

ST JOSEPH'S UNIVERSITY

BENGALURU-27



DEPARTMENT OF MICROBIOLOGY

SYLLABUS FOR UNDERGRADUATE PROGRAMME

For Batch 2024-2027

(STATE EDUCATION POLICY)

Part A		
1	Title of the Academic Program	B.Sc. Microbiology (Major)
2	Program Code	BCYM (Biochemistry, Biology, Microbiology), BCMZ (Biochemistry, Microbiology, Zoology), CMBY (Chemistry, Microbiology, Biology)
3	Name of the University	St. Joseph's University
4	Objectives of the University	<ol style="list-style-type: none"> 1. Academic Excellence 2. Character Formation 3. Social Concern
5	Vision of the University	To form men and women for and with others, who through holistic education, strive for a just, secular, democratic, and ecologically sensitive society which empowers the poor, the oppressed, and the marginalized.
6	Mission of the University	In keeping with the Jesuit heritage, the university aims at an integral formation of the staff and the students, to be men and women who will be agents of societal change, by enabling them to attain academic and human excellence in a teaching-learning environment that fosters intellectual curiosity, ceaseless enquiry, personal integrity, social commitment, creativity, critical thinking and innovation.
7	Name of the Degree	Bachelor of Science (B.Sc.)
8	Name of the Department offering the program	Microbiology
9	Vision of the Department offering the program	<ul style="list-style-type: none"> • The Department intends to inculcate in the students an interest to explore the world of Microbiology and contribute to the rapidly expanding field. We wish to offer the society, a generation of humble yet aspiring young minds eagerly striving towards unraveling the mystery of science.
10	Mission of the department offering the Program	<ul style="list-style-type: none"> • The Department of Microbiology aims at identifying one's potential to become a centre for augmenting and contributing continuously to the vibrant field of Microbiology. • We strive to create and provide an ambient learning atmosphere and prepare students for academia, industry and productive application of this knowledge in everyday life. • It emphasizes the impact of microbes on environment and the human activities.
11	Duration of the Program	3 years (Six semesters)

12	Total No. of Credits	TO BE ANNOUNCED	
16	Program Specific Outcomes (PSOs)	PSO1	Students graduating from the Microbiology program will gain knowledge and understanding of concepts of microbiology and its application in pharma, food, agriculture, beverages, nutraceutical industries, etc.
		PSO2	Students will understand the distribution, morphology and physiology of microorganisms and demonstrate the skills in aseptic culturing of microbes including isolation, identification and maintenance.
		PSO3	Students will be learning and practicing professional skills in handling microbes and contaminants in laboratories and production sectors, exploring the microbial world and analyzing the specific benefits and challenges.
		PSO4	Students will be able to apply the knowledge acquired to undertake studies and identify specific remedial measures for the challenges in health, agriculture, and food sectors.
		PSO5	Students will also learn and build on proficiencies in science communication, teamwork and collaboration, enabled by regular innovative assignments and activities.
		PSO6	Students will be able to demonstrate the ability to identify key questions in microbiological research, optimize research methods, and analyze outcomes by adopting scientific methods, thereby improving the employability.

SUMMARY OF CREDITS IN MICROBIOLOGY

DEPARTMENT OF MICROBIOLOGY (UG) (2024-2027)								
Semester 1	Code Number	Title	No. of Hours of Instructions	Number of Hours of teaching per week	Number of credits	Continuous Internal Assessment (CIA) Marks	End Semester Marks	Total marks
Theory	MB 124	Basic Microbiology and Microbiological Techniques	45	03	03	40	60	100
Practical	MB1P1 24	Basic Microbiology and Microbiological Techniques	33	03	02	25	25	50
Total Number of credits:			05					
Semester 2	Code Number	Title	No. of Hours of Instructions	Number of teaching Hrs /week	Number of credits	Continuous Internal Assessment (CIA) Marks	End Semester Marks	Total marks
Theory	MB 224	Microbial Diversity I	45	03	03	40	60	100
Practical	MB2P1 24	Microbial Diversity I	33	03	02	25	25	50
Total Number of credits:			05					

CORE COURSES (CC)	
Course Title	Code Number
Basic Microbiology and Microbiological Techniques	MB124
Microbial Diversity I	MB224

VALUE ADDED COURSES (VAC)	
Course Title	Code Number
Principles of Genetic Engineering	MBCC 01
Food Technology	MBCC 02
Ethics in Life Sciences and Health care Sector	MBCC 03

DEPARTMENT OF MICROBIOLOGY

Semester	I
Course	1
Paper Code	MB 124
Paper Title	Basic Microbiology and Microbiological Techniques
Number of teaching hours per week	03
Total number of teaching hours per semester	45
Number of credits	03

Objective of the Paper:

This paper introduces the students to the microbial world. It emphasizes on the contribution of scientists to the evolution of the field of Microbiology as an essential modern science. The students will have an in-depth understanding of the prokaryotic and eukaryotic cellular forms, using bacteria and protozoans as model organisms. The students will get equipped with microscopic, staining and sterilization techniques.

