

**Shiksha Mandal's  
Bajaj College of Science, Wardha (Autonomous)**

**Proposed Syllabus for Four Year Multidisciplinary UG Program with DSC as  
Major Microbiology**

**(e.g. Four Year B.Sc. Honors/Research Program)**

**Program: B.Sc. (Academic Session 2023-24) Syllabus under Autonomy**

**DSC –I offered by Department of Microbiology**

**Name of the course: DSC –I Microbiology- I (History and Microbial Morphology)**

**[4hrs/week= 15\*4 Th=60<sup>Th</sup> And 4 hrs/week= 15 weeks\* 4 pract = 60 P]**

**[Credits 4 T+2 P = 6]**

### **Course Description**

This course is designed in such a way that the students will gain insights of History and Microbial Morphology. The students will also learn about bacterial classification, microbial nutrition as well as structure, classification and growth of viruses.

### **Course Objectives**

To learn the basics about History and Microbial Morphology

### **Course Learning Outcomes**

After successful completion of the course, the student is expected to

**CO1:** Students will get detailed knowledge on the basic concept of microbiology. They will learn about the history of microbiology & contribution of various scientists in the development of Microbiology.

**CO2:** Students will learn in great detail about the scope of Microbiology in various fields like Food industry, Dairy industry, Pharmaceutical industry etc. This learning will help them as far as their future in Microbiology is concerned.

**CO3:** In this course students will also learn about various classes of bacteria & also about bacterial identification which is very important for practical point of view.

**CO4:** The course includes detailed study on prokaryotic & eukaryotic microbes, therefore students will learn in detail about it.

**CO5:** Students will come to know about nutritional requirements of microorganisms & also about different types of culture media. This will help them in the laboratory & also in research to select appropriate media for particular bacteria.

**CO6:** In this course students will also learn about structure & classification of viruses. They will also learn the methods of cultivation of viruses.

### **Unit-I: A. History of Microbiology**

- i) Discovery of microbe
- ii) Theory of biogenesis and abiogenesis.
- iii) Contributions of Louis Pasteur, Robert Koch, Sergei Winogradsky, Martinus Beijerinck, John Tyndal and Joseph Lister.

**B. Scope of Microbiology:** Basic Branches of Microbiology: Bacteriology, Mycology, Phycology, Virology Applied Branches Biotechnology: Medical Microbiology, Biotechnology, Geomicrobiology, Exobiology, Environmental Microbiology, Food and Dairy Microbiology

### **Unit -II: Classification of Bacteria**

- i) Definition: Taxonomy, classification, Identification, Nomenclature.
- ii) Approaches in Bacterial Classification: Bacterial Classification, Whittaker Five Kingdom System, Intuitive Method of Classification, Numerical Taxonomy, Genetic Relatedness: GC: AT Ratio, DNA Hybridization, 16SrRNA Cataloguing
- iii) Bergey's Manual of Systematic and Determinative Bacteriology.

### **Unit-III: Prokaryotic Cell structure**

- i) Concept and difference between Eukaryotes and Prokaryotes.
- ii) Typical Bacterial cell structure: Structure of cell wall (gram +ve, gram-ve), Cell membrane: Fluid mosaic model, Mesosomes, Ribosomes, Nucleoid, plasmids, Storage granule, Capsules, slime layer, Pili, Flagella (including types and structure).
- iii) Endospore structure, formation and germination
- iv) Exospores, Myxospores.
- v) Significance of Dormancy

### **Unit-IV: Eukaryotic Microbes**

- i) Fungi and yeast: General characters, Asexual and sexual mode of reproduction, slide culture techniques.
- ii) Algae: General characters and industrially important algal cells

iii) Protozoans: General characters of trypanosome & Giardia

### **Unit-V: Microbial Nutrition**

- i) Basic nutritional requirements. ii) Nutritional classification of bacteria
- iii) Types of culture media: selective, enriched, enrichment, synthetic, non synthetic, Differential, assay media.
- iv) Pure culture v) Axenic cultures, Diauxic cultures.
- i) Isolation of pure culture: various techniques, Preservation of Pure cultures
- ii) Determination of C, N, P by auxanographic and replica plate technique.

