



**College of Arts,
Science &
Commerce**

RISE WITH EDUCATION

(Autonomous) Sion (West), Mumbai – 400022

Faculty: Science

Program: B.Sc.

Subject: MICROBIOLOGY

Academic Year: 2024– 2025

AS PER NATIONAL EDUCATION POLICY 2020

Choice Based Credit System (CBCS)

S.Y.B.Sc. (Minor)

**Revised Credit Based Semester and Grading Syllabus approved by
Board of Studies in Microbiology brought into effect from June
2024**

Approved in academic council meeting on 7th August 2024

PROGRAM OUTCOME (PO)

At the end of an Undergraduate Program, a student would have obtained the following:

- **PO1. Solving Complex Problem:**

Applying the knowledge of various courses learned under a program with an ability to break down complex problems into simple components, by designing processes required for problem solving.

- **PO2. Critical Thinking:**

Organizing thoughts to identify assumptions, verifying the accuracy and validity of assumptions, making informed decisions that guide actions (at Institutional, Personal and Intellectual level), developing the ability to think with different perspectives and ideas.

- **PO3. Reasoning ability and rational thinking:**

Developing rational thinking on the basis of acquired contextual knowledge, assessing societal, public health and safety, cultural, legal, gender, ethnic and environmental issues, and performing with decisive responsibility.

- **PO4. Research skill:**

Utilizing the contextual knowledge in an interdisciplinary framework. Integrating research-based knowledge and research methods involving problem definition, analysis and interpretation of data, synthesis of the information to provide valid conclusions. Exercising analytical skill, research ability, creativity, for employability and collaborating with industries.

- **PO5. Effective Communication skill:**

Facilitating to speak, read, write and listen effectively through both formal language and in one's own mother tongue, in order to make meaning of the world around. Enabling to comprehend and write effective reports and documentation, make successful presentations, give and receive clear instructions.

- **PO6. Proficiency with ICT:**

Equipping to create, select, apply appropriate tools and techniques, resources through electronic media for the purpose of gathering, analyzing data and drawing inference with an understanding of its merits and demerits.

- **PO7. Social Interactive Skills and team work:**

Eliciting networking with people, mediate disagreement and help reach conclusions in group settings. Functioning effectively as an individual, and as a member in diverse groups, and in multidisciplinary settings exhibiting adaptability, leadership quality and team-building

- **PO8. Ethical values:**

Recognizing and respecting different value systems including one's own, to understand the moral dimensions of one's decisions, intention to help the society and feeling good about it, commitment to professional duties and responsibilities.

- **PO9. Self-directed Learning:**

Acquiring the ability to explore and gain knowledge in independent ways, keep evolving lifelong in the broad context of socio-technological changes.

- **PO10. Sensitization towards Environment and Sustainability:**

Understanding the need for sustainable development and concern for environmental issues, realizing the importance of cohabitation, co-evolution in our achievements of sustainable development goal

- **PO11. Gender Sensitization:**

Demonstrating knowledge and understanding of gender equity-issues and gender justice.

- **PO12. Civic Values and Global Citizenship:**

Expressing empathetic social concern while helping others when their rights are violated, no matter where in the world they live, to act with an informed awareness on issues, to participate in civic life by volunteering for social justice.

PROGRAMME SPECIFIC OUTCOMES (PSO) (FOR MICROBIOLOGY)

- PSO1: Students will be introduced to the subject of Microbiology which is not taught at the junior college
- PSO2: Eloquence in specific phraseology pertaining to the subject of microbiology.
- PSO3: Familiarize with the theories and techniques of the various areas in microbiology.
- PSO4: Obtain expertise in essential practical techniques required in microbiological analysis and prepare for advance studies.
- PSO5: Discuss the applications of microorganisms in the various fields of microbiology

MINOR PAPER I		
Course code	SEMESTER III	
SIUMIMN211	Environmental Microbiology	3 Credits (45 lectures)
Unit-I	Air Microbiology	15 lectures
Unit-II	Soil Microbiology	15 lectures
Unit-III	Fresh water & Marine Microbiology	15 lectures
	PRACTICALS	1 Credit

MINOR PAPER II		
Course code	SEMESTER IV	
SIUMIMN221	Industrial Microbiology, Microbial Diversity and Applications Of Microbiology	3 Credits (45 lectures)
Unit-I	Industrial Microbiology	
Unit-II	Microbial diversity in extreme environments and Metagenomics	
Unit-III	Biofertiliser, Biopesticide , Bioremediation	
	PRACTICALS	1 Credit

S.Y.B.Sc. MICROBIOLOGY SYLLABUS

SEMESTER III MINOR PAPER I

Course: Environmental Microbiology

Course code: SIUMIMN211

Course Outcomes (CO)

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

1. Evaluate and compare methods of air sanitation and quality control.
2. Review microbiology of freshwater, marine, sewage
3. Outline the methods of water potability testing and sewage treatment.
4. Discussing the different soil cycles and evaluating their role in Geomicrobiology

Course code	MINOR PAPER	3 CREDITS
SIUMIMN211	Environmental Microbiology	45 LECTURES
UNIT	TOPIC	LECTURES
Unit I	Air Microbiology 1.1 Aeromicrobiology: Important airborne pathogens and toxins, Aerosols, nature of bioaerosols, aeromicrobiological pathway, microbial survival in the air, extramural aeromicrobiology, intramural aeromicrobiology 1.1 Sampling Devices for the Collection of Air Samples, Detection of microorganisms on fomites 1.2 Air Sanitation 1.3 Air Quality Standards	15L

