oxford, 1994

Tiwari, G. S. Hoondal, ***Laboratory Techniques in Microbiology & Biotechnology,*** Swastik publishers, 2005.

Course Designer

Dr. P. Sivamanikandan

Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBC6R	**Medical Microbiology and Food Microbiology Practical**	**Core– XVII**	**90**	**5**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To skill the students towards Clinical microbiological techniques and to understand the Microbiological Quality Analysis of Food Samples.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Demonstrate about the medical sample analysis.	**K1, K2**
CO2	Illustrate about the isolation and identification of *Staphylococcus, Streptococcus*	**K2**
CO3	Illustrate knowledge of antibiotic susceptibility test	**K1, K2**
CO4	Construct the idea of minimal inhibitory concentration and minimal lethal concentration measurement	**K1,K2,K3**
CO5	Utilize the basics of microbial enumeration from food and milk quality analysis.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

1. Collection and processing of medical samples.
2. Isolation and identification of *Staphylococcus, Streptococcus*.
3. Antibiotic susceptibility test: disc diffusion method.
4. Measurement of minimal inhibitory concentration (MIC) and minimal lethal concentration (MLC).
5. Enumeration of microbial population in food samples meat, pickles, ice-cream, fruit juices. Milk quality test-MBRT

Reference Books

Jay JM, ***Modern Food Microbiology***, CBS Publishers and distributors, New Delhi. 2000, 4th edition

Mackie and McCartney, ***Practical Medical Microbiology***, South Asia Edition, 2006, 14th edition.

Course Designer

Dr. P. Sivamanikandan

Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBE61	**Recombinant DNA Technology**	**Elective - II**	**60**	**4**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To understand about the basics of gene cloning and to promote the applications of gene cloning in various fields.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Demonstrate the basics on general Strategies of cloning.	**K1, K2**
CO2	Describe about the various vectors involved in rDNA technique	**K1, K2**
CO3	Illustrate knowledge about Methods in gene transfer and blotting techniques.	**K1, K2**
CO4	Determine the idea of Transgenic animals and Plants	**K2, K3**
CO5	Apply the basics of patent and its rights.	**K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**1**	**1**	**1**	**1**	**1**
CO4	**1**	**3**	**1**	**1**	**3**
CO5	**2**	**2**	**3**	**2**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	2	2	2	2	2
CO3	1	1	1	1	1
CO4	1	3	1	1	3
CO5	2	2	3	2	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

General Strategies of cloning –Gene cloning enzymes Restriction enzymes and types, DNA ligase, Taq polymerase, Klenow, Terminal nucleotide transferase, Alkaline phosphatase, linkers and adopters.

UNIT II 12 Hours

Vectors- Plasmids- constructed plasmids, pBR322, pUC18 - Lambda phage derived vectors, cosmids and their applications. BAC and YAC as vectors.

UNIT III 12 Hours

Methods of gene transfer –Transformation, Transduction, Transfection, microprojectile bombardment, Southern, Northern and Western blotting techniques.

UNIT IV 12 Hours

Transgenic animals, transgenic mice and sheep. - Agrobacterium mediated gene transfer mechanism - Markers and Reporter genes and their applications - Transgenic plants – insecticide resistance, herbicide and drought tolerance. Production of Insulin - Growth hormone (STH) - Interferons, etc.

UNIT V 12 Hours

Intellectual property rights, patent, forms of patents, process of patenting, Indian and international agencies involved in patenting, patenting biological materials.

Text Books

Chaudhuri K, ***Recombinant DNA Technology***, The Energy and Resources Institute, TERI, India, 2012, 1st edition,

Bhatia S. C. ***Textbook of Biotechnology***, Atlantic Publishers & Dist., India, 2005, 1st edition.

Reference Books

Brown T.A, ***Genetics – A Molecular Approach***, Chapman Hall, London, 2004, 2nd edition.

Darnell J. Lodish H, and Baltimore D, ***Molecular Cell Biology***, Scientific American Books Inc., Iowa. 2006, 2nd edition.