### **Unit-VI: Acellular Microbes: Viruses**

- i) Discovery of viruses, General structure, symmetry and classification
- ii) Cultivation of viruses: chick embryo, tissue culture
- iii) Detection of viral growth iv) T4-Bacteriophages and Lambda viruses.
- v) Lytic and Lysogeny cycle

## **Practicals Sem I**

1. General Biosafety rules in Microbiology.
2. General concept of basic equipment's and apparatus
3. Preparation of media: Nutrient agar, nutrient broth, PDA, selective & differential media.
4. Demonstration of microbes from air, water, soil
5. Isolation of pure culture by streak plate, spread plate and pour plate method\*
6. Cultivation of fungi by slide culture technique
7. Staining of fungi
8. Isolation of bacteriophage from sewage
9. Demonstration of antibiotic disc sensitivity test.

## **List of Books Recommended For Semester I and Semester II Microbiology**

- 1) General Microbiology :Stainer, Roger et. al.
- 2) General Virology : Luria, S.E.
- 3) Handbook of Genetics :Esser, K.
- 4) Fundamentals Principles of : A.J. Salle. bacteriology
- 5) Microbiology :Pelczar, Chan, Krieg.(TMH)
- 6) Fundamental of Microbiology : Frobisher
- 7) General Microbiology Vol. I &II : Power &Daginawala. (Himalaya Publication)
- 8) Zinsser Microbiology : W.K. Joklik
- 9) General Microbiology : W.G. Walter
- 10) Elements of Microbiology : M.J. Pelozar& E.C.S. Chan
- 11) Essays in Microbiology : J.N. Norris & M.H. Richmond
- 12) Microbiology : L. Mckane& J. Kandel (Essentials & Applications)
- 13) Basic Microbiology : Volk
- 14) Chemical Microbiology : Rose
- 15) Microbiology : Paul A. Ketchum. (Introduction to Health of Professional)
- 16) Molecular Biology of the gene : J.D. Watson.
- 17) Elementary Microbiology :Modi (AktaPrakashan) Vol. I & II
- 18) Basic experimental : Ronald M., Atlas, & Alfred Microbiology Miller  
E.Brown, Kenneth  
W. Dobra, Lionas (1986) (Prentice Hall - 316 PP)
- 19) General Microbiology : Robert F.Boyd (1984) times mirror / mosby college,  
Pub.
- 20) Text Book of Microbiology :Dubey&Maheshwari (S.Chand, Publication)
- 21)Foundation in  
Microbiology:UlhasPatil,A.B.Chaudhary,Dr.S.B.Chincholkar,J.S.Kulkarni(Neer  
ali Publication)

## **List of books for practicals**

- 1) Microbes in Action :Seely, Wander Mark Tarporewala, Bombay
- 2) A Mannual of Microbiology : A.J. Salle.
- 3) Microbiology Methods : Collins
- 4) Bacteriological Techniques :F.J.Baker
- 5) Introduction to Microbial Techniques :Gunasekaran
- 6) Biochemical methods: Sadashivam&Manickam
- 7) Laboratory Fundamentals of Microbiology: Alcamo, I.E., Jones and  
Bartlett Publishers

**Shiksha Mandal's  
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**DSC-II offered by Department of Microbiology**

**Name of the course: DSC-II Microbiology II (Microbial  
Techniques)**

**[4hrs/week= 15\*4<sup>Th</sup>=60Th And 4 hrs/week= 15 weeks\* 4 pract = 60 P]**

**[Credits 4 T+2 P = 6]**

**B.SC. Semester II**

**Name of Paper: Microbial Techniques**

**Course Description**

This course is designed in such a way that the students will get the knowledge about different types of Microscopy techniques, bacterial and fungal staining techniques. The students will also learn about growth and reproduction of microorganisms as well as microbial control and different microbial interactions.

**Course Objectives**

They will learn the basics about Microbial Techniques

**Course Learning Outcomes**

After successful completion of the course, the student is expected to

**CO1:** Know about the principles & applications of various microscopes.

**CO2:** Learn about various staining techniques used in Microbiology.

**CO3:** Learn in detail about microbial reproduction & microbial growth

**CO4:** Students will learn standard terminologies used in Microbial control.

**CO5:** Students will learn about physical & chemical methods used for microbial control.

**CO6:** The students will understand different types of microbial interactions with plants, animals & with other microbes. This knowledge will help them to understand the significance of microbes in the ecosystem.

