[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 ^{13}C NMR? What are its advantages over normal NMR? I
ii. Discuss the advantages of near IR Spectroscopy
iii. Write a short note on magnetic anisotropy.
iv. Write a note on chemical shift.

b) Describe the applications of NMR Spectroscopy **04**

OR

b) Explain the basic principle of IR spectroscopy. **04**

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

i. How molecular formula and molecular weight is determined using Mass Spectrometry?
ii. Describe the working of FT Raman Spectrometer with a neat and labeled diagram
iii. Write a note on Rayleigh scattering.
iv. Explain the method of sampling using optical fibers in Raman spectroscopy, with suit able diagram.

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

OR

b) Explain the correlation of mass spectra with molecular structure. **04**

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

i. Discuss the different types of thermometric titrations with suitable examples
ii. What are radio release methods? Explain the role of kryptonates in radio release methods.
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) Explain substiochiometry in IDA. What are the requirements of tracers employed in this technique? **04**

OR

b) Give the principle and applications of DSC. **04**

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

i. Describe the principle and theory of GC-MS.
ii. What is hyphenation? Why is it required? What are its advantages?
iii. Give the principle and working of MS-MS.
iv. What are the interfaces available for ICP-MS? Give the main applications of ICP-MS

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

OR

b) How is tandem mass spectroscopic technique used to identify isomers? **04**

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

i. Describe the methods of handling samples in IR Spectroscopy
ii. Explain the term "precession of particles in a field" involved in NMR spectroscopy.
iii. Explain the origin of metastable peaks in mass spectroscopy.
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. How can HPLC be coupled with MS? What are the interfaces available for this purpose?
viii. Explain the interfacing devices used in GC-MS. How is it ensured that the carrier gas is removed from the components?

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