Glick B.R. and Pasternak J. J. ***Molecular Biotechnology - Principles and Applications of Recombinant DNA technology,*** ASM press, Washington, 2006, 4th edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Restriction enzymes and types	3	Discussion
1.2	DNA ligase, Taq polymerase	3	E-Resources
1.3	Klenow, Terminal nucleotide transferase, Alkaline phosphatase	3	E-Resources
1.4	Linkers and adopters	3	E-Resources
UNIT - II			
2.1	Plasmids	2	E-Resources
2.2	constructed plasmid pBR322	2	E-Resources
2.3	constructed plasmids pUC18	2	E-Resources
2.4	Lambda phage derived vectors	2	E-Resources
2.5	Cosmids and their applications	2	Discussion
2.6	BAC as vectors	1	E-Resources
2.7	YAC as vectors	1	E-Resources
UNIT - III			
3.1	Transformation	2	E-Resources
3.2	Transduction	2	E-Resources
3.3	Transfection	2	E-Resources
3.4	Microprojectile bombardment	3	E-Resources
3.5	Southern, Northern and Western blotting techniques	3	E-Resources

UNIT - IV			
4.1	Transgenic animals	2	E-Resources
4.2	Transgenic sheep	2	E-Resources
4.3	Agrobacterium mediated gene transfer mechanism	2	E-Resources
4.4	Markers and Reporter genes and their applications	2	E-Resources
4.5	Transgenic plants – insecticide resistance, herbicide and drought tolerance	2	E-Resources
4.6	Production of Insulin	1	E-Resources
4.7	Production of Growth hormone (STH)-Interferons etc.,	1	Discussion
UNIT - V			
5.1	Patent	2	E-Resources
5.2	Forms of patents	2	E-Resources
5.3	Process of patenting	2	Discussion
5.4	Indian and international agencies involved in patenting	3	Chalk & Talk
5.5	Patenting biological materials	3	Chalk & Talk
	Total	**60**	

Course Designer
Dr. A. Sajith Ahamed
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBE62	Food Biotechnology	Elective - II	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To promote the students in the field of Food Biotechnology and the applications of food in various industries.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Describe the basics of single cell protein and Mushroom.	**K1, K2**
CO2	Discuss about the production of microbial products	**K2**
CO3	Elaborate milk and milk processing	**K1, K2**
CO4	Apply the idea of fish, egg and meat processing	**K1, K2, K3**
CO5	Determine the processing of fruits	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**1**	**2**	**3**
CO2	**2**	**3**	**3**	**3**	**2**
CO3	**3**	**2**	**2**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**1**
CO5	**1**	**3**	**1**	**3**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**2**
CO2	**2**	**2**	**3**	**1**	**3**
CO3	**3**	**3**	**2**	**3**	**3**
CO4	**3**	**2**	**1**	**2**	**3**
CO5	**1**	**3**	**3**	**3**	**1**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Single cell protein and Mushroom: SCP: Sources and Nutritive value of SCPs, Production and Applications of SCP, Advantages and disadvantages. Mushroom: Types of mushroom, cultivation of mushrooms.

UNIT II 12 Hours

Microbial production: Industrial production of amino acids, organic acid, Polysaccharide, antibiotic production and ethanol production.

UNIT III 12 Hours

Milk and Milk processing: Milk: Composition and physical properties of milk, pasteurization of milk, dried milk powder, Sterilized milk, Homogenized Milk, Flavoured Milk, reconstituted or Rehydrated Milk, Recombinant Milk and Tonned Milk.

UNIT IV 12 Hours

Fish, Egg and Meat: Fish: Aging, tendering, freezing and storage of fish. Meat: Aging, tendering, curing and storage of meat. Egg: Egg processing, storage and dried egg.

UNIT V 12 Hours

Processing of fruits and milk: Citrus juices, apple juices, slices, grapes juices and raisins, jams, ketchups, butter, cheese, ice cream, khoa, paneer, yoghurt.

Text Book

George F. Steward, Maynard Amerine, ***Introduction of Food Science and Technology,*** University of California, Davis, 1973, 2nd edition.

Reference Books

Anita Tull, ***Food Technology an Introduction,*** Oxford University, 2002.

PJ Fellows, ***Food Processing Technology***, UK, 2009, 3rd edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	SCP: Sources and Nutritive value of SCPs.	2	Chalk & Talk
1.2	Production and Applications of SCP.	2	E-Resources
1.3	Advantages of Mushroom	2	Discussion
1.4	Disadvantages of Mushroom	2	E-Resources
1.5	Types of mushroom.	2	Discussion
1.6	Cultivation of mushrooms	2	E-Resources
UNIT - II			
2.1	Industrial production of amino acids.	3	Discussion
2.2	Industrial production of organic acid.	3	Chalk & Talk
2.3	Industrial production of Polysaccharide.	2	E-Resources
2.4	Industrial production of antibiotic	2	E-Resources
2.5	Production and ethanol production.	2	Discussion
UNIT - III			
3.1	Composition and physical properties of milk.	3	E-Resources
3.2	Pasteurization of milk, dried milk powder, Sterilized milk,	3	Chalk & Talk
3.3	Homogenized Milk, Flavoured Milk, reconstituted or Rehydrated Milk.	3	Discussion
3.4	Recombinant Milk and Tonned Milk.	3	E-Resources
UNIT - IV			
4.1	Fish: Aging, tendering, freezing and storage of fish	4	Discussion
4.2	Meat: Aging, tendering, curing and storage of meat.	4	E-Resources
4.3	Egg: Egg processing, storage and dried egg.	4	Chalk & Talk