UNIT-I Historical Perspective	4
<p>a. History and Scope of Microbiology: Relevance of Microbiology as a modern science Branches of Microbiology Scope of Microbiology and career opportunities in the field.</p> <p>b. Contribution of Scientists to the field of Microbiology: Antonie Von Leeuwenhoek, Francisco Redi, Edward Jenner, Louis Pasteur, Joseph Lister, Robert Koch and Alexander Fleming.</p>	2
UNIT- II Introduction to the Microbial World	5
<p>Structure and Overview of Different Groups of Microbes (Brief overview of morphology and importance)</p> <p>a. Bacteria b. Fungi c. Algae d. Protozoa e. Virus</p>	

UNIT VI Microbiological Techniques- Sterilization of Microbes	10
<p>Concept of sterilization and disinfection and its importance in Microbiology.</p> <p>i) Factors affecting antimicrobial activity: - Environment, organisms, physiological status, inoculum concentration, intensity of concentration of the antimicrobial agent, temperature, and time of action as factors affecting antimicrobial activity.</p> <p>ii) Physical methods of sterilization: Moist heat (Pasteurization) Moist heat under pressure (Autoclave) Dry heat (incineration, hot air oven) Filtration- membrane filter, HEPA filter Radiation (UV- rays, X- rays, Gamma rays, ultrasonic rays)</p> <p>iii) Chemical agents used in sterilization: Desired characteristics and mode of action of antimicrobial chemical agents. Alcohols, formaldehyde, phenol, halogens and heavy metals, and gaseous agents. Efficacy testing of chemical agents- Phenol coefficient test</p>	<p>2</p> <p>4</p> <p>4</p>

NOTE: 10 hours of self-study (study materials and videos will be provided)

REFERENCES:

1	Black, J. G., & Black, L. J. (2008). <i>Microbiology: Principles and explorations</i> . Hoboken, NJ: John Wiley & Sons, Inc.
2	Madigan, M. T. (2017). <i>Brock Biology Of microorganisms</i> .
3	Murphy, D. B., & Davidson, M. W. (2012). <i>Fundamentals of Light microscopy and Electronic Imaging</i> . John Wiley & Sons.
4	O.P. Sharma. (1992), <i>Textbook of Algae</i> , New Delhi: Tata McGraw-Hill.
5	Talaro, K. P. (2008). <i>Foundations in Microbiology: Basic principles</i> , New York: McGraw-Hill, 11th Edition.
6	Wiley, J. M., Sherwood, L., & Woolverton, C. J. (2017). <i>Prescott's Microbiology</i> .

BLUEPRINT:

Code number: MB 124

Title of the Paper: Basic Microbiology and Microbiological Techniques

Unit number	Number of Hrs	Total marks for which the questions are to be asked (including bonus questions)
Unit I	4	8
Unit II	5	10
Unit III	10	20
Unit IV	5	10
Unit V	11	22
Unit VI	10	20
	45	88
Maximum marks for the paper (Excluding bonus question) = 60		

Practical I
MB 1P1 24 - Basic Microbiology and Microbiological Techniques
(11 sessions 3hr/week)

Sr. No.	Experiment	Units
1	Microbiological laboratory standards and safety protocols.	1
2	Standard aseptic conditions of Microbiological laboratory.	
3	Study of a compound microscope.	1
4	Study of instruments - Autoclave, hot air oven, LAF and biosafety cabinets, incubator, membrane filter, colony counter. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader).	
5	Preparation of media – NB, NA.	1
6	Isolation and identification of bacteria- Cultural characteristics and CFU calculation,	1
7	Pure culture techniques – pour plate, spread plate and streak plate (Simple, Continuous, Quadrant) methods.	1
8	Aseptic transfer techniques.	
9	Simple staining, Negative staining	1
10	Differential staining- Gram's staining	1
11	Structural staining- Endospore.	2
12	Bacterial motility- hanging drop.	1

Course outcomes for MB 124 and MB 1P1

At the end of the course, the student will be able to:

CO1	Appreciate the contributions of Pioneers in the field of microbial research.
CO2	Get acquainted with different types of microbial life forms and their basic structure and functions.
CO3	Understand the basics of the structural organization of a prokaryotic and eukaryotic cell.
CO4	Apply the knowledge gained to identify and use various laboratory aids to culture, visualize and control microorganisms.
CO5	Assess the importance of microbes in all realms of life.
CO6	Apply the basic disinfection and sterilization techniques to maintain health and hygiene.

