

MAHATMA GANDHI UNIVERSITY
Ph.D. COURSE WORK IN BIOSCIENCES/PHARMACY
COURSE II – MODERN BIOLOGICAL TECHNIQUES

Unit- I pH, Buffers, Henderson-Hasselbalch equation, pH electrode Solutions, Methods of expressing concentration of solution. Methods to quantify proteins and nucleic acids. Spectrophotometry and spectroflurometry. Centrifugation in Biochemical research, relative centrifugal force, differential centrifugation, density gradient centrifugation, low speed, high speed, refrigerated and ultracentrifuge. Microscope, Numerical aperture, magnification, bright field microscope, phase contrast, fluorescence, confocal, interference and polarization microscopes. Electron microscopes and specimen preparation, Radioactive isotopes in biological research, units of radioactivity, half life period, labelling, detection and measurement of radioactivity, Radioisotopes and safety.

Unit - II Isolation and purification of biomolecules – lipids, proteins and nucleic acids Iodine value and saponification value, Solvent extraction, Precipitation of proteins, salt and organic solvents for protein precipitation, dialysis, thin layer chromatography, gel filtration, ion exchange chromatography, affinity chromatography, high performance liquid chromatography, gas liquid chromatography, polyacrylamide gel electrophoresis-native and SDS Isoelectric focusing, ELISA, DNA, RNA and plasmid isolation, agarose electrophoresis, competent cell preparation and transformation, restriction digestion, ligation and expression PCR techniques. Sequencing of DNA and amino acid, Molecular markers RFLP, RAPD, AFLP, SCAR, SNP, Structural analysis of biomolecules, spectroscopical analysis- GC, GC/MS, LC/MS, FT IR, NMR, X ray crystallography.

Unit III: Microbial staining techniques – simple staining and differential staining – bacterial culture-media and methods. Sterilization techniques in microbiology – antibiotic sensitivity tests – diffusion and dilution techniques. Cultivation of fungi – cultivation of viruses. Molecular typing and phylogenetic analyses; Immunological techniques. Testing for the evaluation of immunomodulatory effects; Agglutination, precipitation. Western Blotting. Radio Immuno Assay, Immunofluorescence.

Unit IV : Environmental Analyses; soil and water sampling techniques – soil chemical analyses extraction of metals – microwave digestion-soil biological studies – soil microbiological studies – AM fungi and spore counts – water sampling – water chemical analyses – aquatic biological techniques – quadrat studies for terrestrial communities – culture of AM fungi – Algal culture. Plant anatomical, morphological techniques – taxonomic techniques – chemotaxonomy and numerical taxonomy – molecular characterization in the identification of new organisms.

Unit V: Plant and animal tissue culture techniques, sterilization of explants, preparation of culture media-development of different protocols-inoculation culture maintenance-disinfection of culture rooms Techniques in plant transformations. Animal physiology haematological analyses – respiratory testing – bioelectricity recording histological techniques. Free radical biology, In vitro study of anti oxidants – free radical scavenging super oxide scavenging, nitric oxide scavenging, peroxide scavenging, antifungal and anti-microbial leprotic activities. Toxicity – systemic, local, ANS, CVS, anti diuretic anti cancer, analgesic anti inflammatory, anti asthmatic, immune stimulant, immune suppressor activities. Plant derived medicines – general methods of isolation, purification, identification and estimation of phytoconstituents. CPCSEA guidelines, transgenic animals.

Exercises related to Course-II

Seminar: Each student must present a seminar on a biological technique which he/she will be using in his/her research.

Assignment: Each student must submit an assignment on a biological technique as per the directions of the course coordinator.

References:

1. Glick BR and Psternak JJ(1998) Molecular Biotechnology. Principles and applications of recombinant DNA, ASM Press
2. Sharma BK(2000) Instrumental Methods of Chemical Analyses
3. Khandpur RS(2004) Handbook of Biomedical Instrumentation. Tata Mc Graw Hill
4. Brigel L W (1998) A Biologist Guide to Principles and Techniques of Practical Biochemistry
5. APHA, 1998. Standard methods for the examination of water and wastewater American Public Health Association. 1015 Fifteenth Street, NW.Washington.DC
6. Trivedy, R K & P K Goel (1986) Chemical and Biological Methods for Water Pollution Studies, Environmental publications, Karad 415 110. India
7. Monica Cheesbrough(2005) Medical Laboratory Manual for tropical countries Vol.2, LBS
8. Mackie and Mc Cartney (2002) Practical Medical Microbiology, Curchil Livingstone
9. Dube RC and Maheswary DK (2002) S Chand and Company Ltd., New Delhi
10. Sambrook J and Russel D (2001) Molecular Cloning. A Laboratory Manual, 3rd Edition, Cold Spring Harbor, New York.
11. Widmaier Raff and Strang (2005) Vander's Human Physiology the Mechanism of Body function, McGraw-Hill, New York
12. Ronald Darnley Gibbs (1974) Chemotaxonomy of flowering plants. Volume I &2, Betterworldbooks, New York
13. Peter H A Sneath (1973) Numerical Taxonomy: The Principles and Practice of Numerical Classification. W H Freeman & Co.