

Please check whether you have got the right question paper.

- N.B:
1. All questions are **compulsory**.
 2. All questions carry **equal marks**.
 3. **Figures** to the **right** indicate **full marks**.
 4. **Use** of logarithmic table/non-programmable calculator **is allowed**.

- Q.1 Answer any **five** of the following : (15)
- a) Write a note on 'Miller indices'.
 - b) Give silent features of electron diffraction.
 - c) Discuss the symmetry and shape of AB₄ molecule.
 - d) Describe the principles of DMS technique.
 - e) What are the problem of surface analysis?
 - f) Describe the use of modulation coil in ESR technique.
 - g) Explain the etching process in detail for surface analysis.
 - h) Discuss the various conditions for good Mossbauer spectrum.
- Q.2 a) Draw a neat labelled diagram of x ray tube and explain its working. (5)
- OR
- a) Describe the use of x-ray diffraction data in order to obtain absolute configuration. (5)
- b) With an x-ray wave length of 1.5404 Å, the first order reflection through (211) plane of NaCl crystal occurs at 16° 12'. Calculate the lattice constant of NaCl crystal (5)
- OR
- b) Compare X ray and electron diffraction. (5)
- c) Discuss the concept of magnetic scattering of neutron diffraction. (5)
- Q.3 a) Write informative note on 'Hyperfine structure in ESR spectra'. (5)
- OR
- a) A free electron is placed in a magnetic field of strength 1.3τ . Calculate the resonance frequency if $g = 2.0023$ ($\mu_B = 9.274 \times 10^{-24} \text{ JT}^{-1}$)
 $h = 6.626 \times 10^{-34}$ (5)
- b) Explain the factors affecting spectroscopic splitting factor in ESR spectroscopy. (5)
- OR
- b) Discuss the recoilless emission and absorption of γ - radiations (5)
- c) What is isomer shift in Mossbauer spectroscopy? Explain isomer shift for iron and tin compounds in different oxidation states. (5)
- Q.4 a) What is nuclear relaxation in NMR spectroscopy? Explain various types of nuclear relaxation. (5)
- OR
- a) Explain contact and pseudo contact shift in NMR spectroscopy (5)

b) What are the requisites of a good thermo balance (5)

OR

b) Discuss factors affecting DTA curve. (5)

c) Write an informative note on TMA. (5)

Q.5 a) Write a neat labelled diagram, and explain the instrumentation used in Scanning Electron microscope (SEM). (5)

OR

a) Give a detail account of Auger Electron spectroscopy (5)

b) Explain application of any one of the following for spectral interpretation and characterization of inorganic compounds.

i) IR spectroscopy

ii) NMR spectroscopy

b) Write informative note on secondary ion mass spectroscopy (SIMS) (5)

c) Discuss the theory behind ISS technique (5)