LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **CHEMISTRY**

FIFTH SEMESTER – **NOVEMBER 2024**

UCH 5503 – SPECTROSCOPY

Date: 14-11-2024 Dept. No. Max. : 100 Marks

Time: 09:00 am-12:00 pm

SECTION A

Answer ANY FOUR of the following **4 x 10 = 40 Marks**

1. Discuss (a) Born-Oppenheimer approximation and (b) interaction of electromagnetic radiation with matter. (5+5)
2. State and explain Franck-Condon principle.
3. Explain the various factors that affect absorption maximum and intensity in UV-visible spectroscopy.
4. Give the block diagram for IR spectroscopy. Explain the sample preparation in IR spectroscopy.
5. (a) Explain the fundamental modes of vibrations. (5)
   (b) Mention the differences between IR and Raman spectroscopy. (5)
6. (a) What is spin-spin coupling? Explain with an example. (6)
   (b) What is hyperfine splitting? Give an example. (4)
7. (a) Enumerate the advantages and disadvantages of TMS as reference in NMR spectroscopy. (6)
   (b) Mass spectra of acetone, propionaldehyde and ethyl methylketone show strong peaks at m/z values of
   43, 57 and 57, respectively. Suggest a possible origin for each of these peaks. (4)
8. Discuss various fragmentation patterns possible in mass spectroscopy with suitable examples.

SECTION B

Answer ANY THREE of the following **3 x 20 = 60 Marks**

9. (a) Discuss the factors affecting intensity and width of the spectral lines. (10)
   (b) Write the differences between absorption and emission spectra. (5)
   (c) Calculate the energy of radiation having wavelength 4000 Å. (5)
10. (a) Explain the principle and applications of atomic absorption spectroscopy. (10)
    (b) Draw and label the block diagram of double beam UV-Visible spectrophotometer and explain. (10)
11. (a) Describe the various types of electronic transitions. (5)
    (b) Differentiate Stokes from anti-Stokes lines. (5)
    (c) Describe the various factors affecting the fundamental vibrational frequencies. (10)
12. (a) Discuss the principle of EPR spectroscopy. Explain the EPR spectrum of benzene radical. (10)
    (b) Illustrate the various factors affecting the chemical shift values in ^{1}H NMR spectroscopy. (10)
13. (a) Explain the various types of coupling possible in ^{1}H NMR spectroscopy? (8)
    (b) Discuss the following: (i) Metastable peak (ii) Base peak (iii) Isotopic peak. (12)
14. (a) Explain the following: (12)
    (i) McLafferty rearrangement (ii) Nitrogen rule. (iii) Retro-Diels-Alder reaction.
    (b) Illustrate the block diagram of Mass spectrometer and mention the parts. (8)
