

**Exam. Code : 107406**

**Subject Code : 1790**

**B.Sc.(Bio Technology) 6<sup>th</sup> Semester**  
**PHYSICAL, ORGANIC AND INORGANIC**  
**ASPECTS OF SPECTROSCOPY-B**

**Paper—BT-7**

Time Allowed—2 Hours] [Maximum Marks—40

**Note :—** There are *eight* questions of equal marks.  
Candidates are required to attempt any  
*four* questions.

- I. What is the meaning of the terms FT and pulse in FT NMR ? What type of magnets are used in the FT NMR spectrometer ? What are main advantages of FT NMR ?
- II. It is found that in proton NMR spectrum of a compound, there are only a small number of nuclei more in the ground state as compared to that in the excited state when NMR spectrum is recorded. How then this number is maintained and no saturation of the NMR system occurs ? Discuss relaxation phenomena which do this job.

- III. (a) The NMR signal of OH proton of p-nitrophenol undergoes shift to highfield when concentration of p-nitrophenol is decreased, while OH proton of o-nitrophenol did not change its position with concentration. Explain this behaviour of two compounds.
- (b) Predict  $^1\text{H}$  NMR spectrum of ethyl acetate  $\{\text{CH}_3\text{-C(=O)-O-CH}_2\text{-CH}_3\}$ .
- IV. (a) Suppose  $^1\text{H}$  NMR spectrum of compound A shows one triplet in intensity ratio (1 : 2 : 1) at  $\delta = 2.5$  ppm; one quartet of doublets in intensity ratio (1 : 3 : 3 : 1) at  $\delta = 3.5$  ppm and one triplet in intensity ratio (1 : 2 : 1) at  $\delta = 5.5$  ppm. Suggest structure of compound with suitable justification.
- (b) Depict and explain  $^1\text{H}$  NMR spectrum of 1, 1, 2-tribromoethane.
- V. Explain briefly : electron ionization (EI) and chemical ionization (CI) techniques used for formation of ions in mass spectrometry.
- VI. (a) Illustrate with an example, Diels-Alder fragmentation encountered in mass spectrometry of organic compounds.

- (b) Describe mass spectrum of butyrophenone ( $\text{C}_{10}\text{H}_{12}\text{O}$ ; MW 148). Illustrate McLafferty rearrangement shown, if any, by this compound.

VII. Give applications of mass spectrometry to :

- (a) alcohols and  
(b) aromatic compounds.

Describe main species and their relative abundances.

- VIII.(a) Mass spectrum of 3-methylpyridine showed three peaks at  $m/z$  values of 93, 92 and 66 with relative abundances of 100%, 25% and 45% respectively. Explain the formation of ions (atomic masses C, 12, H, 1; N, 14).
- (b)  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$  have natural abundance in 3 : 1 ratio, then suggest molecular ions obtained from mass spectrum of methyl chloride.