DEPARTMENT OF MICROBIOLOGY

Semester	II
Course	2
Paper Code	MB 224
Paper Title	Microbial diversity - I
Number of teaching hours per week	03
Total number of teaching hours per semester	45
Number of credits	03

Objective of the Paper:

This paper allows students to understand microbial systematics and methods to classify some of the microbes. It helps them explore the different types of microorganisms, their growth patterns, preservation techniques, and control methods.

UNIT I Microbial Taxonomy	10
a. Microbial Systematics - 5 kingdom classification system, 3 domain classification system Concept of 'species' in eukaryotes and prokaryotes, Nomenclature Phenetic classification, Phylogenetic classification, Genotypic classification	5
b. Classification on the basis of Classical characters and Molecular characters- Numerical taxonomy, chemotaxonomy and genetic analyses	4
c. Phylogenetic trees – rooted and unrooted	1
d. Classification based on pathogenicity. Biosafety level 1, 2, 3, and 4.	
UNIT II Bacteriology – Growth and control	20
Bacterial classification - Bergey's Manual of Bacteriology	2
Growth and maintenance of bacteria –	10
a. Nutritional requirements and types	
b. Types of Media for microbial growth- Differential and selective media, enrichment media, transfer media, defined and undefined media	
c. Bacterial growth curve and calculation of generation time. Diauxic growth curve.	

<p>Technique for determination of microbial growth - Spectrophotometry d. Long term maintenance of microorganisms- glycerol stocks, cryopreservation, lyophilization</p> <p>Control of bacterial growth - a. Development and classification of antibiotics. b. Mode of action and types– Antibacterial antibiotics: Cell wall synthesis inhibitors – Penicillin, Protein synthesis inhibitors- Tetracyclines and Chloramphenicol, DNA synthesis inhibitors- Fluoroquinolones, RNA synthesis inhibitors- Rifampin, mycolic acid synthesis inhibitors- isoniazid, membrane disruptors- Polymyxin B c. Development of Resistance to antibiotics, mechanisms of resistance and determination of antibiotic resistance.</p>	8
<p>UNIT III Virology</p>	15
<p>Viral Classification – Baltimore 1 Structure, Reproduction and Significance of - 7 Bacterial viruses - T4, Plant virus- TMV, Animal virus – HIV Cultivation of viruses, one step growth curve and plaque assay 4 Antiviral therapies – concepts of antiviral therapies 2 Phage therapy 1</p>	1 7 4 2 1

NOTE: 10 hours of self-study (study materials and videos will be provided).

REFERENCES:

1.	Black, J. G., & Black, L. J. (2008). <i>Microbiology: Principles and explorations</i> . Hoboken, NJ: John Wiley & Sons, Inc.
2.	Madigan, M. T. (2017). <i>Brock Biology Of microorganisms</i> .
3.	Primrose, S. B. (1974). <i>Introduction to modern virology</i> .
4.	Wilson, K. and Walker, J. (2010) <i>Principles and Techniques of Biochemistry and Molecular Biology</i> . Cambridge University Press, Cambridge.
5.	Willey, J. M., Sherwood, L., & Woolverton, C. J. (2017). <i>Prescott's Microbiology</i> .

BLUEPRINT:

Code number: MB 224

Title of the Paper: Microbial diversity - I

Unit number	Number of Hrs	Total marks for which the questions are to be asked (including bonus questions)
Unit I	10	20
Unit II	20	39
Unit III	15	29
	45	88
Maximum marks for the paper (Excluding bonus question) = 60		

Practical II
MB 2P1 24 – Microbial Diversity - I

(11 sessions 3hr/week)

Sr. No.	Experiments	Units
1.	Bacterial growth on different types of media- NA, minimal agar, EMB, Mc Conkey agar	2
2.	Bacterial growth curve	1
3.	Growth of bacteria on various Carbon and Nitrogen sources	2
4.	Biochemical tests for the identification of bacteria- IMViC, starch hydrolysis, TSI, Gelatin liquefaction, catalase and oxidase test, Carbohydrate fermentation.	2
5.	Preparation of glycerol stocks	1
6.	Bacteriophage Plaque assay	2
7.	Antibiotic assay – Kirby Baur's	1

Course outcomes for MB 224 and MB 2P1 24

At the end of the course, the student will be able to:

CO1	Demonstrate knowledge of microbial systematics, including the 5-kingdom classification system and the 3-domain classification system, and explain their significance in understanding microbial diversity.
CO2	Develop an understanding of nutritional requirements of various microorganisms for their subsequent growth/cultivation and control.
CO3	Perform basic experiments to culture, identify, classify and preserve microorganisms in the laboratory.
CO4	Carry out comparative analysis of growth requirements of various kinds of microorganisms.