



# LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

**M.Sc. DEGREE EXAMINATION – BIOTECHNOLOGY**

**SECOND SEMESTER – APRIL 2025**

**PBT2MC01 – BIOANALYTICAL TECHNIQUES**



Date: 24-04-2025

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

## SECTION A – K1 (CO1)

**Answer ALL the questions**

**(5 x 1 = 5)**

### 1 Choose the best option

- a) The staining technique that is widely used for routine histological examination is
  - i) Hematoxylin and Eosin (H&E) staining
  - ii) Gram staining
  - iii) Acid-fast staining
  - iv) Giemsa staining
- b) Large DNA fragments can be separated by
  - i) SDS-PAGE
  - ii) Agarose gel electrophoresis
  - iii) Isoelectric focusing
  - iv) Pulsed-field gel electrophoresis
- c) Detection method used in Gas Chromatography is
  - i) UV-Visible Spectroscopy
  - ii) Flame Ionization Detector (FID)
  - iii) Infrared Spectroscopy
  - iv) NMR Spectroscopy
- d) What is the function of a monochromator in spectroscopy?
  - i) Detects emitted fluorescence
  - ii) Separates wavelengths of light
  - iii) Measures sample absorbance
  - iv) Produces ionization in mass spectrometry
- e) The technique that allows structural determination of biomolecules without requiring crystallisation
  - i) X-ray Crystallography
  - ii) Cryo-Electron Microscopy
  - iii) Mass Spectrometry
  - iv) Raman Spectroscopy

## SECTION A – K2 (CO1)

**Answer ALL the questions**

**(5 x 1 = 5)**

### 2 Answer in one or two sentences

- a) What is the primary purpose of fixation in tissue processing?
- b) Define angular velocity in centrifugation?
- c) How does affinity chromatography achieve high specificity?
- d) Describe how Beer-Lambert's Law is applied in UV-Vis spectroscopy for concentration determination
- e) List the uses of radiation dosimetry?

## SECTION B – K3 (CO2)

**Answer any THREE of the following**

**(3 x 10 = 30)**

- 3 Demonstrate how phase contrast microscopy is used in biotechnology research.
- 4 Differentiate between rate-zonal and isopycnic centrifugation using specific examples.
- 5 Explain the principle behind ion-exchange chromatography and describe the procedure for separating a mixture of proteins using this technique.
- 6 Give the principle and key components of mass spectrometry.
- 7 Discuss the advantages and limitations in detecting ionizing radiation using Geiger-Müller (GM) counter.

**SECTION C – K4 (CO3)**

|    |                                                                                                          |
|----|----------------------------------------------------------------------------------------------------------|
|    | <b>Answer any TWO of the following</b> <span style="float: right;"><b>(2 x 12.5 = 25)</b></span>         |
| 8  | Describe how Atomic Force Microscopy can be used to obtain high-resolution images of surface topography. |
| 9  | Explain the working principle of a biosensor and describe its components.                                |
| 10 | Explain column chromatography and discuss the types of matrices used.                                    |
| 11 | Compare Colorimeter and Spectrophotometer.                                                               |

**SECTION D – K5 (CO4)**

|    |                                                                                                                                                            |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>Answer any ONE of the following</b> <span style="float: right;"><b>(1 x 15 = 15)</b></span>                                                             |
| 12 | Classify the types of centrifuges and explain differential and density gradient centrifugation.                                                            |
| 13 | Explain the principle of X-ray crystallography and describe the key steps involved in determining the atomic structure of a molecule using this technique. |

**SECTION E – K6 (CO5)**

|    |                                                                                                                                                                                                                                                                      |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>Answer any ONE of the following</b> <span style="float: right;"><b>(1 x 20 = 20)</b></span>                                                                                                                                                                       |
| 14 | In what situations would you prefer Paper Chromatography over Thin Layer Chromatography for analyzing a mixture? Describe the steps you would follow in Paper Chromatography for a mixture of sugars and explain the reasoning behind your choice of solvent system. |
| 15 | Critically evaluate the advantages and disadvantages of using radioactive isotopes in hydrobiology research.                                                                                                                                                         |

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