<p>Unit II</p>	<p style="text-align: center;">Fresh Water and Marine Microbiology</p> <p>2.1 Fresh Water Microbiology</p> <ul style="list-style-type: none"> • Fresh water environments and micro-organisms found in Springs, rivers and streams, Lakes, marshes and bogs <p>2.2 Potable water:</p> <ul style="list-style-type: none"> • Definition, water purification, water quality standards and pathogens transmitted through water <p>2.3 Microbiological analysis of water:</p> <ul style="list-style-type: none"> • Indicator organisms and their detection in water-Total Coliforms, Faecal Coliforms and <i>E. coli</i>, Faecal <i>Streptococci</i>, <i>Clostridium perfringens</i> <p>2.4 Marine Microbiology</p> <ul style="list-style-type: none"> • Marine zones Bacteria in marine, estuarine, ocean environments 	<p style="text-align: center;">15L</p>
<p>Unit III</p>	<p style="text-align: center;">Soil and Geo Microbiology</p> <p>3.1 Terrestrial Environment</p> <p>Soil- Definition, Composition, function , Textural triangle</p> <p>Types of soil microorganisms and their activities</p> <p>3.2 Methods of studying soil microorganisms:</p> <p>Sampling, Cultural methods, Physiological methods, Immunological methods, Nucleic acid based methods, Radioisotope techniques</p> <p>3.3 Biogeochemical Cycles:</p> <p>Carbon cycle, Nitrogen cycle, Sulphur cycle, Phosphorus Cycle, Iron cycle</p>	<p style="text-align: center;">15L</p>

Course code	PRACTICALS	1 Credit
SIUMIMNP211	MINOR PAPER I	1 Credit
	TOPIC	
	<ol style="list-style-type: none"> 1. Enumeration of microorganisms in air and study of its load after fumigation 2. Study of air microflora and determination of sedimentation rate 3. Routine analysis of water: Standard Plate Count, Detection of Coliforms in water: Presumptive Test, Confirmed Test , Completed Test 4. Study of microbial flora in raw and treated sewage 5. Total viable count of soil microflora 6. Isolation of bacteria, Actinomycetes and fungi from soil 7. Enrichment and isolation of Nitrosifiers, Nitrifiers, Cellulose degraders, Sulphate reducers and Phosphate solubilisers from soil 8. Preparation of Winogradsky's column 	

**SYBSc Microbiology Syllabus
Semester 4**

Course: Industrial Microbiology, Microbial Diversity and Applications of Microbiology

Course code: SIUMIMN221

Course Outcomes (CO)

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

1. Describe and understand basic fundamentals of industrial microbiology.
2. Classifying microorganisms based on taxonomic principles and evaluate the different methods of microbial taxonomy.
3. Understanding extreme environment and comparing the microbial diversity and studying the applications of extremophiles.
4. Evaluating the role of microbes as biofertilizers, biocontrol agents and remediation of polluted environment.

COURSE CODE	MINOR PAPER	3 CREDITS
SIUMIMN221	Industrial Microbiology, Microbial Diversity and Applications of Microbiology	45 LECTURES
UNIT	TOPIC	LECTURES
Unit I	Industrial Microbiology 1.1 Strains of industrially important microorganisms: Desirable characteristics of industrial strain Principles and methods of primary and secondary Screening 1.2 Types of fermentations: Surface and Submerged, Batch, continuous fermentation Solid state fermentation 1.3 Design of an ideal fermenter: conventional stirred tank reactor 1.4 Concept of upstream and Downstream processing Industrial inoculum	15L

	<p>build up</p> <p>1.5 Media for industrial fermentations: Production and Inoculum media, Media components :- Carbon source, nitrogen source, amino acids and vitamins, minerals, water, buffers, antifoam agents, precursors, inhibitors and inducers</p>	
Unit II	<p>Biodiversity in extreme environments and Metagenomics</p> <p>2.1 Biodiversity in extreme environments</p> <ul style="list-style-type: none"> • Extreme Environments and their types with respect to the physical conditions which lead to microbial stress • Temperature based environments- Low and high temperature environments • pH based environments- Acidic and alkaline environments, Acid mine drainage • Environments with high salt concentration <p>2.2 Applications of extremophiles:</p> <ul style="list-style-type: none"> • Applications of Acidophiles and Alkalophiles • Applications of halophiles- in biotechnology and medicine • Applications of psychrophiles in pharmaceuticals and environment. • Applications of thermophiles and hyperthermophiles in enzymology 	15L

Unit III	<p>Biofertiliser, Biopesticide , Bioremediation</p> <p>3.1 Biofertiliser: Introduction of Biofertilizers, Different types of biofertilizers, Mass production of Biofertilizers, Application of Biofertilizers</p> <p>3.2 Biopesticides- Introduction of biopesticides, Types of Biopesticides Technical Aspects of Biopesticides, Major biopesticides produced and used in India</p> <p>3.3 Bioremediation: Introduction of Bioremediation, Principle of Bioremediation Factors affecting Bioremediation, Phytoremediation – types, Microbial Populations used for Bioremediation processes, Bioremediation strategies, Advantages and Disadvantages of Bioremediation</p>	15
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COURSE CODE	PRACTICALS	1 Credits
SIUMIMNP221	MINOR PAPER	1 Credit
	TOPIC	
	<ol style="list-style-type: none"> 1. Crowded plate technique 2. Antibiotic producer screening by Wilkins overlay method 3. Antibiotic spectrum determination(streak/strip) 4. Solid state fermentations (group experiment) 5. Isolation of thermophiles, acidophiles and psychrophiles 6. Estimation of heavy metals (Titration method) 7. Preparation of biofertilizer 8. Efficacy of biofertilizer 	