

**JYOTI NIVAS COLLEGE AUTONOMOUS**  
**PROGRAMME: B.SC.**  
**SEMESTER: II - GENETICS - II**  
**BIOINSTRUMENTATION AND CYTOGENETIC TECHNIQUES**

**COURSE CODE: 21HGT2**  
**CREDITS: 04**

**NO. OF HOURS: 60**

**COURSE OBJECTIVES (COS):**

- Differentiate the various types of microscopes based on their uses.
- Describe and illustrate the basic analytical equipments used in a laboratory.
- Understand basics of centrifugation and chromatography techniques.
- Elucidate Genomic, Proteomic and blotting techniques.

**LEARNING OUTCOMES (COS):**

At the end of the course, the students will be able to:

- Recognize the various microscopes and use them.
- Comprehend the working principle of different analytical equipments.
- Compare centrifugation and chromatography techniques based on function.
- Acquire knowledge in Genomic, Proteomic and blotting techniques.

**UNIT – 1**

**15 HOURS**

**CHAPTER 1:**

**Microscopy:** Introduction, and history of Microscopy

**Principle and Optical Components of microscope:** Eye piece, Eye piece tube, Objective lenses, Coarse and Fine Focus knobs, Stage and stage clips, Aperture, Illuminator, Condenser, Condenser Focus Knob, Iris Diaphragm.

**CHAPTER 2:**

**Types of microscopes:** Simple and Compound microscopes, Light microscopes, Fluorescence, electron microscopy (transmission and scanning), Phase contrast, Confocal, Stereo microscopy, Optical pathway in different microscopes.

**CHAPTER 3:**

**Uses of microscopy and biological applications:** High resolution imaging, immunohistochemistry, high-content screening and high- throughput imaging, Medical science, Forensic laboratories.

**UNIT – 2**

**15 HOURS**

**CHAPTER 4:**

**Analytical Instruments: pH meter** - principle and components of pHmeter.

**Common laboratory equipments:** Micropipette, Gel rocker, Cyclomixer, Laminar Air Flow, BOD Incubator.

**CHAPTER 5:**

**Colorimeter:** Principles of measurement and applications. **Spectrophotometer:** Beer-Lambert's Law in spectrometry, UV spectrophotometers, Electron Spin Resonance (ESR), Nuclear Magnetic Resonance (NMR) Spectrophotometers

**CHAPTER 6:**

**Different types of sterilization methods:** Autoclave, steam sterilizers, dry heat sterilizers and ovens and UV chambers.

**UNIT – 3****15 HOURS****CHAPTER 7:**

**Centrifugation:** Principle and applications of centrifuge, types of centrifuge-high speed centrifuge, ultra-centrifuge, Refrigerated centrifuge. Rotors: Types of rotors- vertical, Swing-out, Fixed angle.

**CHAPTER 8:**

**Chromatography:** Principle, types and application of Chromatography- paper chromatography, ion exchange, gel filtration, HPLC, affinity chromatography.

**CHAPTER 9:**

**Electrophoresis:** Principle and applications of electrophoresis. Types of electrophoresis: vertical and horizontal.

**Components:** Electrodes, Power supply, electrophoresis chamber.

**UNIT – 4****15 HOURS****CHAPTER 10:**

**Genomic Techniques:** End point PCR, Multiplex PCR, SNP analysis. Differential gene expression analysis by Microarray and RT PCR.

**CHAPTER 11:**

**Proteomic techniques:** Multiplex ELISA, biomarker identification using 2D gel electrophoresis, biosensors and lateral flow assays.

**CHAPTER 12:**

**Blotting techniques:** Southern, Northern, Western, Eastern, South-western, Far-eastern, Reverse Northern, Far-western blot

**TEXT BOOKS:**

1. Alberts B, Johnson A, Lewis J, et al. "Molecular Biology of the Cell", 2002, 4th edition, New York: Garland Science.
2. Lodish H, Berk A, Zipursky SL, et al. "Molecular Cell Biology". 4<sup>th</sup> edition. New York: W. H. Freeman; 2000.
3. A. J. Ninfa and D. P. Ballou, *Fundamental Laboratory Approaches for Biochemistry and Biotechnology*, 1998 2<sup>nd</sup> Edition Wiley.
4. J. Sambrook and D. W. Russell, *Molecular Cloning: A Laboratory Manual*, 2001, 3<sup>rd</sup> Edition Cold Spring Harbor Laboratory Press.

**REFERENCES:**

1. Joseph Bronzino, "Biomedical Engineering and Instrumentation", PWS Engg ., Boston.
2. Willard Van Nostrand, "Instrumental Methods of Analysis"-
3. Sharms, "Instrumental Methods", S Chand & Co.
4. Harry Bronzino E, "Handbook of Biomedical Engineering and measurements", Reston, Virginia.

## PRACTICAL

CREDITS: 02

NO OF

HOURS: 56

1. Demonstration of optical Components of microscope: Eye piece, Eyepiece tube, Nose piece, Objective lenses, Coarse and Fine Focus knobs, Stage and stage clips, Aperture, Illuminator, Condenser, Condenser Focus Knob, Iris Diaphragm.
2. Fluorescence Microscopy: viewing cells stained with fluorescent dyes.
3. Demonstration experiments on, laser scanning, Phase contrast, confocal and scanning electron microscopy.
4. Preparation of buffers using pH meter.
5. Colorimetric estimation of proteins: Protein estimation by Lowry's method
6. Demonstration of Beer-Lambert's Law in spectrometry
7. Recording ultraviolet absorption spectra for DNA and Protein
8. Demonstration of UV spectrophotometers, Electron Spin Resonance (ESR), Nuclear Magnetic Resonance (NMR) Spectrophotometers
9. Chromatography: Paper chromatography of Plant pigments, amino acids and *Drosophila* eye pigments
10. Colorimetric estimation of DNA and RNA
11. Demonstration of components of different centrifuges. Rotors: Types of rotors- vertical, Swing-out, Fixed angle.
12. Agarose gel electrophoresis of DNA
13. SDS-PAGE electrophoresis of proteins Demonstration of sterilization methods: Autoclave, steamsterilizers, dry heat sterilizers and ovens and UV chambers.