

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(Fifth Semester)

Branch - BIOTECHNOLOGY

ANALYTICAL TECHNIQUES

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The pH of a buffer solution is given by the Henderson-Hasselbalch equation. Which of the following is correct? a) $\text{pH} = \text{pKa} + \log\left(\frac{[\text{Acid}]}{[\text{Base}]}\right)$ b) $\text{pH} = \text{pKa} + \log\left(\frac{[\text{Base}]}{[\text{Acid}]}\right)$ c) $\text{pH} = \text{pKa} - \log\left(\frac{[\text{Base}]}{[\text{Acid}]}\right)$ d) $\text{pH} = [\text{Base}] / [\text{Acid}]$	K1	CO1
	2	Explain the principle of a pH meter. a) It measures the electrical conductivity of a solution. b) It measures the potential difference between two electrodes. c) It measures the color change of a pH indicator. d) It measures the change in light absorbance.	K2	CO1
2	3	What is the principle of Beer-Lambert's law? a) It relates the concentration of a solution to its density. b) It relates the scattering of light to the concentration of a solution. c) It relates the absorbance of light to the concentration and path length of a solution. d) It relates the fluorescence of a substance to its concentration.	K1	CO2
	4	Describe the working principle of Ultraviolet-Visible (UV-Vis) spectroscopy. a) It measures the emission of light by a sample excited by a laser. b) It measures the absorption of electromagnetic radiation in the UV and visible regions. c) It measures the bending of light as it passes through a sample. d) It measures the mass-to-charge ratio of ions.	K2	CO2
3	5	Which type of centrifugation is used to separate components based on their density? a) Analytical centrifugation b) Preparative centrifugation c) Differential centrifugation d) Rate-zonal centrifugation	K1	CO5
	6	Differentiate between preparative and analytical centrifugation. a) Preparative centrifugation is used for purification, while analytical is for characterization. b) Preparative centrifugation is used for characterization, while analytical is for purification. c) Preparative centrifugation is performed at low speeds, while analytical is at high speeds. d) Preparative centrifugation uses a swing-out rotor, while analytical uses a fixed-angle rotor.	K2	CO5
4	7	Which chromatography technique separates molecules based on their size? a) Ion-exchange chromatography b) Affinity chromatography c) Adsorption chromatography d) Molecular (size) exclusion chromatography	K1	CO4
4	8	Explain the principle of partition chromatography. a) Separation is based on charge. b) Separation is based on size. c) Separation is based on the differential distribution of analytes between two immiscible liquid phases. d) Separation is based on specific binding interactions	K2	CO4
5	9	What is the unit of radioactivity? a) Joule b) Coulomb c) Becquerel d) Hertz	K1	CO3

Cont...

5	10	Describe the basic principle of a Geiger-Muller (GM) counter. a) It measures the energy of gamma rays. b) It detects radiation by measuring the ionization it produces in a gas. c) It detects radioactive particles by the light they emit when interacting with a scintillator. d) It measures the mass of ionized particles	K2	CO3
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SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Explain the principle and applications of a pH meter and a conductivity meter	K1	CO1
		(OR)		
	11.b.	Describe the types and principles of buffers. How are they prepared?		
2	12.a.	Explain the principles of fluorescence and circular dichroism spectroscopy	K2	CO2
		(OR)		
	12.b.	Summarize the principles and applications of Atomic spectroscopy and NMR..		
3	13.a.	Explain the principles of preparative and analytical centrifugation. Describe the safety aspects of centrifuges.	K3	CO5
		(OR)		
	13.b.	Describe the principles and applications of dialysis and capillary electrophoresis		
4	14.a.	Elucidate the principles of HPLC and its key performance parameters.	K3	CO4
		(OR)		
	14.b.	Illustrate the principles of ion-exchange chromatography and affinity chromatography		
5	15.a.	Explain the concept of physical and biological half-life. Describe the principles of GM and Scintillation counters	K3	CO3
		(OR)		
	15.b.	Describe the fundamental components of a mass spectrometer and its applications in biological research		

SECTION - C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Explain the principle and applications of biosensors for glucose estimation. Differentiate between semi-automatic and automatic analysis.	K3	CO1
2	17	Explain the principles and applications of Ultraviolet and visible spectroscopy. Differentiate between atomic spectroscopy and light scattering	K3	CO2
3	18	Discuss the various types of electrophoresis and their principles. Explain how electrophoresis is used for the separation of biomolecules	K3	CO5
4	19	Discuss the principles and applications of different types of chromatography, including High-performance liquid chromatography and Gas chromatography	K3	CO4
5	20	Explain the uses of radioisotopes in biological research. Describe the principles of radioactive detection methods like Autoradiography and Fluorescent dye labeling	K3	CO3