22BTU519

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2025
(Fifth Semester)

Branch – **BIOTECHNOLOGY**

ANALYTICAL TECHNIQUES

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1 Which of the following buffers is a good example of a weak acid buffer?
(i) Sodium acetate and acetic acid
(ii) Ammonium chloride and ammonia
(iii) Sodium chloride and hydrochloric acid
(iv) Potassium hydroxide and water

2 Surface plasmon resonance (SPR) is commonly used to study what type of interactions?
(i) Thermal (ii) Enzyme-substrate
(iii) Nucleic acid hybridization (iv) Protein-protein

3 Which of the following best describes the principle of sedimentation?
(i) Separation based on size
(ii) Separation based on shape
(iii) Separation based on density differences
(iv) Separation based on electrical charge

4 What is a common application of affinity chromatography?
(i) Analyzing gas mixtures
(ii) Purifying proteins
(iii) Separating small organic molecules
(iv) Detecting volatile compounds

5 Which part of a mass spectrometer separates ions based on their mass-to-charge ratio (m/z)?
(i) Ionizer (ii) Detector
(iii) Ion trap (iv) Mass analyzer

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6 a Describe the principle of biosensors for glucose estimation and how they are used in clinical diagnostics.

OR

b Compare potentiometric and conductometric titrations with examples of each, focusing on their principles and applications.

7 a What is nuclear magnetic resonance (NMR) spectroscopy, and how does it provide information about molecular structure?

OR

b Explain the significance of functional group identification in organic compounds using IR and Raman spectroscopy.

Cont...

8 a Describe the principle of sedimentation and how it can be influenced by factors such as particle size and density.

OR

b What role does sample preparation play in electrophoresis, and what steps are typically involved?

9 a Discuss the significance of retention time in chromatography. How does it relate to the efficiency of a chromatographic method?

OR

b Account on the mechanisms involved in ion-exchange chromatography.

10 a What roles do radioisotopes play in biological research?

OR

b How do radioisotopes contribute to diagnostic imaging techniques in healthcare?

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11 a Explain the principles of semi-automatic and automatic analysis systems and their advantages in a laboratory setting.

OR

b Differentiate molarity and molality. In what situations would one be preferred over the other?

12 a Explain the significance of the molar absorptivity coefficient in UV-Vis spectroscopy. How does this coefficient facilitate the quantification of unknown samples, and what factors could affect its accuracy?

OR

b Compare and contrast fluorescence spectroscopy with UV-Vis spectroscopy. What are the unique advantages of fluorescence in detecting low-abundance analytes, and how do environmental factors influence fluorescence intensity?

13 a Examine the process of freeze-drying and its advantages for preserving biological samples. How does this method affect the physical and chemical properties of the samples?

OR

b Analyze the safety considerations that must be taken into account when operating centrifuges. What are the potential hazards, and what best practices can be implemented to minimize risks?

14 a Explain the principle of affinity chromatography and its specificity. How do specific interactions between a ligand and an analyte enhance separation? Provide examples of affinity chromatography applications in purifying proteins or antibodies.

OR

b Analyze the advantages and disadvantages of High-Performance Liquid Chromatography (HPLC). How does HPLC compare to traditional liquid chromatography in terms of sensitivity, speed, and resolution? Discuss specific applications where HPLC is preferred.

15 a Analyze the principles of operation of a Geiger-Müller (GM) counter. Discuss its advantages and limitations in detecting different types of radiation. How would you assess its effectiveness in a field study compared to other detection methods?

OR

b Discuss the role of ionizers in mass spectrometry. What are the different types of ionization techniques used, and how do they affect the sensitivity and resolution of the analysis? Provide examples of specific applications in biological research.

Z-Z-Z END