(Elective course)

Course Title: Tools and Techniques

Credit: 4 (L-4, T-0, P-0)

Course code:

Contact Hrs/Week: 4 Hrs

Course Outcomes

Students will be able to understand fundamental of techniques used in biological sciences and their applications at cellular and molecular level.

Course Learning Outcomes (CLO): The students will be able to:

1. Comprehend basic principle of microscopy
2. Working principles of instruments and their applications
3. Understand procedures for detecting proteins and nucleic acid
4. Basic principle of radioactivity and its application in biological sciences.
5. Understand the basic principle of cell culture techniques

Unit I

Microscopy - Principle of light transmission, numerical aperture, limit of resolution, types of objectives, bright field microscope, dark field microscope, phase-contrast, fluorescence, confocal, Electron microscopy: Transmission electron microscope and scanning electron microscopes.

Unit II

Principles and uses of analytical instruments - pH meter, Colorimeter, Chromatography electrophoresis, Centrifugation: density gradient centrifugation and ultracentrifugation, UV-Visible Spectrophotometer, HPLC, NMR.

Unit III

Detection of proteins: Immunohistochemistry, Western blotting, DNA-protein and protein-protein interaction., DNA foot printing, EMSA. Enzyme linked sorbent assay (ELISA), Electrophoresis and iso-electrofocussing, Protein sequencing

Restriction enzymes, cloning vectors, preparation and screening of cDNA and genomic DNA libraries, Polymerase chain reaction principle and application, Chromosome banding, chromosome painting and FISH techniques, Restriction fragment length polymorphism (RFLP)

Unit IV

Radioactivity and decay, Radiation interaction, beam quality and dose, half-life. Applications of radioisotopes in biological sciences. Measurement of radioactivity (alpha,beta & gamma radiations), Radioisotope, mass isotope techniques in biology. Autoradiography, metabolic labelling and magnetic resonance imaging (MRI), densitometer, radioactivity counters.

Unit V

Cell culture techniques: Culture Media preparation, cell harvesting and sterilization, Inoculation and growth monitoring, use of fomenters, biochemical mutants and their uses, methods of microbial assays, Cell proliferation measurements, Cell viability testing.

Cryotechniques: Cryopreservation for cells, tissue, organisms, Cryotechniques for microscopy, Freeze-drying for physiologically active substances

Suggested Readings:

1. Wilson K and Walker, J. (2018). Principles and techniques of practical Biochemistry, Cambridge University press
2. Harris, R. (1991). Biological micropy for biology: A practical approach, Oxford press
3. Plummer D.T. (1987). An introduction to practical Biochemistry. Tata McGraw Hill
4. Avinash Upadhyay, Kakoli Upadhyay, Nirmalendu Nath (2020). Biophysical chemistry principles and techniques. Himalaya Publishing House Pvt.