

[Time: 2½ Hours]

[Marks: 60]

Please check whether you have received the right question paper.

- N.B. 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of logarithmic table/non programmable calculator is allowed.
- Q.1 A) Attempt **any two** of the following:
- Describe the types of open tubular columns used in gas chromatography? Why is temperature programming used in gas chromatography? 4
 - Discuss the principle and applications of fluorescence detector used in HPLC. 4
 - On the basis of van Deemter equation, explain the effect of eddy diffusion on band broadening. 4
 - Give an account of the stationary phase of GLC. 4
- B) Attempt **any one** of the following:
- Discuss in brief, "Ion pair chromatography". 4
 - Describe the working of a detector which is selective for the determination of pesticide containing phosphorus, by G.C. 4
- Q.2 A) Attempt **any two** of the following:
- Describe powder method and rotating crystal method used in X-ray diffraction analysis. 4
 - What is double isotopic dilution method? Give its applications. 4
 - Distinguish between X-ray Fluorescence and X-ray absorption. Give important applications of X-ray absorption spectroscopy. 4
 - With the help of suitable diagram, describe the construction and working of quadrupole mass analyzer. 4
- B. Attempt **any one** of the following: 4
- Give an account of Fast atom bombardment source used in mass spectrometry. 4
 - Describe following techniques with respect to compensation of matrix effect in X-ray spectroscopy,
i) External standard calibration ii) Use of internal standard
- Q.3 A) Attempt **any two** of the following:
- Explain the Scanning Electron Microscope (SEM) with suitable diagram 4
 - Discuss the applications of Auger Electron Spectroscopy. 4
 - Explain the working of Electron Spectrometer used in ESCA. 4
 - What is Tunneling Microscope? How it is used for surface analysis? 4
- B) Attempt **any one** of the following:
- Why is ICP-AES a superior technique as compared to AAS for multielement analysis. 4
 - Explain the direct current plasma source with suitable diagram. 4

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- Q.4 A) Attempt **any two** of the following: 4
- Describe enzyme electrode that can be used to measure blood urea nitrogen. 4
 - Explain the effect of complex formation on polarographic wave of a metal ion 4
 - Differentiate between amperostatic and potentiostatic coulometry 4
 - What is electrogravimetry? What are the factors that affect the nature of deposit in electrogravimetry 4

- B) Attempt **any one** of the following: 4
- Calculate the concentration of copper ion in the sample solution on the basis of following information for current measured at -1.1 V versus SCE in a polarographic analysis

Sr.No	Solution	Current in μ A
(i)	25.0 cm ³ of 0.2 M K ₂ SO ₄ solution, diluted to 50.0 cm ³ with distilled water	10.7
(ii)	25.0 cm ³ of 0.2 M K ₂ SO ₄ solution, + 10 cm ³ copper solution diluted to 50.0 cm ³ with distilled water.	46.8
(iii)	25.0 cm ³ of 0.2 M K ₂ SO ₄ solution, + 10 cm ³ copper solution + 5.0 cm ³ of 0.02M copper solution diluted to 50.0 cm ³ with distilled water.	68.3

- Calculate the time needed for a constant current of 1.45 A to deposit 0.574g of
 - elemental cobalt on a surface of cathode.
 - Co₃O₄ on an anode.
 Assume 100% current efficiency for both cases. (Given: 1 Faraday = 96500 Coulombs. At. Wt. Co = 58.9, O = 16) 4

- Q.5 Attempt **any four** of the following: 12
- What should be the ideal properties of GC detector.
 - What is HETP? How is it related to column efficiency?
 - Explain basic principle of mass spectrometry.
 - What is principle of single isotopic dilution method?
 - What are the advantages and limitations of Atomic Absorption Spectroscopy?
 - What is the principle of Auger Electron spectroscopy?
 - Explain interference of dissolved oxygen in polarographic analysis.
 - Describe liquid membrane electrode used for determination of divalent metal ions