



SACRED HEART COLLEGE (AUTONOMOUS)

Tirupattur – 635 601, Tamil Nadu, S.India

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Ready for
Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 * Affiliated to Thiruvalluvar University, Vellore * Autonomous since 1987

Accredited by NAAC (4th Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

B.Sc Microbiology

Sem	Part	Subject Code	Subject Title	Hrs	Credit (s)	E - Hrs	CA	SE	Total
I	I	LT114	Tamil – I	5	3	3	50	50	100
	II	LE115AT	English – I	5	2	3	50	50	100
	III	ABC102	Allied Biochemistry – I	4	3	3	50	50	100
	III	PABC102	Allied Practical – I	2	1	3	40	60	100
	III	MB103	Fundamentals of Microbiology	4	4	3	50	50	100
	III	MB104	Microbial Diversity and Classification	3	3	3	50	50	100
	III	PMB102	Main Practical – I	3	3	3	50	50	100
	IV	SK104	Communication Skills	2	1	-	-	-	-
	IV	VE105A/ VE105B	Christian Religion – I/Value Education - I	2	1	3	50	50	100
	IV	CE103	Communicative English – I	-	1	-	-	-	-
Total				30	22	-	-	-	-
II	I	LT214	Tamil – II	5	3	3	50	50	100
	II	LE215AT	English – II	5	2	3	50	50	100
	III	ABC202	Allied Biochemistry – II	4	3	3	50	50	100
	III	PABC202	Allied Practical – II	2	1	3	50	50	100
	III	MB203	Microbial Physiology and Metabolism	4	4	3	50	50	100
	III	MB204	Bioinstrumentation	3	3	3	50	50	100
	III	PMB202	Main Practical – II	3	3	3	50	50	100

	IV	SK204	Leadership Skills	2	1	-	-	-	-
	IV	VE205A/ VE205B	Christian Religion – II/Value Education - II	2	1	3	50	50	100
	IV	CE203	Communicative English – II	-	1		-	-	-
Total				30	22	-	-	-	-
III	I	LT312	Tamil – III	5	3	3	50	50	100
	II	LE309T	English – III	5	2	3	50	50	100
	III	AM310C	Allied Biostatistics – I	6	5	3	50	50	100
	III	MB303	Immunology	4	4	3	50	50	100
	III	MB304	Mushroom Technology	3	3	3	50	50	100
	III	PMB302	Main Practical – III	3	3	3	50	50	100
	IV	SK304	Technical Skills	2	1		-	-	-
	IV	VE306	Human Rights	2	1	3	50	50	100
	IV	LE309P	English Lab - III	-	1	-	50	50	100
Total				30	23	-	-	-	-
IV	I	LT411	Tamil – IV	5	3	3	50	50	100
	II	LE409T	English – IV	5	2	3	50	50	100
	III	AM409C	Allied Biostatistics – II	6	5	3	50	50	100
	III	MB404	Bioinoculant Technology	4	4	3	50	50	100
	III	MB405	Microbial Genetics	3	3	3	50	50	100
	III	PMB402	Main Practical – IV	3	3	3	50	50	100
	IV	SK404	Employment Skills	2	1	-	-	-	-
	IV	VE406	Environmental Science	2	1	3	50	50	100
	IV	LE409P	English Lab IV	-	1	-	50	50	100
	V		Outreach Programme	-	2	-	-	-	-
	V		SHELTERS	-	2	-	-	-	-
III		Internship	-	2*	-	-	-	-	
Total				30	27 + 2*	-	-	-	-
Sem	Part	Subject Code	Subject Title	Hrs.	Credit (s)	E – Hrs	CA	SE	Total

