[Time: 2 Hours] **[Marks:75]**

Please check whether you have got the right question paper.

N.B: 1. All questions are compulsory.
2. All questions carry equal marks.

Q.1 a) Attempt **ANY TWO** of the following:- **08**

i. What is ^{31}P NMR? What are its advantages over normal NMR?
ii. What is the significance of group frequency region and fingerprint region in qualitative analysis of organic compounds by IR spectroscopy?
iii. Write a short note on magnetic anisotropy.
iv. Explain the basic principle of IR spectroscopy.

b) What are the advantages of FTNMR measurement over a continuous - wave measurements? **04**

OR

b) Discuss the significance of near, far and mid IR regions. **04**

Q.2 a) Attempt **ANY TWO** of the following:- **08**

i. Explain the function of time of fight mass analyzer in mass spectrometer.
ii. Describe the applications of Raman Spectroscopy.
iii. Explain the use of mass spectrum for structural information from fragmentation pattern.
iv. Explain the origin of metastable peaks in mass spectroscopy.

b) Write note on Surface - Enhanced Raman spectroscopy. **04**

OR

b) Explain the function of fast atom bombardment sources in mass-spectroscopy. **04**

Q.3 a) Attempt **ANY TWO** of the following:- **08**

i. Discuss the different types of thermometric titrations with suitable examples.
ii. Give the expression used in quantitative isotope dilution analysis and explain the terms involved in it.
iii. Describe the working of instrument used in DTA with suitable diagram.
iv. What are radiometric titrations? Explain the nature of the titration curve obtained in the determination of chloride ions using this technique.

b) Give the applications of evolved gas analysis. **04**

OR

b) Discuss the advantages and disadvantages of thermal neutron activation analysis. **04**

Q.4 a) Attempt **ANY TWO** of the following :- **08**

i. Explain the interfaces used in ICP-MS and advantages of using mass spectrometer as detector.

ii. What is hyphenation? Why is it required? State its advantages.

iii. Explain the interfacing devices used in GC-MS. How is it ensured that the carrier gas is removed from the components?

iv. How can IR be coupled to GC? Discuss the difficulties in the same.

b) Give the principle and working of ICP-OES. **04**

OR

b) How is tandem mass spectroscopic technique used to identify compounds having same mass but different structures? **04**

Q.5 Attempt **ANY FOUR** of the following:- **12**

i. Discuss advantages of Fourier transform infrared spectrometer compared with a dispersive instrument?

ii. Explain the term "precession of particles in a field" involved in NMR spectroscopy.

iii. Explain the method of sampling using optical fibers in Raman spectroscopy, with suitable diagram.

iv. Explain the use of helium/neon laser as a source in Raman spectroscopy.

v. What is autoradiography? How is it different from gamma radiography?

vi. Describe the working of instrument used in differential scanning calorimetry (DSC).

vii. Give the main applications of ICP-MS.

viii. Give the principle and working of MS-MS.

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