

[Time: 2½ Hours]

[Marks:60]

Please check whether you have got the right question paper.

- N.B:**
1. All questions are **compulsory**.
 2. **Figures** to the **right** indicate **full marks**.
 3. All questions carry **equal marks**.

- Q.1 a Attempt any **two** of the following 8
- i How is Raman spectroscopy useful in the study of active sites in heme proteins?
 - ii Describe the symmetry and shape of AB₅ molecule.
 - iii Discuss a method to determine the paramagnetic susceptibility of co-ordination compound by NMR spectroscopy.
 - iv Explain contact and pseudo contact shift in NMR spectroscopy.
- Q.1 b Attempt any **one** of the following 4
- i Explain the modes of bonding in cyano group as ambidentate ligand.
 - ii What are the characteristics of NMR spectra of ¹⁹⁵Pt compounds
- Q.2 a Attempt any **two** of the following 8
- i Describe the various applications of ion-scattering spectroscopy.(ISS)
 - ii What is KLL-Auger transition? With a neat diagram describe the instrumentation used in Auger emission spectroscopy.(AES)
 - iii Enlist the applications of secondary ion-mass spectroscopy. (SIMS)
 - iv Explain the role of depth profile analysis and elemental mapping in surface microscopy.
- Q.2 b Attempt any **one** of the following 4
- i Draw a neat labelled diagram and explain the ion microprobe and quadrapole mass analyzer in secondary ion mass spectroscopy.(SIMS)
 - ii Discuss the advantages and limitations of Auger emission spectroscopy(AES)
- Q.3 a Attempt any **two** of the following 8
- i Discuss the different modes of operations of atomic force microscopy(AFM)
 - ii Draw a neat labelled diagram and explain the instrumentation involved in atomic force microscopy(AFM)
 - iii Enlist the applications of transmission electron microscopy (TEM)
 - iv What is ESCA? Discuss its applications?
- Q.3 b Attempt any **one** of the following 4
- i With the help of neat labelled diagram explain the instrumentation involved in scanning electron microscopy(SEM)
 - ii Explain the reactions of electron observed in scanning electron microscopy(SEM)
- Q.4 a Attempt any **two** of the following 8
- i With the help of neat labelled diagram explain the instrumentation involved in differential thermal analysis(DTA)
 - ii Explain the determinations of heat capacity, standard enthalpy of formation of the compounds for the reaction employing thermo analytical measurements.
 - iii What is the principle involved in evolved gas analysis? Enlist its applications.
 - iv Describe the applications of thermal techniques in material science.

- Q.4 **b** Attempt any **one** of the following 4
- i Draw a neat labelled diagram explain the instrumentation involved in differential scanning calorimetry.(DSC)
 - ii Describe the different factors which affect the thermo gravimetric curves.(TG)
- Q.5 Attempt any **four** of the following 12
- a Discuss the applications of “biochemical shifts”.
 - b Explain the principle involved in ion- scattering spectroscopy.
 - c Explain the instrumentation involved in transmission electron microscopy (TEM) with suitable diagram
 - d Comment on the principle involved in thermo gravimetry.
 - e Describe various factors affecting the nuclear relaxation.
 - f Describe the applications of Auger emission spectroscopy.
 - g Explain the use of scanning electron microscopy for surface morphology of inorganic compounds.
 - h Enlist the applications of .(TMA)