

3-1-102

SUBJECT: BIO-TECHNOLOGY

SEMESTER-I

Paper I: MICROBIOLOGY AND CELL BIOLOGY

UNIT I

History, Development and Microscopy

History and development of microbiology: contributions of Louis Pasteur, Robert Koch and Edward Jenner. Microscopy: Compound microscopy: Numerical aperture and its importance, resolving power, oil immersion objectives and their significance, principles and applications of dark field, phase contrast, fluorescent microscopy. Electron microscopy: Principle, ray diagram and applications, TEM and SEM, comparison between optical and electron microscope, limitations of electron microscopy.

Stains and staining procedures: Acidic, basic and neutral stains, Gram staining, Acid fast staining, Flagella staining, Endospore staining.

UNIT II

A. Bacteria:

Bacterial morphology and subcellular structures, general morphology of bacteria, shapes and sizes, generalized diagram of typical bacterial cell.

Slime layer and capsule, difference between the structure, function and the position of the two structures. Cell wall of gram +ve and Gram -ve cells, Prokaryotic classification. General account of flagella and fimbriae.

Chromatin material, plasmids; definition and kind of plasmids (conjugative and non-conjugative) F, R, and Col plasmids.

Endospores: Detailed study of endospore structure and its formation, germination, basis of resistance.

A brief idea Bergey's manual. Morphology of archaea, archaeal cell membrane (differences between bacterial and archaeal cell membrane), other cell structures, concept of the three distinct archaea groups.

B. Viruses: General characteristics of viruses, difference between virus and typical microbial cell, structure, different shapes and symmetries with one example of each type, classification of viruses on the basis of nucleic acids, phage and animal cell viruses, example of each and their importance. Brief idea of lytic cycle and lysogeny.

UNIT III

Microbial Nutrition: Basic nutritional requirements: Basic idea of such nutrients as water, carbon, nitrogen, sulfur and vitamins etc., natural and synthetic media, nutritional classification of bacteria. Selective and Differential media, Enriched media, Enrichment media.

UNIT IV: Microbial growth and control:

Growth: Growth rate and generation time, details of growth curve and its various phases.

Concept of synchronous cultures, continuous and batch cultures (chemostat and turbidostat). Measurement of growth.

Physical conditions required for growth: Temperature (classification of microorganisms on the basis of temperature requirements), pH etc. Pure cultures and cultural characteristics.

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Maintenance of pure culture.

Microbial Control: Terminologies - Sterilization, disinfection, antiseptic, sanitization, germicide, microbistasis, preservative and antimicrobial agents.

Mechanism of cell injury: Damage to cell wall, cell membrane, denaturation of proteins, inhibition of protein synthesis, transcription, replication, other metabolic reactions and change in supercoiling of DNA.

Physical control: Temperature (moist heat, autoclave, dry heat, hot air oven and incinerators), dessication, surface tension, osmotic pressure, radiation, UV light, electricity, ultrasonic sound waves, filtration.

Chemical control: Antiseptics and disinfectants (halogens, alcohol, gaseous sterilization. Concept of biological control.

UNITV: CellBiology

Eukaryotic Cell - Structure and function of the following: nucleus, nuclear membrane, nucleoplasm, nucleolus, golgi complex, Mitochondria, Chloroplast, endoplasmic reticulum, lysosomes, peroxisomes, glyoxisomes and vacuoles. Plant cell wall.

Cytoskeleton (Micro and Macro filaments, microtubules) and cell locomotion. Mitosis and meiosis. Brief idea of cell cycle.

Muscle and nerve cell structure, synaptic transmission and neuromuscular junctions.

Practicals: Microbiology & Cell Biology

1. Demonstration, use and care of microbiological equipments.
2. Preparation of media, sterilization and isolation of bacteria.
3. Isolation of Bacteriophage from sewage / other sources.
4. Demonstration of motility of Bacteria.
5. Simple staining of bacteria
6. Gram staining of Bacteria
7. Acid fast staining of Bacteria
8. Endospore staining.
9. Demonstration of starch hydrolysis by bacterial cultures
10. Growth of fecal coliforms on selective media.
11. Isolation of pure culture by pour plate method
12. Isolation of pure culture by streak plate method.
13. Anaerobic cultivation of microorganisms.
14. Cultivation of yeast and moulds.
15. Antibiotic sensitivity assay.
16. Oligodynamic action of metals.
17. To study germicidal effect of UV light on bacterial growth.
18. Stages of mitosis.
19. Stages of meiosis.

Note: - Mandatory to perform at least ten practical.

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Attempt any five from Part A and all questions from part B

Time 3 Hrs

75 Marks

Part A

Note: The paper setter is advised to set at least one question from each unit. (5x3=15marks)

1. Edward Jenner concept
2. Principle of compound microscope
3. Properties of plasmids
4. Lysogeny
5. Preparation of medium
6. Effect of temperature on microbial growth
7. Mitosis
8. Structure of cell wall

Part B

(5x12=60 Marks)

9. A) Write on the principles of staining of microbes
OR
B) Explain the principle and applications of SEM
10. A) Elucidate the structure of E coli
OR
B) Discuss in detail on the conjugation of bacteria
11. A) discuss the differences between natural and synthetic media
OR
B) Based on nutritional aspects classify the microorganisms with reasons
12. A) Explain the mechanisms involved in regulation of microorganisms
OR
B) Describe the physical conditions required for microbial culture
13. A). Discuss in detail on the structure and functions of golgi complex
OR
B). Write an essay on meiosis I with its significance

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