V	III	MB508	Molecular Biology and Genetic Engineering	4	4	3	50	50	100
	III	MB509	Medical Bacteriology	5	5	3	50	50	100
	III	MB510	Medical Virology	5	4	3	50	50	100
	III	MB511	Medical Mycology and Parasitology	5	4	3	50	50	100
	III	PMB502	Main Practical – V	5	4	6	50	50	100
	III	MB512A MB512B MB512C	Major Elective – I a) Public Health Microbiology b) Bioinformatics and Chemoinformatics c) Pharmaceutical Microbiology (One out of three)	4	3	3	50	50	100
	III	NMB502	Non – Major Elective – I	2	1	3	50	50	100
	III	-	SSP – 1: Entrepreneurship Microbiology	-	1*	-	-	-	-
Total				30	25 + 1*	-	-	-	-
VI	III	MB608	Microbial Biotechnology	4	4	3	50	50	100
	III	MB609	Environmental Microbiology	5	5	3	50	50	100
	III	MB610	Vermitechnology	4	3	3	50	50	100
	III	MB611	Food Microbiology	5	5	3	50	50	100
	III	MB612	Industrial Microbiology	5	5	3	50	50	100
	III	PMB602	Main Practical – VI	5	4	6	50	50	100
	III	NMB602	Non – Major Elective – II	2	1	3	50	50	100
	III	-	SSP – 2: Probiotic Microbiology	-	1*	-	-	-	-
	III	-	Group Project	-	1*	-	-	-	-
	III	-	NPTEL/MOOCs/Other Certificate courses	-	1*	-	-	-	-
Total				30	27 + 3*	-	-	-	-

Sacred Heart College (Autonomous), Tirupattur District
1.2.1 List of New Courses

Department: B.Sc Microbiology

S.No	Course Code	Course Name
1.	MB103	Fundamentals of Microbiology
2.	MB104	Microbial Diversity and Classification
3.	PMB102	Main Practical – I
4.	MB203	Microbial Physiology and Metabolism
5.	MB204	Bioinstrumentation
6.	PMB202	Main Practical – II

Syllabus:

Semester – I

4 Hours

4 Credits

MB 103: FUNDAMENTALS OF MICROBIOLOGY

Objectives

- To make students to understand the Fundamentals in Microbiology.

- To know the basic principles and types of Light microscope and Electron microscope.
- To familiarize with detailed structure of Prokaryotes.
- To acquire knowledge on various Sterilization techniques.
- To learn the Microbial cultivation techniques and methods for isolation of microorganisms.

Course Outcomes

Microbiology has played a central role in all aspects of Biological sciences. An understanding of Microbiology is thus basics to Biological research. This course will familiarize the students with fundamental knowledge on Microbiology.

S.No.	Description	Cognitive Level (K-level)
CO-1	Develop an understanding of the Fundamentals of Microbiology.	K6, K2
CO-2	Define and understand the concept of Cell, Cell theory, Prokaryotes and Eukaryotes.	K1, K2
CO-3	Categorize the various types, principles and applications of Light microscope and Electron microscope.	K4
CO-4	Broad knowledge on the structure and functions of organelles of Bacteria.	K3, K6
CO-5	Demonstrate a clear understanding of microbial control mechanisms through Sterilization techniques and Antibiotics.	K2
CO-6	Evaluate the methods used for the cultivation and identification of bacteria.	K5

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)								Mean Scores of COs		
	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS	PS	PS	PS	PS	PS		PSO9	

	1	2	3	4	5	6	7	O1	O2	O3	O4	O5	O6	O7	O8		
1	3	3	2	2	3	3	3	3	3	3	2	3	3	3	2	3	2.7
2	2	2	3	3	2	3	1	2	3	2	3	3	2	2	3	2	2.3
3	3	1	2	3	1	3	3	3	2	3	2	2	3	3	2	3	2.4
4	2	2	3	2	3	2	2	2	3	3	3	3	3	3	3	2	2.5
5	2	3	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2.1
6	3	2	2	3	3	2	3	3	2	3	3	3	3	3	2	3	2.6
Mean Overall Score																2.5	
Result																High	

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100)
	I CA (50)	II CA (50)	Marks Allotment
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I

Members of Microbial world; History and recent developments of Microbiology – Spontaneous generation and Biogenesis; Contributions of Anton van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Ignaz Semmelweis, Dmitri Ivanoski, Martinus Beijerinck, Sergei Winogradsky, Alexander Fleming and Selman Waksman; Cell - Prokaryotes and Eukaryotes; Golden age of Microbiology; Branches and Scope of Microbiology.

