Reg. No ..... Name **25U590**

B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2025

SEMESTER 5 : CHEMISTRY

COURSE : **19U5CRCHE08 : PHYSICAL CHEMISTRY – II**

(For Regular 2023 Admission and Supplementary 2022/ 2021/ 2020/ 2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer All (1 mark each)

1. Why to Electronic spectra show broad bands in solution?
2. Give any one application of mass spectrometry in organic chemistry?
3. The frequencies of stokes lines for a molecule are ----------than that of rayleigh line.
4. Explain the general broadness of spectral bands in UV-visible spectroscopy.
5. Name an instrument which functions on the basis of Beer-Lamberts law.
6. Calculate the energy of a radiation that has a wave number 0.005 nm^{-1}.
7. How many peaks will obtained in the proton NMR spectrum of diethyl ether? Why?
8. What is the essential condition for a molecule to absorb IR radiation?

(1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. Show diagrammatically the transitions in the electronic spectra of polyatomic molecules.
10. Explain hypochromic shift taking a specific example.
11. What is the essential condition for the vibration or rotation to be Raman-active?
12. State the principle of mutual exclusion.
13. Calculate the wavenumber for a radiation of wavelength 200 nm.
14. Is the molecular ion peak be necessarily the peak with the highest m/z in a mass spectrum justify your answer?
15. Briefly explain Born-Oppenheimer approximation.
16. Discuss the significance of Franck-Condon principle in explaining the intensities of spectral lines in electronic spectroscopy.

(2 x 6 = 12)

PART C

Answer any 4 (5 marks each)

17. Discuss the complementary character of IR and Raman spectroscopy.
18. Explain the terms bathochromic and hypsochromic shift with suitable examples.
19. Discuss the proton NMR spectrum of acetaldehyde and acetophenone.
20. Discuss briefly the nature of fragmentation that can happen in a mass spectrometric experiment?
21. Using the energy level diagram and the selection rules draw and explain an energy level diagram and the spectral transitions for the rotation-vibration spectrum of a diatomic molecule.
22. What is meant by fluorescence how do you explain fluorescence?

(5 x 4 = 20)

PART D

Answer any 2 (10 marks each)

23. What is chemical shift in NMR spectroscopy? Which are the different scales used for expressing chemical shift? Explain the factors affecting chemical shifts in NMR spectroscopy?

24. Explain Jablonski diagram and explain the following from it a) Intersystem crossing b) Internal Conversion c) Radiative transitions.

25. Derive the expressions for (i) the moment of inertia (ii) the rotational energy of a rigid diatomic molecule. Show that the spectral lines for such a molecule are equally spaced.

26. Explain the vibrational spectrum of a diatomic molecule based on the simple harmonic oscillator model. Comment on fundamental vibrational frequency and zero point energy.

(10 x 2 = 20)