BTC DSC 402T
MOLECULAR DIAGNOSTICS

Contact Hours: 45
Full Marks = 100 [ESE (70) CCA (30)]

Course Objective: *The Molecular Diagnostics course is designed to equip students with a comprehensive understanding of diagnostic techniques used in clinical microbiology and immunodiagnostics. They will learn about enzyme immunoassays, molecular methods such as PCR, RT-PCR, RFLP, and hybridization methods, along with laboratory tests for antimicrobial chemotherapy. Students will also explore antigen and antibody purification, idiotypes, and epitopes, and gain practical skills in immunodiagnostic tests like ELISA, immunofluorescence, and radioimmunoassay.*

UNIT 1 *(10 Lectures)*

Enzyme Immunoassays: overview of enzyme immunoassays; types of enzymes used in immunoassays (horseradish peroxidise and alkaline phosphatase); conjugation of enzymes to antibodies; solid phases in enzyme immunoassays (microplates and membranes); homogeneous vs. heterogeneous enzyme immunoassays; use of polyclonal and monoclonal antibodies.

UNIT 2 *(9 Lectures)*

Molecular Methods in Clinical Microbiology: polymerase chain reaction (PCR) and its applications; reverse transcription PCR (RT-PCR); restriction fragment length polymorphism (RFLP); nuclear hybridization methods; southern blotting; northern blotting; fluorescence in situ hybridization (FISH); microarray analysis.

UNIT 3 *(10 Lectures)*

Laboratory tests for antimicrobial chemotherapy: minimum inhibitory concentration (MIC); minimum bactericidal concentration (MBC). **Micro-dilution and macro-dilution broth procedures:** broth microdilution method (MIC determination). **Diffusion test procedures for susceptibility testing:** disk diffusion method (Kirby-Bauer); agar dilution method. **Tests for bactericidal activity:** time-kill curve assay.

UNIT 4 *(9 Lectures)*

Purification and standardization of antigens and antibodies: protein purification techniques; antibody production and purification. **Idiotypes:** idiotype and anti-idiotype antibodies; application in immunodiagnostics. **Epitope:** design and applications in diagnostic assays.

UNIT 5 *(7 Lectures)*

Immunodiagnostic tests: ELISA (indirect, sandwich, competitive); immunofluorescence (direct and indirect); radioimmunoassay (competitive and non-competitive).

Course Outcome: *By the end of this course, students will be proficient in a wide range of molecular diagnostic techniques. They will understand the principles and applications of enzyme immunoassays, molecular methods in clinical microbiology, and laboratory tests for antimicrobial chemotherapy. Students will learn the technique of antigen and antibody purification, idiotype applications, and epitope design. Additionally, they will be skilled in performing various immunodiagnostic tests, making them well-prepared for careers in molecular diagnostics and clinical microbiology.*

SUGGESTED READING

1. Maggio, E. T. (2018). Enzyme Immunoassay. United States: CRC Press.
2. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). Jawetz, Melnick and Adelberg's Medical Microbiology. 24th edition. McGraw Hill Publication.
3. Ananthanarayan R and Paniker CKJ. (2005). Textbook of Microbiology. 7th edition (edited by Paniker CKJ). University Press Publication.
4. Joklik WK, Willett HP and Amos DB (1995). Zinsser Microbiology. 19th edition. Appleton-Centuary-Crofts publication.
5. Clift Ian C. (2020). Clinical Immunodiagnostics: Laboratory Principles and Practices: Laboratory Principles and Practices. Jones & Bartlett Learning.