DEPTH OF BIOLOGY

B. PHARMACY

8 SEM PRACTICE QUESTIONS

ADVANCED INSTRUMENTATION TECHNIQUES

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UNIT-I

Nuclear Magnetic Resonance spectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications

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2/3 MARKS

1. Define chemical shift in NMR spectroscopy.
2. What is the unit of measurement for chemical shift?
3. Name any two ionization techniques used in mass spectrometry.
4. What does MALDI stand for?
5. State the principle of proton NMR spectroscopy.
6. What is spin-spin coupling?

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5/7 MARKS

1. Explain the principle of ^{1}H-NMR spectroscopy.
2. Write a short note on the factors affecting chemical shift.
3. Describe the working of a quadrupole mass analyzer.
4. Compare electron impact and chemical ionization techniques.
5. Discuss the concept of coupling constant in NMR and its significance.
6. Explain the principle and application of Time-of-Flight (TOF) analyzer.

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10/15 MARKS

1. Discuss the principles of proton (^{1}H) and carbon (^{13}C) NMR spectroscopy. Include chemical shift, spin-spin coupling, and relaxation in your answer.
2. Describe in detail the instrumentation and applications of NMR spectroscopy.
3. Explain the principle of mass spectrometry. Discuss various ionization techniques such as Electron Impact, Chemical Ionization, MALDI, and FAB.
4. Compare and contrast the Time-of-Flight and Quadrupole mass analyzers with suitable diagrams and applications.
5. Write in detail about the fragmentation patterns in mass spectrometry and their role in structure elucidation.

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UNIT-II **10 Hours**

Thermal Methods of Analysis: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X-ray

Crystallography, rotating crystal technique, single crystal diffraction,powder diffraction, structural elucidation and applications.

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2/3 MARKS

1. What is the principle of Thermogravimetric Analysis (TGA)?
2. Name one key difference between DTA and DSC.
3. What does DSC measure in a sample?
4. Define X-ray crystallography.
5. What is the source of X-rays in XRD instruments?
6. Mention any one application of X-ray diffraction methods.

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5/7 MARKS

1. Compare Thermogravimetric Analysis (TGA) and Differential Thermal Analysis (DTA).
2. Explain the principle and instrumentation of Differential Scanning Calorimetry (DSC).
3. Write a short note on the applications of thermal analysis in pharmaceuticals.
4. Describe the principle and process of powder X-ray diffraction.
5. Explain the importance of single crystal diffraction in structural elucidation.
6. Outline the rotating crystal technique used in X-ray diffraction studies.

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10/15 MARKS

1. Describe in detail the principles, instrumentation, and applications of TGA, DTA, and DSC. Compare them with examples.
2. Discuss the role of thermal methods of analysis in characterizing pharmaceutical substances.
3. Explain the origin of X-rays and discuss the basic aspects of crystals relevant to X-ray crystallography.
4. Describe various X-ray diffraction methods: rotating crystal, single crystal diffraction, and powder diffraction. Include instrumentation and applications.
5. Explain how X-ray diffraction is used in the structural elucidation of crystalline materials.
6. Analyze the role of DSC and TGA in determining the purity and thermal stability of drug substances.

UNIT-III

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer,

Fluorimeter, Flame Photometer, HPLC and GC

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2/3 MARKS

1. What is the purpose of instrument calibration?
2. Expand ICH and USFDA.
3. Name any two instruments that require calibration in a pharmaceutical lab.
4. What is validation according to ICH guidelines?
5. Mention one parameter checked during HPLC calibration.
6. Define the term "traceability" in the context of calibration.

DEPTH OF BIOLOGY

5/7 MARKS

1. Explain the difference between calibration and validation with examples.
2. Briefly describe the ICH guidelines for equipment calibration.
3. Write a short note on the calibration of a UV-Visible spectrophotometer.
4. Describe the steps involved in calibrating an electronic balance.
5. What are the key parameters assessed during calibration of an IR spectrophotometer?
6. Outline the importance of fluorimeter and flame photometer calibration in pharmaceutical analysis.

DEPTH OF BIOLOGY

10/15 MARKS

1. Discuss the concepts of calibration and validation as per ICH and USFDA guidelines. Why are they important in pharmaceutical analysis?
2. Describe in detail the calibration procedure for HPLC and GC systems.
3. Explain the step-by-step calibration method for any four instruments from the following: electronic balance, UV-Vis spectrophotometer, IR spectrophotometer, fluorimeter, flame photometer.
4. Analyze the regulatory significance of calibration and validation in maintaining analytical instrument performance.
5. Write detailed notes on the qualification of analytical instruments (DQ, IQ, OQ, PQ) with reference to ICH guidelines.

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UNIT-IV

Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay

Extraction techniques:General principle and procedure involved in the solid phase extraction and liquid-liquid extraction

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2/3 MARKS

1. What is the basic principle of Radioimmunoassay (RIA)?
2. Name any one application of RIA.
3. List any two components of a typical radioimmunoassay system.
4. Define solid-phase extraction (SPE).
5. What is the main purpose of liquid-liquid extraction?
6. Mention one limitation of RIA.

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5/7 MARKS

1. Describe the principle and importance of Radioimmunoassay in pharmaceutical analysis.
2. Write a short note on the components involved in Radioimmunoassay.
3. Explain the general procedure of solid-phase extraction (SPE).
4. Differentiate between solid-phase extraction and liquid-liquid extraction.
5. What are the limitations of using RIA in analytical procedures?
6. Briefly explain the principle and applications of liquid-liquid extraction.

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10/15 MARKS

1. Explain in detail the principle, components, types, limitations, and applications of Radioimmunoassay (RIA).
2. Discuss the importance of RIA in clinical and pharmaceutical analysis. Include a diagrammatic representation of the method.
3. Describe the procedure and underlying principle of both solid-phase extraction and liquid-liquid extraction. Compare their advantages and limitations.
4. Analyze the role of extraction techniques in sample preparation and purification with pharmaceutical examples.
5. Write a detailed note on the different methods of Radioimmunoassay and their significance.
6. Evaluate the practical challenges and regulatory considerations in the use of RIA in modern labs.

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UNIT-V

Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS.

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2/3 MARKS

1. What does LC-MS/MS stand for?
2. Name the detector commonly used in LC-MS/MS.
3. What is the main advantage of using hyphenated techniques?
4. Expand HPTLC-MS.
5. Mention one application of GC-MS/MS.
6. Define the term "hyphenated technique" in analytical chemistry.

DEPTH OF BIOLOGY

5/7 MARKS

1. Briefly describe the working principle of LC-MS/MS.
2. Compare LC-MS/MS and GC-MS/MS with respect to sample types and applications.
3. Write a short note on the applications of HPTLC-MS in pharmaceutical analysis.
4. Explain the importance of tandem mass spectrometry (MS/MS) in modern analytical labs.
5. Discuss the components involved in GC-MS/MS instrumentation.
6. What are the advantages of coupling chromatography with mass spectrometry?

DEPTH OF BIOLOGY

10/15 MARKS

1. Discuss the principle, instrumentation, and applications of LC-MS/MS in pharmaceutical and biomedical analysis.
2. Explain in detail the working and applications of GC-MS/MS. Include sample preparation and detection process.
3. Describe the principle and significance of HPTLC-MS. How does it enhance traditional TLC techniques?
4. Compare and contrast LC-MS/MS, GC-MS/MS, and HPTLC-MS in terms of instrumentation, applications, and sensitivity.
5. Explain the concept of hyphenated techniques and discuss their advantages in complex sample analysis.
6. Analyze the role of tandem mass spectrometry (MS/MS) in structural elucidation and quantification of pharmaceutical compounds.