

FACULTY OF SCIENCE

M.Sc. I – Semester (CBCS) Examination, December 2016

Subject: Chemistry

Paper – IV

Analytical Techniques & Spectroscopy-I

Time: 3 Hours

Max.Marks: 80

Note: Answer all questions from Part-A and Part-B.
Each question carries 8 marks in Part-A and 12 marks in Part-B.

PART – A (4x8 = 32 Marks)
[Short Answer Type]

- 1 a) Write a note on FID.
- b) In a typical chromatogram, the retention times of A is 8 min. If the dead time (t_M) of the column is 2 min, calculate the capacity factor (k') of the column.
- 2 a) What are equivalent and non-equivalent protons? Give examples.
- b) Sketch the nmr spectrum of C_2H_5OH containing a small amount of acid and explain the proton exchange process.
- 3 a) The rotational constant of a diatomic molecule is 3 cm^{-1} . Calculate the energy (in J) required for $J = 3 \rightarrow J = 4$ transition.
- b) Write a note on Fermi Resonance.
- 4 a) The optical density of 0.01 M solution of X is 0.4 when measured using 1 cm cell. What is the optical density of 0.001 M solution of X when 0.5 cm cell is used?
- b) Explain how cis and trans isomers can be identified from their electronic spectra.

PART – B (4x12 = 48 Marks)
[Essay Answer Type]

- 5 a) Describe the instrumentation of GC.
- b) The following data is obtained in the chromatogram of a sample when 30 cm long column is used.

$$W = 2\text{ min}$$

$$t_R = 10\text{ min}$$

Calculate the plate height (H) of the column.

OR

- c) Define the following terms:
 - i) Selectivity factor
 - ii) Number of plates
- d) Describe the instrumentation of HPLC.

- 6 a) What are vicinal, geminal and long range couplings? Give examples.
 b) Explain how cyclic bromonium ion can be identified from NMR spectra.
 OR
 c) Sketch the nmr spectrum of benzyl acetate and explain the splitting pattern.
 d) What are the effects of electronegativity, shielding and deshielding on the chemical shifts.
- 7 a) The IR spectrum of a diatomic molecule gave bands at 2886 cm^{-1} (strong), 5668 cm^{-1} (weak) and 8347 cm^{-1} (very weak). Calculate the vibrational frequency (in cm^{-1}) and anharmonicity constant (χ_e).
 b) Discuss the IR spectra of metal – NO_3^- complexes.
 OR
 c) Write notes on fundamental bands, overtones, and hot bands.
 d) The B value of $^{12}\text{C}^{16}\text{O}$ is 1.92 cm^{-1} . The B' value of $^{13}\text{C}^{16}\text{O}$ is 1.836 cm^{-1} . Calculate the atomic mass of ^{13}C .
- 8 a) Discuss the application of Beers law to dissociation constant of a weak acid.
 b) What is the effect of solvent on the absorption maxima of a compound.
 OR
 c) Write about the absorption spectra of polynuclear aromatic hydrocarbons.
 d) Calculate the λ_{max} of the following:


