

QP Code : 76608

(2½ Hours)

[ Total Marks : 60

- N.B. : (1) All questions are compulsory.  
(2) Use of log table or non programmable calculator is permitted.

1. (a) Attempt any two of the following :
- (i) Discuss the effect of magnetic anisotropy.
  - (ii) Explain the function of thermocouple and bolometer as infrared transducers.
  - (iii) Elaborate the term spin-spin relaxation involved in NMR spectroscopy.
  - (iv) Give the basic principle of IR spectroscopy.
- (b) Discuss the applications of near-IR absorption spectrometry. 4
- OR
- (b) What is  $p^{31}$  NMR? Give its advantages over normal NMR. 4
2. (a) Attempt any two of the following :- 8
- (i) Explain the method of sampling using optical fibers, used in Raman spectroscopy with suitable diagram.
  - (ii) Elaborate the mechanism of Raman and Rayleigh scattering.
  - (iii) What is the function of ion sources and mass analyzers in mass spectrometer?
  - (iv) Explain the function of fast atom bombardment sources in mass-spectroscopy.
- (b) Explain the use of Raman spectra for qualitative and quantitative analysis of inorganic species with suitable example. 4
- OR
- (b) How does mass spectrum provide structural information from fragmentation pattern? 4
3. (a) Attempt any two of the following : 8
- (i) Give the expression used in quantitative isotope dilution analysis and explain the term involved in it.
  - (ii) How are simultaneous thermal analyzers superior to the individual instruments?
  - (iii) Explain the principle and working of thermometric titration with suitable example.  
What are radiometric titrations? Discuss the nature of the titration curve obtained in the determination of chloride ions using this technique.

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(b) Describe the working of instrument used in differential scanning calorimetry (DSC). 4

OR

(b) Discuss the advantages and disadvantages of thermal neutron activation analysis. 4

4. (a) Attempt any two of the following :

(i) Explain the interfaces used in ICP-MS. State advantages of mass spectrometer as detector.

(ii) How can HPLC be coupled with MS? What are the interfaces available for this purpose?

(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? What are the difficulties in coupling an IR to GC?

(b) How the tandem mass spectroscopic technique used to identify compounds having same mass but different structures? 4

OR

(b) Give the principle and working of ICP-OES. 4

5. Attempt any four of the following :- 12

(a) Discuss advantages of fourier transform infrared spectrometer as compared to a dispersive instrument.

(b) What are the advantages of FTIR measurement over a continuous wave measurement?

(c) Under what circumstances would helium / neon laser preferred to an argon ion laser as a Raman source?

(d) Explain the function of "Time of flight mass analyser" in mass spectrometer.

(e) What is autoradiography? How is it different from gamma radiography?

(f) Give applications of evolved gas analysis.

(g) What is hyphenation? What are its advantages?

(h) Describe the stretching and bending vibrations of molecules with suitable diagram.