

Syllabus for Microbiology Minor

Semester: I	Course No.: 113	Course Code: -- MIE-113 (T+P)
		Course Title: Microbial Saga: Discovery and Introduction
Credits: 4		Course Category: -Minor

Course Outcomes: On successful completion of the course the learner will be able to

CO#	COGNITIVE ABILITIES	COURSE OUTCOMES
CO113.1	REMEMBERING	Learn about the origin of life and the evolution of the microbiology field. Contributions of scientists pertaining to microbiology and different areas of microbiology.
CO113.2	UNDERSTANDING	Learn about the morphological and differential characteristics of different groups of microorganisms.

Unit No.	Unit Contents	Sessions Allotted
1	<p>Origin and History of the Microbial World: Origin and history of the microbial world</p> <p>A. Origin of Microbial Life</p> <ol style="list-style-type: none"> i. Biogenesis Vs Abiogenesis (Hypothesis and experiments) ii. Miller's experiments, Ubiquitous nature of microbial life. iii. Development from simple to complex life forms. <p>B. History of Microbiology Significance of Scientific contributions in the development in Microbiology as a discipline:</p> <ol style="list-style-type: none"> i. Early contributions: Robert Hook, Anton Van Leeuwenhoek, Louis Pasteur, Robert Koch, John Tyndall. ii. Scientific contribution leading to diversification of Microbiology: Recent milestone discoveries in the field of microbiology. <p>C. Medical Microbiology and Immunology: Edward Jenner, Paul Ehrlich, Ellie Metchnikoff, Joseph Lister</p> <p>D. Food Microbiology and Fermentation: Alexander Fleming, Louis Pasteur, Selman Waksman</p> <p>E. Soil Microbiology: Sergei Winogradsky, Martinus Beijerinck</p> <p>F. Microbial Genetics: Watson and Crick, Hargobind Khurana, Griffith, Avery, McCarty, and Macloed</p> <p>G. Avenues of Microbiology</p>	15
2	<p>Introduction to the Microbial world:</p> <p>A. Distribution in nature. Different habitat:</p> <ol style="list-style-type: none"> i. Terrestrial- soil and other animals, plants ii. Aquatic – Fresh and Marine water iii. Atmosphere- Air iv. Extremophiles – Temperature, Salt, Anaerobiosis, Pressure <p>B. Major groups of microorganisms.</p> <ol style="list-style-type: none"> i. Bacteria and Actinomycetes ii. Yeast and Fungi iii. Algae iv. Viruses v. Viroids and prions vi. Protozoa 	15

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MIE-113(P): MICROBIOLOGY PRACTICALS

Paper Name: Microbiology Practicals

Credits: 02 (08 hrs/week Total: 60 hrs)

CO#	COGNITIVE ABILITIES	COURSE OUTCOMES
CO113.1	REMEMBERING	Describe the good lab practices and biosafety measures to be adopted while working in a microbiology lab. Explain the principle and applications of various instruments used in microbiology laboratory
CO113.2	UNDERSTANDING	Preparation, sterilization, and disposal of basic bacteriological media used for the cultivation of bacteria Handling and use of glassware used in microbiology laboratory
CO113.3	APPLYING	Apply staining techniques to prepare slides for microscopic examination of various types of microorganisms.

1. Introduction to microbiological laboratories: Dos and Don'ts
2. Study of principle, component parts, and operation of the compound light microscope
3. Study of principles and working of laboratory instruments: Autoclave, Hot air oven, Incubator, Water bath, Bacteriological Filters, Centrifuge, Rotary shaker, pH meter, Colorimeter
4. Disposal of laboratory waste and cultures
5. pH adjustment of solution by use of pH strip and pH meter
6. Preparation of bacteriological media: Nutrient broth and Nutrient agar
7. Study of curd sample by wet mount (temporary mount)
8. Simple staining of bacteria: Monochrome staining & Negative staining

Suggested Text Books:

1. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata McGraw Hill Press.
2. Prescott L.M., Harley J.P., and Klein D.A. (2005). Microbiology, 7th Edition. McGraw Hill Companies Inc.

Suggested Reference Books:

1. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3rd Edition. Thomson Brooks / Cole.
2. Fundamentals of Microbiology – 6th edition, I. E. Alcamo, Jones, and Bartlett Publishers
3. H A Modi Elementary Microbiology Volume I Akta Prakashan, Nadiad
4. Black J G, (2002) Microbiology: Principles and Explorations, 5th edn, John Wiley and Sons, Inc.

