PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS)

KAKINADA

DEPARTMENT OF BIOTECHNOLOGY

I B.Sc BIOTECHNOLOGY – II SEMESTER

PAPER – 3 - MICROBIOLOGY

Theory | Credits: 3 | 3 hrs/week

I.LEARNING OUTCOMES

On successful completion of the course, the students will be able to

- Summarize the historical contributions of Pasteur, Koch, and Jenner in microbiology.
- Differentiate between light, phase contrast, dark field, fluorescent, and electron microscopy.
- Describe bacterial morphology, cell structures, plasmids, endospores, and staining methods.
- Identify nutritional requirements, growth phases, and apply sterilization and disinfection techniques.
- Explain the structural organization, replication strategies, and transmission of viruses including modern examples.

II.Syllabus

Unit I

History, Development and Microscopy

1.1 History and development of microbiology: contributions of Louis Pasteur, Robert Koch and Edward Jenner.

1.2 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.

1.3 Electron microscopy: Principle, ray diagram and applications, TEM and SEM, comparison between optical and electron microscope, limitations of electron microscopy.

Unit II

Bacteria:

2.1 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 and function.

2.2 Cell wall of Gram +ve and Gram -ve cells. 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.

2.3 Staining: Acidic, Basic and Neutral stains. Simple and Gram Staining, Acid fast staining, Flagella staining, Endospore staining.

Unit III

Microbial Nutrition:

3.1 Basic nutritional requirements. Composition of Natural and Synthetic Media. Selective and Differential media, Enriched media, Enrichment media.

3.2 Factors Affecting Growth of Microbes: pH, Temperature, Salinity.

3.3 Classification of microorganisms based on nutrition and temperature.

Unit IV

Microbial growth and control:

4.1 Growth rate and generation time, details of growth curve and its phases. Measurement of growth.

4.2 Pure cultures and cultural characteristics. Maintenance of pure culture.

4.3 Microbial Control: Sterilization (Physical and chemical methods of sterilization), disinfection, sanitization, germicide, microbistasis, antiseptics and antimicrobials.

Unit V

Viruses:

5.1 Properties and General characteristics of Viruses. Classification of viruses on the basis of nucleic acids composition.

5.2 Basic Structure of Lamda and M13 DNA Virus. Brief idea of lytic cycle and lysogeny.

5.3 Viral Transmission: Different modes (dengue, SARS-CoV2) and their preventive measures

I B.Sc BIOTECHNOLOGY – II SEMESTER

PAPER – 3 - MICROBIOLOGY

Practical **Credits: 1** **2 hrs/week**

List of Practical: -

1. Cleaning and preparation of glassware
2. Observation of permanent slides using microscope
3. Preparation of nutrient agar medium for bacteria
4. Preparation of PDA medium for fungal culture
5. Sterilization techniques (autoclave, hot air oven, filter)
6. Isolation of bacteria from soil
7. Simple staining technique
8. Differential staining technique
9. Microbial counting by Haemocytometer
10. Identification of different bacteria
11. Motility test by hanging drop
12. Biochemical identification of bacteria
13. Preparation of pure culture by slab, slant, streak culture

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I B.Sc BIOTECHNOLOGY – II SEMESTER

PAPER – 4 - BASIC IMMUNOLOGY

Theory Credits: 3 3 hrs/week

I.LEARNING OUTCOMES

On successful completion of the course, the students will be able to

- Explain the organization of the immune system and differentiate innate and acquired immunity.
- Describe antibody structure, types, and antigenic determinants.
- Analyze mechanisms of humoral, cell-mediated, and NK cell-mediated immune responses.
- Differentiate between types of hypersensitivity and explain the principles and applications of vaccination.
- Apply knowledge of immunological techniques for antigen-antibody interactions and monoclonal antibody production.

II.Syllabus

UNIT I

1.1 Immune System: History and Scope of Immunology. Types of Immunity: Innate and Acquired.

1.2 Cells of immune system: T cells, B cells.

1.3 Organs of the Immune system: Bone marrow, spleen, thymus, MALT, lymph node.

UNIT II

2.1 Antibody and Antigen: Antibodies: Structure and Types of Antibodies (IgG, IgM, IgA, IgE,IgD).

2.2 Monoclonal and Polyclonal antibodies. Antibody diversity.

2.3 Antigens: Types of Antigens. Antigenicity (factors affecting antigenicity). Antigenic determinants – adjuvants and haptens, epitopes.

Unit III

3.1 Immunity: Humoral immunity. Cell-mediated immunity – T Cell-mediated immunity, NK cell-mediated immunity, ADCC.

3.2 Brief description of cytokines and interleukins.

3.3 Major Histocompatibility Complex (MHC) – Structure and functions of Class I and Class II MHC molecules

Unit IV

4.1 Hypersensitivity and Vaccination: General features of hypersensitivity, various types of hypersensitivity. Autoimmunity.

4.2 Vaccination: Discovery, principles, and significance.

4.3 Types of Vaccines – Live, attenuated, killed, toxoids, recombinant-based (mRNA and Protein).

Unit V

5.1 Immunological Techniques: Antigen-antibody reactions: Precipitation, agglutination, complement fixation, immunodiffusion – Radial immune diffusion, Ouchterlony double immune diffusion.

5.2 ELISA, RIA, immunoelectrophoresis, Rocket electrophoresis.

5.3 Hybridoma technology: Monoclonal antibodies and their applications in immunodiagnostics.

I B.Sc BIOTECHNOLOGY – II SEMESTER

PAPER – 4 - BASIC IMMUNOLOGY

Practical **Credits: 1** **2 hrs/week**

List of Practical: -

1 Antigen–antibody reaction–determination of Blood group, Cross reactivity

2. Pregnancy test

3. Widal test

4. Ouchterlony immunodiffusion

5. Radial immuno diffusion

6. ELISA

7. Production of antibodies and their titration