Unit – II

History of Microscopy; Principles of Microscopy; Difference between Simple microscope and Compound microscope; Principle, Instrumentation and Applications - Bright field microscope, Dark field microscope, Phase contrast microscope, Fluorescence microscope and Electron Microscopy – SEM & TEM; Difference between SEM and TEM.

Unit – III

Bacteria – Ultrastructure; Morphological Classification (Gram positive and Gram negative), Shape and arrangement; Cell wall; Cell membrane; Cell inclusions; Ribosomes; Capsules and Slime layer; Gas vesicles; Endospore; Surface appendages – Flagella (Arrangement and Types of Motility), Fimbriae and Pili.

Unit – IV

Microbial control terminologies; Sterilization; Physical method – Drying, Dry heat, Moist heat, Filtration, Radiation; Quality control and sterility checking; Chemical method – Disinfection and Disinfectants; Chemotherapy terminologies; Antibiotics – Classification, Antimicrobial resistance and Antibiotic sensitivity test.

Unit – V

Stains and its types; Staining techniques – Simple staining, Differential staining (Gram staining & Acid fast staining), Special staining (Capsule staining, Metachromatic granule staining, Endospore staining & Flagella staining); Motility test; Culture techniques - Culture medium and its types; Biochemical Tests for bacterial identification.

Text Books

- 1) Gerard J. Tortora, Berdell R. Funke and Christine L. Case. 2015. Microbiology – An Introduction, 12th Edition, Peareson Publishers, San Francisco.
- 2) Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton. 2017. Prescott's Microbiology, 10th Edition, McGraw Hill Publication, United States.
- 3) Reba Kanungo. 2017. Ananthanarayan and Paniker's Text book of Microbiology, 7th Edition, Orient Longman Limited, Chennai, India.
- 4) Saranraj, P. 2020. Basic Techniques in Microbiology. JPS Scientific Publications, India.

References

- 1) Dubey, R.C. and D. K. Maheswari. 2010. A Text book of Microbiology. 3rd Edition, S. Chand and Company, New Delhi.
- 2) Chakraborty. 2003. A Text book of Microbiology. 2nd Edition, Published by New Central Book Agency (P) Ltd., Kolkata.
- 3) Pelczar Jr. M. J., Chan, E. C. S and Kreig, N. R. 2006. Microbiology. 5th Edition Mc Graw Hill Inc. New York.
- 4) Powar, C. B and H. F. Daginawala. 2008. General Microbiology. Volume – II, Himalaya Publishing House, Mumbai.

Semester – I

3 Hours

3 Credits

MICROBIAL DIVERSITY AND CLASSIFICATION

Objectives

- To learn the Taxonomy of microorganisms.
- To analyze the Ultrastructure of Fungi, Algae and Protozoa.
- To understand the Classification of microorganisms.
- To recognize the fundamentals on Economic importance of microorganisms.
- To impart knowledge on Molecular identification of microorganisms.

Course Outcomes

The basic task of Microbial Diversity and Classification is to differentiate the various characteristics of microorganisms based on Ultrastructure and Classification. It enables the students to identify any microorganisms through Molecular identification. The students will be able to understand and predict the Economic importance of microorganisms.

S.No.	Description	Cognitive Level (K-level)
CO-1	Understand the knowledge of Classifications and Taxonomy of Microorganisms in detail	K2, K3
CO-2	Acquire the basic knowledge on the Ultrastructure, Classification, Mode of nutrition and Reproduction of Fungi, Algae and Protozoa.	K3
CO-3	Discuss the Economic importance of Fungi, Algae and Protozoa.	K2
CO-4	Examine and define the structure, properties and classification of Human, Plant and Animal viruses.	K1
CO-5	Explore and recommend the Molecular techniques applied in identification of microorganisms.	K4, K5
CO-6	Compile the basic information on the diversity and classification of Fungi, Algae, Protozoa and Algae.	K6

