Veer Narmad South Gujarat University, Surat
M. Sc. Semester I
Elective paper 1
MB 1004: BIOPHYSICAL TECHNIQUES AND INSTRUMENTATION

1. Course Code & Title

Course code: Elective paper 1
Course title: Biophysical techniques and instrumentation
Course type: Elective (AECC)
Course credits: 04

2. Course overview and Course Objectives

This course is to learn the principles of detection and measurement systems and principles of the major molecular techniques to study the prokaryotes. The study also emphasizes the study of the various separation techniques and the spectroscopic techniques for the detection of bio-analytes.

Course Objectives

- To learn molecular techniques based on non-amplified and amplified nucleic acids and genetic fingerprinting methods.
- To study principle and different types of chromatographic techniques and electrophoresis.
- To understand UV/vis, IR and Mass spectroscopic techniques.
- To study NMR and X-ray spectrometers and its applications.

3. Course Content

UNIT 1	MOLECULAR TECHNIQUES
1.1	Non-amplified nucleic acid probes
1.2	Amplified nucleic acid technique 1.2.1 Signal Amplification technique 1.2.2 Target amplification technique 1.2.3 Probe Amplification technique
1.3	Genetic fingerprinting methods 1.3.1 RFLP to analyze lower eukaryotic pathogens and prokaryotes. 1.3.2 RFEL 1.3.3 RAPD 1.3.4 Other PCR-Based method for DNA fingerprinting.

UNIT 2	SEPARATION TECHNIQUES
2.1	Chromatographic techniques 2.1.1 Principles of chromatography 2.1.2 Chromatographic performance parameters 2.1.3 Partition chromatography 2.1.4 Adsorption chromatography 2.1.5 Thin layer chromatography 2.1.6 Gel permeation chromatography 2.1.7 Ion exchange chromatography 2.1.8 Affinity chromatography 2.1.9 High-Performance Liquid chromatography 2.1.10 Gas chromatography
2.2	Electrophoresis 2.2.1 Principle 2.2.2 Modes of electrophoresis 2.2.3 Support media 2.2.4 Different types of electrophoresis 2.2.5 Electrophoresis of DNA 2.2.6 Immuno-electrophoresis

UNIT 3	SPECTROSCOPIC TECHNIQUES
3.1	3.1.1 General properties of electromagnetic radiation 3.1.2 The electromagnetic spectrum 3.1.3 Interactions of radiation and matter 3.1.4 Transmittance, Absorbance & Beer's law 3.1.5 Measurement of Transmittance and Absorbance
3.2	UV/Vis Spectrometry 3.2.1 Instrument component 3.2.2 Types of instruments 3.2.3 Some typical instruments: Photometers & Spectrophotometers 3.2.4 Qualitative Applications of UV/Vis Spectroscopy
3.3	IR Spectrometry 3.3.1 Theory of IR absorption spectrometry 3.3.2 IR instrumentation 3.3.3 IR sources and transducers 3.3.4 Sample handling for IR spectrometry 3.3.5 Application of IR spectrometry
3.4	Mass spectrometer 3.4.1 Molecular mass spectra 3.4.2 Ion Sources 3.4.3 Mass Spectrometers: Instrument components 3.4.4 Mass Analyzers 3.4.5 Tandem Mass Spectrometry 3.4.6 Application of Mass spectrometry

UNIT 4	BIOPHYSICAL TECHNIQUES
4.1	Nuclear Magnetic Resonance spectrometers 4.1.1 Theory of NMR: Quantum & Classical Description 4.1.2 Types of NMR Spectrometers 4.1.3 Theory of chemical shift 4.1.4 NMR Spectrometers: Instrumentation 4.1.5 Application of NMR
4.2	X-Ray Spectrometers 4.2.1 X-Ray Spectrum 4.2.2 Instrumentation for X-Ray Spectrometry 4.2.3 X-Ray Diffractometers 4.2.4 X-Ray Absorption meter 4.2.5 X-Ray Fluorescent spectrometer 4.2.6 Electron probe microanalyzer

4. Course Learning Outcomes/Student's Learning Outcomes (SLO)

Unit 1: Students shall gain an understanding of amplified nucleic acid techniques and applications of genetic fingerprinting methods.

Unit 2: Students shall learn the principle of chromatography and electrophoresis, types and application of separation techniques.

Unit 3: Students shall develop insight of principle of spectroscopic techniques and applications of IR and Mass spectrometer.

Unit 4: Students shall learn theory and applications of NMR and X-ray spectrometers.

Recommended Learning Resources:

- Murray, P. R., Baron, E. J., Pfaller, M. A., Tenover, F. C., & Yolken, R. H. (2005). Manual of clinical microbiology. 9th edition, Vol.2, American Society of Microbiology Press, Washington DC, (ISBN; 1-55581-255-4)
- Wilson, K. and Walker, J., (2010). Principles and Techniques of Biochemistry and Molecular Biology, 7th edition, Cambrige University Press (Low price edition), New York. (ISBN; 9780521731676)
- Ghosal, S., & AVASTHI, A. S. (2018). Fundamentals of bioanalytical techniques and instrumentation. PHI Learning Pvt. Ltd. (ISBN; 978-8120338555)
- Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Instrumental analysis. Cengage learning. (ISBN; 978-8131505427)
- Khandpur, R. S., (2008). Handbook of analytical instruments. 2nd edition, Tata McGraw-Hill Publishing Company Limited (New Delhi). (ISBN; 978-0070604605)