UNIT - V			
5.1	Citrus juices, apple juices	2	E-Resources
5.2	Slices, grapes juices and raisins	2	Chalk & Talk
5.3	Jams, ketchups,	2	Discussion
5.4	Butter, cheese, ice cream,	3	Discussion
5.5	Khoa, paneer, yoghurt.	3	E-Resources
	Total	**60**	

Course Designer
Ms. R. Selvakani
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBE63	Biofertilizer	Elective -II	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

The aim of the course is to make the student to learn importance of biofertilizers in agriculture and to know about field application and production technologies.

Course Outcomes (CO)

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

No.	Course Outcome	Knowledge Level
CO1	Demonstrate about the application of biofertilizers application technology.	**K1, K2**
CO2	Illustrate about the role of *Rhizobium*, Cyanobacteria and Azolla as biofertilizers	**K2**
CO3	Illustrate about the role of *Azospirillum* and *Azotobacter*	**K1, K2**
CO4	Construct the idea of Phosphate solubilizing bacteria as biofertilizers	**K1, K2, K3**
CO5	Utilize the basics ideas on Mycorrhizae as biofertilizers	**K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**1**	**1**	**1**	**1**	**1**
CO4	**1**	**1**	**1**	**1**	**1**
CO5	**2**	**2**	**2**	**2**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Definition and types, importance of biofertilizers in agriculture, Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings. Biofertilizers – carrier materials - storage, shelf life.

UNIT II 12 Hours

Isolation, identification, characterization, mass multiplication, formulation, field application and benefits of *Rhizobium*, Cyanobacteria and Azolla.

UNIT III 12 Hours

Isolation, identification, characterization, classification, mass cultivation, Formulation, field application and benefits of *Azospirillum* and *Azotobacter*.

UNIT IV 12 Hours

Phosphate solubilizing bacteria - isolation, identification, characterization, Mass cultivation, formulation, field application and benefits.

UNIT V 12 Hours

Mycorrhizae – Ecto and Endo (Arbuscular mycorrhizae). Isolation, identification, characterization, mass cultivation, formulation, field application and benefits.

Text Books

Maheswari K. D. ***Bacteria in Agrobiology***, Springer Heidelberg, New York. 2012, 1st edition.

Kannaiyan S. ***Biotechnology of biofertilizers***, Narosa publishing house, New Delhi. 2002, 1st edition.

Reference Books

Kannaiyan S. ***Biotechnology of biofertilizers***, CHIPS, Texas, McGraw Hill, New York. 2003, 5th edition.

Kannaiyan S and Kumar K. ***Azolla biofertilizers for sustainable rice production***, Daya publishing house, Delhi. 2005.

Mahendra K Rai. ***Hand book microbial biofertilizers***. The Haworth press, Inc. New York. 2015, 9th edition.

Mukerji KG, Manoharachary C and Chamola BP, ***Techniques in Mycorrhizal studies***, Kluwer Academic Publishers. 2002.

Ramesh Chandra and Raverkar KP. ***Bioresources for sustainable plant nutrient management***, scholars world publishers, New Delhi. 2014.

Reddy SMLV, Gangwane P, Prakash and Kunwar IK. ***Bioinoculants for sustainable agriculture and forestry***, Scientific publishers, Jodhpur. 2002.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Definition and types, importance of biofertilizers in agriculture	4	Discussion
1.2	Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings	4	Discussion
1.3	Biofertilizers – carrier materials - storage, shelf life.	4	E-Resources
UNIT - II			
2.1	Isolation, identification, characterization, mass multiplication, formulation, field application and benefits of *Rhizobium*	4	E-Resources
2.2	Isolation, identification, characterization, mass multiplication, formulation, field application and benefits of *Cyanobacteria*	4	E-Resources
2.3	Isolation, identification, characterization, mass multiplication, formulation, field application and benefits of Azolla	4	E-Resources