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)									Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	PSO9	
1	3	2	2	3	3	2	3	2	3	3	2	3	3	3	2	2	2.5
2	3	2	3	3	2	3	2	2	2	2	3	3	2	2	3	2	2.4
3	1	2	2	3	2	2	3	3	1	3	2	2	2	2	3	3	2.2
4	3	3	2	2	2	2	1	2	3	2	3	3	2	3	3	2	2.3
5	2	2	3	1	3	2	2	2	2	1	2	2	3	2	2	2	2.0
6	3	3	1	2	3	2	3	3	2	3	2	3	2	3	2	3	2.5
Mean Overall Score																2.3	
Result																High	

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100)
	I CA (50)	II CA (50)	Marks Allotment
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I

Phylogenetic Hierarchy; Nomenclature of Microorganisms; Taxonomy and Taxonomic Hierarchy; Kingdom concept of Organisms classification – Lennaeus Two Kingdom concept, Haeckel Three Kingdom concept, Copeland's Four Kingdom concept, Whittaker's Five Kingdom concept, Grey & Doolittle's Six Kingdom concept and Cavalier-Smith's Eight Kingdom concept; Wose – Fox's Three Domains of Life; Genetic and Intraspecies Classification; Classification of Bacteria - Bergey's manual and its importance; Economical importance of Bacteria.

Unit – II

Fungi – Ultrastructure, Nutrition and Reproduction; Characteristics of Molds & Yeasts; Classification of Fungi; Budding in Yeast; Fungal identification (Microscopic examination) and Cultivation in Culture medium; Water molds; Economical importance of Fungi.

Unit – III

Algae – Ultrastructure and Nutrition; Role of Algae in Nature; Classification of Algae; Diatoms and Dinoflagellates; Lichens; Algal diseases of humans; Algal identification (Microscopic examination) and Cultivation in Culture medium; Economical importance of Algae.

Unit – IV

Protozoa - Ultrastructure, Classification and Nutrition; Microscopic examination of Protozoa; Slime Molds – Cellular Slime Molds & Plasmodial Slime Molds; Economic importance of Protozoa; Virus – Structure and Classification; Animal and Plant Viruses; Viroids and Prions.

Unit – V

Molecular Identification of Microorganisms – Fatty acid profiles, DNA Base composition (G + C Content), DNA Fingerprinting, Polymerase Chain Reaction (PCR), CRISPR and Nucleic acid Hybridization (Southern Blotting, DNA Chips, FISH and rRNA Sequencing).

Text Books

- 1) Gerard J. Tortora, Berdell R. Funke and Christine L. Case. 2015. Microbiology – An Introduction, 12th Edition, Peareson Publishers, San Francisco.
- 2) Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton. 2017. Prescott's Microbiology, 10th Edition, McGraw Hill Publication, United States.
- 3) Reba Kanungo. 2017. Ananthanarayan and Paniker's Text book of Microbiology, 7th Edition, Orient Longman Limited, Chennai, India.

References

- 1) Chakraborty. 2003. A Text book of Microbiology. 2nd Edition, Published by New Central Book Agency (P) Ltd., Kolkata.
- 2) Dubey, R.C. and D. K. Maheswari. 2010. A Text book of Microbiology. 3rd Edition, S. Chand and Company, New Delhi.
- 3) Pelczar Jr. M. J., Chan, E. C. S and Kreig, N. R. 2006. Microbiology. 5th Edition Mc Graw Hill Inc. New York.
- 4) Powar, C. B and H. F. Dagainawala. 2008. General Microbiology. Volume – II, Himalaya Publishing House, Mumbai.

3 Hours

3 Credits

MAIN PRACTICAL - I

- 1) Orientation to the Microbiology Laboratory
- 2) Cleaning and Sterilization of Glasswares
- 3) Preparation of Hand Sanitizer
- 4) Handling of Microscope
- 5) Preparation of Broth and Agar medium for Bacteria and Fungi
- 6) Simple Staining
- 7) Gram Staining
- 8) Capsule Staining – Negative Staining
- 9) Endospore Staining
- 10) Metachromatic Granule Staining (Demo only)
- 11) Acid Fast Staining (Demo only)
- 12) Motility Test – Hanging Drop Method
- 13) Lactophenol Cotton Blue (LPCB) Staining
- 14) KOH Wet mount

Semester – II

MICROBIAL PHYSIOLOGY AND METABOLISM**Objectives**

- To analyze the Nutrient requirements and Nutrition types of microorganisms.
- To observe the Transport of Nutrients in Microorganisms.
- To study the Microbial growth and its measurement.
- To learn the Microbial metabolism and respiration.
- To understand the Photosynthesis reaction in microorganisms.