**Unit-I: Microscopy: Basic Principle and Applications**

- i) Bright field microscopy concept of Resolution, Magnification, Numerical aperture
- ii) Dark field microscopy
- iii) Electron microscopy (TEM, SEM)
- iv) Confocal microscopy
- v) Phase contrast microscopy
- vi) Fluorescent microscopy.

**Unit-II: Staining Techniques**

- i) Stains and dyes, chromophore, auxochrome, chromogens, types of stains.
- ii) Staining techniques: simple, differential, gram staining, acid fast staining.
- iii) Staining of specific structure: flagella, spores, capsule (negative), Metachromatic granule staining.

### **Unit-III: Microbial Reproduction and Growth.**

- i) Microbial Reproduction: Binary fission, Budding, Fragmentation, Sporulation
- ii) Microbial growth: Principle of growth curve, Different phases and mathematical expression of growth rate
- iii) Continuous culture: Dialysis, Turbidostat and Chemostat, Concept of Synchronous culture, Helmstetter Cummings Filterpad Technique .
- iv) Methods for quantitative measurement of bacterial growth
- v) Factors influencing microbial growth

### **Unit-IV: Microbial Control.**

- i) General Terminologies: sterilization, disinfection, disinfectants, sanitizer, antiseptics, microbiostatic, microbiocidal, sanitizer, preservation, Pasteurization.
- ii) Physical methods: Heat, moist heat sterilization, Dry heat sterilization, Low temperature, Filtration, radiation, osmotic pressure. Applications of physical control agent.

### **Unit-V: Chemical Control Agents**

- i) Characteristics of an ideal disinfectants, Phenolics, Alcohols, Halogens, Heavy metals, Quaternary ammonium compounds, Surface active agents, Aldehydes, Gaseous sterilization, Chemotherapeutic agents.
- ii) Mechanism of cell injury, Factors influencing antibacterial activity.
- iii) Phenol coefficient.
- iv) Applications of chemical control agents

### **Unit-VI: Microbial interaction**

- i) Positive and negative interaction: Commensalism, synergism, syntropism, mutualism, parasitism, predation, antagonism, competition
- ii) Protist-Protist Interaction: Bdellovibrio
- iii) Protist-Plant interaction: Root nodule bacteria
- iv) Protist-Animal interaction: Rumen bacteria, insect midgut bacteria, luminescent bacteria

## **Practicals Sem II**

1. Simple, Grams, acid-fast, fungal and endospore staining
2. Determination of phenol coefficient

3. To Study the effect of salt concentration on bacterial growth
4. To perform membrane filtration
5. To cultivate anaerobic bacteria
6. Isolation of rhizobium from root nodules of leguminous plants.
7. Performance of Oligodynamic action of metals
8. Enumeration of microorganisms by SPC
9. Demonstration of Micrometry
10. Determination of no. of cells by Breed method

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**Shiksha Mandal's  
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**Minor -II offered by Department of Microbiology**

**Name of the course: Minor-II Microbiology (Microbial  
Techniques)**

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**[Credits 4 T+2 P = 6]**

**B.SC. Semester II**

**Name of Paper: Microbial Techniques**

**Course Description**

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**Course Objectives**

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**CO1:** Know about the principles & applications of various microscopes.

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**Unit-II: Staining Techniques**

i) Stains and dyes, chromophore, auxochrome, chromogens, types of stains. ii) Staining techniques: simple, differential, gram staining, acid fast staining. iii) Staining of specific structure: flagella, spores, capsule (negative), Metachromatic granule staining.



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iv) Methods for quantitative measurement of bacterial growth v) Factors influencing microbial growth

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i) General Terminologies: sterilization, disinfection, disinfectants, sanitizer, antiseptics, microbiostatic, microbiocidal, sanitizer, preservation, Pasteurization. ii) Physical methods: Heat, moist heat sterilization, Dry heat sterilization, Low temperature, Filtration, radiation, osmotic pressure. Applications of physical control agent.

### **Unit-V: Chemical Control Agents:**

i) Characteristics of an ideal disinfectants, Phenolics, Alcohols, Halogens, Heavy metals, Quaternary ammonium compounds, Surface active agents, Aldehydes, Gaseous sterilization, Chemotherapeutic agents. ii) Mechanism of cell injury, Factors influencing antibacterial activity. iii) Phenol coefficient. iv) Applications of chemical control agents

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