UNIT - III			
3.1	Isolation, identification, characterization, classification, mass cultivation, Formulation, field application and benefits of *Azospirillum*	6	E-Resources
3.2	Isolation, identification, characterization, classification, mass cultivation, Formulation, field application and benefits of *Azotobacter*	6	E-Resources
UNIT - IV			
4.1	Phosphate solubilizing bacteria - isolation, identification, characterization	4	E-Resources
4.2	Phosphate solubilizing bacteria - mass cultivation and formulation	4	E-Resources
4.3	Phosphate solubilizing bacteria - field application and benefits.	4	Discussion
UNIT - V			
5.1	Mycorrhizae – Ecto and Endo (Arbuscular mycorrhizae).	3	E-Resources
5.2	Mycorrhizae – Ecto and Endo – identification and characterization	3	E-Resources
5.3	Mycorrhizae – Ecto and Endo - mass cultivation and formulation	3	E-Resources
5.4	Mycorrhizae – Ecto and Endo - field application and benefits.	3	Discussion
Total		**60**	

Course Designer
Dr. A. Sajith Ahamed
Assistant Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBS61	**Dairy Technology**	**SBS - III**	**30**	**2**

Nature of Course	
Knowledge Oriented	
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

To encourage and promote the students in the field of dairy technology for their career and to promote and participate the students in every way in the economic development of dairy industry.

Syllabus

UNIT I 6 Hours

Milk-Physiochemical properties of milk-microbiology of milk-Factors affecting composition of milk-food and nutritive value of milk.

UNIT II 6 Hours

Special Milk-Homogenized milk, flavoured milk and fermented milk-Flavour defects in milk, their causes and prevention.

UNIT III 6 Hours

Dried Milk-milk drying system-cold treatment, Drum drying system, spray drying system.

UNIT IV 6 Hours

Cheese –Types-Preparation of Swiss cheese, cheddar cheese-defects in cheese causes and prevention.

UNIT V 6 Hours

Indian dairy products-Kheer, Khoa, Panir, Ghee- preparation and preservation-quality analysis of dairy products-various agencies in Quality management-FDA,WHO,AGMARK,ISI-HACCP,GMP.

Reference Books

Sukumar De, ***Outlines of Dairy technology***, Oxford university press, 1997.

William C Frazier et al, **Food Microbiology,** Tata McGraw-Hill publications, 4th edition

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Physiochemical properties and microbiology of milk	2	E-Resources
1.2	Factors affecting composition of milk.	2	E-Resources
1.3	food and nutritive value of milk	2	Chalk & Talk
UNIT - II			
2.1	Homogenized milk and flavoured milk	2	E-Resources
2.2	Fermented milk	2	E-Resources
2.3	Flavour defects in milk, their causes and prevention.	2	E-Resources
UNIT - III			
3.1	Milk drying system and cold treatment	2	Discussion
3.2	Drum drying system	2	E-Resources
3.3	Spray drying system	2	E-Resources
UNIT - IV			
4.1	Types of Cheese and Preparation of Swiss cheese	3	E-Resources
4.2	Cheddar cheese-defects in cheese causes and prevention.	3	E-Resources
UNIT - V			
5.1	Indian dairy products-Kheer, Khoa, Panir, Ghee- preparation and preservation	3	E-Resources
5.2	Quality analysis of dairy products-various agencies in Quality management-FDA,WHO,AGMARK,ISI-HACCP,GMP	3	E-Resources
	Total	**30**	

Course Designer

Mr. RM. Lakshmanan

Associate Professor of Microbiology

Course Code	Course Title	Category	Total Hours	Credits
20UMBS62	**Microbiology for Competitive Examination Paper – II**	**SBS - IV**	**30**	**2**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	✓
National	✓
Global	

Preamble

To enable the students to appear for competitive and to gain knowledge about applied microbiology and Quantitative Aptitude.

Syllabus

UNIT I 6 Hours

Multiple Choice Questions from Immunology.

UNIT II 6 Hours

Multiple Choice Questions from Medical Microbiology.

UNIT III 6 Hours

Multiple Choice Questions from Industrial Microbiology.

UNIT IV 6 Hours

Multiple Choice Questions from Aptitude.

UNIT V 6 Hours

Multiple Choice Questions from Reasoning.

Reference Books

Agarwal R.S., ***Quantitative Aptitude***, S Chand Publication

Vidyasagar G, ***MCQs in Microbiology***, New Age International Publishers (P) limited.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Multiple Choice Questions from Immunology	6	Chalk & Talk
UNIT - II			
2.1	Multiple Choice Questions from Medical Microbiology	6	E-Resources
UNIT - III			
3.1	Multiple Choice Questions from Industrial Microbiology	6	E-Resources
UNIT - IV			
4.1	Multiple Choice Questions from Aptitude	6	E-Resources
UNIT - V			
5.1	Multiple Choice Questions from Reasoning	6	E-Resources
	Total	**30**	

Course Designer
Dr. P. Sivamanikandan
Assistant Professor of Microbiology