Course Outcomes

The paper Microbial Physiology and Metabolism enables the students about to know about Microbial nutrition and growth. The students will also be able to understand and predict the Intermediate metabolism and Photosynthesis of microbes.

Course Outcome (CO)	Description	Cognitive level (K level)
CO-1	Help learners to define and understand the objectives of Microbial physiology, Microbial nutrition and Microbial metabolism.	K1, K2
CO-2	Analyze and understand the basic concepts of Nutrient requirements and Nutrition types of microorganisms.	K4
CO-3	Provide students with learning experiences that help in still deep interests in learning Transport of nutrients in Microorganisms.	K3
CO-4	Develop broad and balanced knowledge and understanding of Microbial growth, Growth measurement and Preservation of microorganisms.	K6
CO-5	Equip students with appropriate knowledge on Microbial metabolism which includes Catabolism and Anabolism.	K4
CO-6	Recommend students to find the Photosynthetic reaction in microorganisms.	K5

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)									Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	PSO9	
1	3	2	3	3	3	2	3	2	3	3	2	3	3	3	3	2	2.6
2	3	2	3	3	2	3	2	2	3	2	3	3	3	2	3	2	2.5
3	2	2	2	3	2	2	3	3	2	3	2	2	3	2	3	3	2.4
4	3	3	2	2	3	2	2	2	3	2	3	3	3	3	3	2	2.5
5	3	2	3	2	3	2	2	3	2	2	2	3	3	2	2	3	2.4
6	3	3	2	2	3	2	3	3	2	3	3	3	3	3	2	3	2.6
Mean Overall Score																	2.5
Result																	High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100)
	I CA (50)	II CA (50)	Marks Allotment
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I

Microbial Nutrition – Chemical nutrient requirements and Growth factors, Nutritional groups of microorganisms; Uptake of nutrients by cells: Passive transport - Simple diffusion, Facilitated diffusion and Osmosis; Active transport – ABC Transporters, Group translocation, Exocytosis and Endocytosis (Phagocytosis and Pinocytosis); Iron uptake by microorganisms.

Unit – II

Cell division in Bacteria (Binary fission); Microbial Growth – Generation time and Growth Curve; Influence of environmental factors on growth; Measurement of microbial growth – Direct and Indirect methods; Continuous

culture of microorganisms - Chemostat; Diauxic growth and Synchronous growth; Preservation of microbial cultures.

Unit – III

Microbial Metabolism – Difference between Catabolism and Anabolism; Fermentation and its types; Generation of ATP - Substrate level Phosphorylation, Oxidative Phosphorylation and Electron transport chain; Carbohydrate catabolism – Glycolysis, Phosphoketolase pathway and Entner Doudoroff pathway.

Unit – IV

Microbial Respiration - Aerobic and Anaerobic respiration by microorganisms; Aerobic Respiration – Kreb's cycle; Biosynthesis of Bacterial cell wall polysaccharides, Purines, Pyrimidines, Amino acids and Fatty acids; Anaerobic Respiration – Acetogenesis and Methanogenesis.

Unit – V

Photosynthesis; Diversity of photosynthetic organisms; Difference between plant, algal and bacterial photosynthesis; Photosynthetic pigments; Light reaction (Photophosphorylation) and Dark reaction (Calvin cycle).

Text Books

- 1) Gerard J. Tortora, Berdell R. Funke and Christine L. Case. 2015. Microbiology – An Introduction, 12th Edition, Peareson Publishers, San Francisco.
- 2) Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton. 2017. Prescott's Microbiology, 10th Edition, McGraw Hill Publication, United States.
- 3) Reba Kanungo. 2017. Ananthanarayan and Paniker's Text book of Microbiology, 7th Edition, Orient Longman Limited, Chennai, India.