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Semester: II	Course No.: 123	Course Code: MIE-123 (T+P)
		Course Title: Foundations and fundamentals of Bacteriology
Credits: 4		Course Category: -Minor

Course Outcomes: On successful completion of the course the learner will be able to

CO#	COGNITIVE ABILITIES	COURSE OUTCOMES
CO123.1	REMEMBERING	Have knowledge regarding the fine structure of bacterial cell Learn about the functions of bacterial organelles Learn the details of different surface organelles of bacteria
CO123.2	UNDERSTANDING	Define different terms involved in the nutrition of bacteria. Describe various media and their use for the cultivation of bacteria. Methods for cultivation of anaerobic bacteria

Unit No.	Unit Contents	Sessions Allotted
1	<p>Structural Organization of a Bacterial Cell</p> <p>A. Surface appendages (a) Flagella (b) Pili and Fimbriae (c) Prosthecae and Stalks</p> <p>B. Surface layers (a) Capsule and Slime layer (b) Cell wall,</p> <p>C. Differential staining – Gram staining and Acid-fast staining (c) Cytoplasmic membrane and Mesosomes</p> <p>D. Cytoplasm and cell organelles (a) Cytoplasm (b) Ribosomes (c) Nuclear material and Plasmid (d) Cellular reserve food material (e) Bacterial Endospore – structure, sporulation and germination</p>	15
2	<p>Nutrition and Cultivation of Bacteria</p> <p>A. Nutritional and chemical requirements of bacteria: i. Carbon, ii. Oxygen, iii. Nitrogen, iv. Sulfur, v. Phosphorus, vi. Trace elements, vii. Vitamins, viii. Growth factors ix. Water</p> <p>B. Nutritional diversities in bacteria i. Based on the source of energy: Phototrophs, Chemotrophs ii. Based on the source of electron donor: Lithotrophs, Organotrophs iii. Based on the source of carbon: Autotrophs, Heterotrophs, Mixotrophs, Obligate parasites</p> <p>C. Culture media : i. Media ingredients, ii. Preparation of media, iii. Types of media a. Based on the state of media: Solid, Broth, Semi-solid b. Based on ingredients: Natural, Synthetic, and complex c. Based on functions: General purpose, selective, Differential, Enriched and Enrichment media Biochemical media, Assay media and Enumeration Media</p>	15

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Paper Code: MIE-123(P) (Practicals)

Paper Name: Microbiology Practicals

Credits: 02 (08 hrs/week Total: 60 hrs)

CO#	COGNITIVE ABILITIES	COURSE OUTCOMES
CO123.1	REMEMBERING	Students will learn the growth & morphological characteristics of different bacteria
CO123.2	UNDERSTANDING	Students will understand the principle behind different staining techniques & The growth conditions of bacteria
CO123.3	APPLYING	Students will be able to perform bacterial staining & identify different structures of bacteria such as spores, capsules, cell walls, and granules

1. Differential staining techniques: Gram Staining
2. Cultivation and isolation of bacteria:
 - a. Broth culture method
 - b. Agar plate methods
 - i. Spread plate method
 - ii. Pour plate method
 - iii. Streak plate method [Method: Gram stain of mixed bacterial culture, Isolation of bacteria, Colony (Cultural) characteristics, Morphological characteristics (Gram stain)]
 - c. Agar slant (slope) method for pure culture
3. Preservation of microbial cultures:
 - a. Periodic subculturing and storage at refrigeration temperature
 - b. Preservation of bacteria in soil (Nitrogen fixers)
4. Study of hay infusion by hanging drop method
5. Study of pigmented bacteria:
 - a. *Staphylococcus aureus*
 - b. *Micrococcus luteus*
 - c. *Serratia marcescens*
 - d. *Pseudomonas aeruginosa*
6. Cultivation of anaerobic bacteria by use of ...
 - a. Robertson's cooked meat medium
 - b. Thioglycolate broth
 - c. Anaerobic jar (Demonstration)

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lyoyal
HEAD OF MICROBIOLOGY DEPARTMENT
M. G. Science Institute,
AHMEDABAD-380009.