

**PAPER – II (MICROBIOLOGY)**  
CW 02: TOOLS AND TECHNIQUES

**UNIT – I**

**Fundamentals of Microbiology:** Basic concept of microbial research. Concepts of microbial diversity and their habitats. Koch's postulates. Identification of microbes (bacteria, fungi and cyanobacteria) - basic and ribosomal gene sequence analysis methods. Assessment of microbial diversity by molecular techniques. Applications of microbiology in agriculture, industry, medical science and environment science.

**UNIT – II**

**Applied Microbiology:** Methods of microbiological examination of water and aerobiological research. Biodegradation of recalcitrant compounds (lignin, pesticides); Bio-inoculants - Bio-pesticides, Bio-herbicides and Bio-insecticides. Production of proteins in bacteria; Recombinant and Edible vaccines; Antibiotics - Properties, Production and its applications. Probiotics, Biofuels, Genetically modified microorganisms and their applications. Bio-fermenter, Biosensor.

**UNIT – III**

**Basic Techniques of Microbial research:** Condition and maintenance of microbiological laboratory; Culture media for bacteria, fungi and cyanobacteria; Sterilization - methods applied for samples, chemicals, glassware and whole laboratory; Autoclave and Laminar air flow. Isolation and characterization of microbes (bacteria, fungi and cyanobacteria). Techniques to measure growth of microorganisms. Effects of carbon, nitrogen, temperature, osmotic pressure, oxygen and CO<sub>2</sub> on microbial growth. Methods for antimicrobial assay.

**UNIT – IV**

**Instrumentation:** Microscopy - Confocal, Phase contrast and Electron microscopy. Chromatography - Principle, Protocol and Applications of TLC, GLC and HPLC. Spectrophotometry - Principle and applications. Centrifugation - Principle, types and applications. Electrophoresis - Principle, protocol and applications. Principle and applications of pH meter, colony counter and flow cytometer.

**UNIT – V**

**Advanced Techniques & Bioinformatics:** Principles and applications of PCR and DNA Sequencer. DNA isolations, DNA microarray, DNA sequencing, Protein microarray, Protein sequencing /profiling, X-ray Crystallography and NMR. Introduction and Bioinformatics; Knowledge of various databases and bioinformatics tools available at these resources - Literature databases, Nucleic acid sequence databases: GenBank, EMBL and DDBJ. Protein sequence and structure databases, Genome Databases, Basic online and offline tools for Sequence alignment, Molecular phylogeny, Genomics and Proteomics, and Drug designing.

**Books suggested –**

1. Dubey, R.C. and Maheshwary, D.K. (1999). Text book of Microbiology. S. Chand and company.
2. Aneja, K.R. Experiments in Microbiology, Plant pathology and Biotechnology, Fourth edition, New Age International publishers.
3. Powar, C.B. and Dagainawal, H.F. General Microbiology. Vol-I and Vol- II, Himalaya Publishing House.
4. Wilson & Walker. (2000). Principles and Techniques in Practical Biochemistry. 5<sup>th</sup> Edition Cambridge University Press.
5. Reed, G. Prescott and Dunn's (1999). Industrial Microbiology. CBS Publishers.
6. Demain, A. L. (2001). Industrial Microbiology and Biotechnology. 2<sup>nd</sup> Edition.
7. Waites, M.J., Morgan, N.L., Rockey, J.S. and Higton, G. (2002). Industrial Microbiology: An Introduction. Blackwell Science Publishers.
8. Mount D. (2004). Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press, New York.
9. Baxevanis, A.D. and Francis Ouellette, B.F. (2009). Bioinformatics- A Practical Guide to the Analysis of Genes and Proteins. Wiley India Pvt Ltd.
10. Text Book of Spectroscopy. Jyoti Kumar, Sonali Publications, New Delhi. 110002.
11. Chromatography :Kamalesh Bhansal, Campus Books International, Prahlad Street, Ansari Road, Darya ganj New Delhi 110002.
12. Biopesticides and pest management. G.S. Dhaliwal and Opendar Koul, Kalyani Publishers. New Delhi.

➤ *Any other books suggested by Course coordinator/ Course Teacher/ Supervisor concerned may be applied.*