References

- 1) Caldwell, D.R., 2008. Microbial Physiology and Metabolism. Wm C Brown Publishers, England.
- 2) Chatterjee, N and Rana Shinde. 2012. Textbook of Medical Biochemistry, 8th edition, Jaypee publication, New Delhi.
- 3) Dubey, R.C. and D. K. Maheswari. 2010. A Text book of Microbiology. 3rd Edition, S. Chand and Company, New Delhi.
- 4) Pelczar Jr. M. J., Chan, E. C. S and Kreig, N. R. 2006. Microbiology. 5th Edition Mc Graw Hill Inc. New York.

BIOINSTRUMENTATION**Objectives**

- To provide knowledge about Safety measures in Microbiology laboratory and First aid methods.
- To understand the principles and applications of various instruments used in Life science.
- To learn the techniques for operating the Microbiological instruments.
- To explain the principles and applications of types of Chromatography techniques.
- To learn principles, types and applications of Calorimeter and Spectrophotometer.

Course Outcomes

The Bioinstrumentation course offers the students with an opportunity to gain knowledge on the principles and applications of various instruments which are used in Biological laboratories.

S.No.	Description	Cognitive Level (K-Level)
CO-1	Determine the Safety measures in Microbiology laboratory and First aid methods.	K3
CO-2	Define and explain the principles and applications of various instruments used in Life science.	K1, K2
CO-3	Explain the Working principles and Applications of Various Microbiology laboratory instruments.	K4
CO-4	Analyzing the principles and applications of types of Chromatography techniques.	K4
CO-5	Evaluate the Working principle and Applications of Electrophoresis techniques.	K5
CO-6	Perform the detailed analysis on Calorimeter and Spectrophotometer.	K6

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)									Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	PSO9	
1	3	3	3	3	3	2	3	2	2	3	3	3	3	3	3	3	2.8
2	2	2	3	3	3	2	2	3	3	3	3	3	2	3	2	3	2.6
3	2	3	2	3	2	3	3	3	2	3	2	3	3	2	3	3	2.6
4	3	3	3	2	3	2	3	2	3	2	3	3	3	3	3	2	2.6
5	3	2	3	2	3	2	3	3	2	3	3	3	3	1	2	3	2.8
6	3	3	1	3	3	3	3	3	3	2	3	3	3	3	3	3	2.5
Mean Overall Score																2.6	
Result																High	

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100)
	I CA (50)	II CA (50)	Marks Allotment
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I

Safety in Microbiology Laboratory – Electrical equipment, Heating devices, Cryogenic liquids and Radiation exposure; Personal Protection in Laboratory – Safety Spectacles, Gloves and Face masks; Hazards in the Laboratory; Radiation hazard – Sources, effects and safety measures; Biological Hazards and its disposal; Laboratory acquired infections and safety measures; First aid methods for Laboratory accidents.

Unit – II

Bioinstruments: Principle, Instrumentation, Applications and Safety aspects of pH Meter, Bacterial Incubator, Hot air oven, Autoclave, Colony counter and Laminar flow cabinet.

Unit – III

Chromatographic techniques: Principle and Applications of Paper Chromatography, Thin layer chromatography (TLC), Gel Filtration Chromatography, Adsorption Column chromatography, Gas Chromatography, High Performance Liquid Chromatography (HPLC) and HPTLC.

Unit – IV

Centrifugation techniques: Basic principles of Centrifuge; Types of Centrifuges – Small Bench Centrifuges, Large Capacity Refrigerated Centrifuges, High Speed Refrigerated Centrifuges and Ultracentrifuges; Different types of Rotors; Types of Centrifugation - Differential centrifugation, Density gradient centrifugation and Centrifugal elutriation; Safety aspects of Centrifuges.

Unit – V

Electrophoretic techniques: Principle, Instrumentation and Applications of Paper Electrophoresis, Gel Electrophoresis, Capillary Electrophoresis and SDS-PAGE; Gel Documentation System; Principle, Instrumentation and Applications of Colorimeter and Spectrophotometer.

Text Books

- 1) Arumugam, S. 2002. Biomedical Instrumentation, Anuratha Agencies Publishers, 2nd edition, India.
- 2) Asokan, P. 2001. Analytical Biochemistry, Chinnaa Publications, India.
- 3) Gurumani, N. 2014. Research Methodology for Biological Sciences, MJP Publisher, India.
- 4) Veerakumari, L. 2019. Bioinstrumentation, MJP Publisher, India.

