

Programme: B. Pharm

Course: Advanced Instrumentation Technology

Course Code: BP811ET

Enrolment no. _____

Full Marks: 75

Time: 3 Hrs.

Q.N o.	Questions	CO	Bloom Taxonomy Category	Marks
Section I				
1	Objective Type Questions			
	<p>i. What type of material is commonly used as a reference in DTA? a. Chemically active material b. Inert material c. Reactive material d. Conductive material</p> <p>ii. What does NMR spectroscopy primarily study? a. Electron transitions b. Nuclear spin states c. Molecular vibrations d. Chemical reactions</p> <p>iii. Radioimmunoassay is commonly used for detecting which class of biomolecules? a. Proteins b. Hormones c. Lipids d. Carbohydrates</p> <p>iv. What is used to check the photometric accuracy of a UV spectrophotometer? a. Potassium dichromate solution b. Hydrochloric acid c. Sodium bicarbonate d. Ethanol</p> <p>v. What is the primary advantage of HPTLC-MS over conventional TLC? a. improved separation and identification. b. faster solvent evaporation. c. lower resolution of compounds. d. higher solvent consumption.</p> <p>vi. Column calibration in GC primarily evaluates: a. Retention time reproducibility b. Peak symmetry and resolution c. Flame ionization detection d. Solvent evaporation rate</p> <p>vii. Which type of analyte is best suited for extraction using polar solvents in liquid-liquid extraction? a. polar analytes. b. non-polar analytes. c. volatile analytes. d. solid analytes.</p> <p>viii. What is the recommended method for checking GC flow rate calibration? a. Measuring peak retention time variations b. Measuring the volume of carrier gas delivered over time c. Adjusting injection temperature settings d. Changing stationary phase composition</p> <p>ix. Which law is fundamental in analyzing X-ray diffraction patterns? a. Boyle's Law b. Bragg's Law c. Planck's Law d. Avogadro's Law</p> <p>x. What type of crystal structure can XRD analyze? a. Amorphous solids only b. Crystalline solids only c. Both crystalline and amorphous solids d. Liquids only</p> <p>xi. Which standard is commonly used for wavelength calibration in UV spectrophotometry? a. Holmium oxide solution b. Acetic acid c. Sodium chloride d. Methanol</p> <p>xii. Which component is measured in RIA to determine the presence of an analyte? a. Radioactivity b. Fluorescence intensity c. pH change d. Optical density</p> <p>xiii. Which ionization technique is commonly used in LC-MS/MS? a. electrospray ionization. b. flame ionization. c. electron capture ionization. d. photoionization.</p> <p>xiv. Which reference gas is often used for GC detector calibration? a. Helium b. Carbon dioxide c. Nitrogen d. Oxygen</p> <p>xv. What is the purpose of a calibration certificate? a. To verify instrument ownership b. To confirm compliance with regulatory standards c. To provide warranty details d. To list instrument accessories</p> <p>xvi. Which calibration method is commonly used for HPLC detectors? a. Linearity test using standard solutions b. Flame ionization detection c. Mass spectrometry calibration d. X-ray diffraction calibration</p> <p>xvii. Which type of sorbent is commonly used in solid-phase extraction? a. silica-based sorbents. b. metallic sorbents. c. liquid sorbents. d. gas-phase sorbents</p> <p>xviii. According to ICH guidelines, how often should HPLC calibration be performed? a. Daily b. Weekly c. Regularly as per SOP guidelines d. Only when errors occur</p> <p>xix. What is the primary purpose of calibrating a UV-Visible spectrophotometer? a. To adjust the sample temperature b. To ensure wavelength accuracy and detector sensitivity c. To increase solvent evaporation rate d. To reduce instrument noise</p> <p>xx. Column performance calibration in HPLC primarily evaluates: a. Column length b. Plate number, resolution, and peak symmetry c. Mobile phase evaporation rate d. Pump pressure fluctuations</p>	CO1	Remember	1 x 20 = 20
Section II				
2. Short Answer type questions.				

a	Explain how chemical shift, spin-spin coupling, and integration contribute to the interpretation of NMR spectra.	CO1	Understand	7 x 5 = 35
b	How does Bragg's Law relate to the diffraction patterns observed in XRD? Explain the instrumentation of XRD.	CO2	Remember	
c	Outline the steps for Electronic balance calibration. How does calibration ensure compliance with regulatory standards?	CO3	Remember	
d	Describe the steps involved in a typical RIA procedure along with its application in various fields.	CO4	Remember	
e	Describe the instrumentation and working principle of HPTLC-MS.	CO5	Understand	
f	Compare and contrast the calibration guidelines provided by the USFDA and ICH	CO3	Remember	
	or Explain how calibration and validation contribute to Good Manufacturing Practice (GMP) compliance.	CO3	Remember	
g	Discuss the significance of solvent selection in Liquid-Liquid Extraction (LLE) and the factors affecting partitioning.	CO4	Remember	
	or Explain the significance of Radioimmunoassay (RIA) in biochemical and medical analysis.	CO4	Understand	
Section III				
Long Answer Type questions				
3	Give the critical evaluation of LC-MS/MS, GC-MS/MS, and HPTLC-MS with respect to inherent challenges, including matrix effects, ion suppression, limited sensitivity for certain analytes, complex sample preparation protocols, and the need for rigorous method validation to ensure reproducibility and accuracy.	CO5	Evaluates	2 x 10 = 20
	or Analyze the role of hyphenated techniques in metabolomics and proteomics research.	CO5	Analyze	
4	Evaluate the effectiveness, advantages, and limitations of widely used ionization methods—such as Electron Ionization (EI), Chemical Ionization (CI), Fast Atom Bombardment (FAB), and Matrix-Assisted Laser Desorption/Ionization (MALDI)—in relation to their applicability in various mass spectrometric analyses	CO1	Evaluates	
	or Discuss the fundamental concepts, instrumentation components, and practical applications of Nuclear Magnetic Resonance (NMR) spectroscopy to understand how each element contributes to its overall functionality in structural and molecular analysis.	CO1	Analyze	

Course Outcomes (CO):

CO1: Understand the advanced instruments used and its applications in drug analysis

CO2: Know analysis of drugs using various analytical instruments

CO3: Understand the calibration of various analytical instruments

CO4: Understand RIA and Extraction Techniques, ensuring a clear understanding of their applications in analytical chemistry.

CO5: Understand the chromatographic separation and analysis of drugs