References

- 1) Chatwal, G. R and S. K. Anand. 2003. Instrumental Methods of Chemical Analysis. 5th Edition, Himalaya Publishing House, Mumbai
- 2) Mandeep Singh. 2014. Introduction to Biomedical Instrumentation, Paperback publishers, India.
- 3) Sharma, B. K. 2007. Instrumental Methods of Chemical Analysis, Krishna Prakashan Media (P) Ltd, India.
- 4) Wilson, K. and J. Walker. 2010. Principles and Techniques of Biochemistry and Molecular Biology. 7th Edition, Cambridge University Press, UK.

Semester – II

3 Hours

3 Credits

MAIN PRACTICAL – II

- 1) Serial Dilution Technique – Pour plate method and Spread plate method.
- 2) Pure Culture Technique – Streak plate method.
- 3) Bacterial Growth Curve.
- 4) Effect of pH on Bacterial growth.
- 5) Effect of NaCl on Bacterial growth.
- 6) Biochemical Tests – Carbohydrate fermentation, Indole, Citrate utilization, MR, VP, Urease, Catalase, Oxidase, TSI, Casein hydrolysis, Starch hydrolysis and Gelatin Liquefaction Test

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)									Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	PSO9	
1	3	3	3	3	3	2	3	2	2	3	3	3	3	3	3	3	2.8
2	2	2	3	3	3	2	2	3	3	3	3	3	2	3	2	3	2.6
3	2	3	2	3	2	3	3	3	2	3	2	3	3	2	3	3	2.6
4	3	3	3	2	3	2	3	2	3	2	3	3	3	3	3	2	2.6
5	3	2	3	2	3	2	3	3	2	3	3	3	3	1	2	3	2.8
6	3	3	1	3	3	3	3	3	3	2	3	3	3	3	3	3	2.5
Mean Overall Score																2.6	
Result																High	

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100)
	I CA (50)	II CA (50)	Marks Allotment
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I

Microbiology – Various branches and Scope; Cell - Prokaryotes and Eukaryotes; Bacteria – Characteristics (Gram positive and Gram negative); Culture medium; Economic importance of Bacteria.

Unit - II

Fungi and Algae – Characteristics and Economic importance. Water pollution; Bacteriological analysis of water; Water borne diseases; Purification of water.

Unit – III

Food Preservation; Lactic acid bacteria; Fermented dairy products – Cheese, Yogurt and Fermented milk; Spoilage and defects of fermented dairy products; Testing of Milk.

Unit - IV

Microbial fermentation and its types; Fermentation products - Baker's yeast, Bread and Alcoholic beverages (Beer & Wine); Cultivation and Health benefits of Spirulina and Mushroom.

Unit – V

Bioinoculants – Definition, Types, Importance and Advantages; Nitrogen Fixing Biofertilizers; Phosphate solubilizing microorganisms; Biopesticides; Organic farming - Composting and Vermicomposting.

Text Books

- 1) Gerard J. Tortora, Berdell R. Funke and Christine L. Case. 2015. Microbiology – An Introduction, 12th Edition, Peareson Publishers, San Francisco.
- 2) Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton. 2017. Prescott's Microbiology, 10th Edition, McGraw Hill Publication, United States.
- 3) Reba Kanungo. 2017. Ananthanarayan and Paniker's Text book of Microbiology, 7th Edition, Orient Longman Limited, Chennai, India.

References

- 1) Dubey, R.C. and D. K. Maheswari. 2010. A Text book of Microbiology. 3rd Edition, S. Chand and Company, New Delhi.
- 2) Chakraborty. 2003. A Text book of Microbiology. 2nd Edition, Published by New Central Book Agency (P) Ltd., Kolkata.
- 3) Pelczar Jr. M. J., Chan, E. C. S and Kreig, N. R. 2006. Microbiology. 5th Edition Mc Graw Hill Inc. New York.
- 4) Powar, C. B and H. F. Daginawala. 2008. General Microbiology. Volume – II, Himalaya Publishing House, Mumbai.