18.4

TM242250F

Reg. No :.....

Name :.....

MASTER'S DEGREE (C.S.S) EXAMINATION, MARCH 2024

2023 ADMISSIONS REGULAR

SEMESTER II - CORE COURSE CHEMISTRY

CH2C08TM20 - Molecular Spectroscopy

Time : 3 Hours **Maximum Weight : 30**

Part A

I. Answer any Eight questions. Each question carries 1 weight **(8x1=8)**

1. Sketch the vibrational modes of H_2O and CO_2. Which of them are IR active?
2. Give a brief account of polarized and depolarized Raman lines.
3. Explain briefly the Lamb Dip Spectrum in molecular spectroscopy.
4. Write a note on Resonance fluorescence.
5. Discuss the different fundamental vibrations for molecules in IR spectroscopy.
6. Define chemical shift.
7. Discuss why nuclear magnetic resonances of ^{13}C nuclei are difficult to observe than those of ^{1}H.
8. Differentiate between T_1 and T_2 relaxation mechanisms.
9. i)Discuss briefly on Quadrupole nucleus ii) List the important criteria for observing zero field NMR Spectroscopy.
10. Write a note on Electric Quadrupole moment (eQ). Quadrupole moment is a measure of the departure from spherical symmetry of the nuclear charge. Comment.

Part B

II. Answer any Six questions. Each question carries 2 weight **(6x2=12)**

11. Explain the concept of Fermi resonance in vibrational spectroscopy.
12. Excitation of a sample by irradiation with 435.7 nm mercury line yields the first Stokes line at 445.1 nm. Calculate the Raman shift in cm^{-1} and the wavelength in nm at which the first anti-Stokes line would appear in the above Raman Spectrum.
13. Explain the influence of rotation on the vibration spectra of polyatomic linear molecule.
14. Write a note on stark effect and its applications.
15. Compare the NMR signals obtained at low and high field strengths.
16. Describe the general rule for predicting whether a nucleus is NMR active.
17. Discuss the origin of spin-spin splitting in NMR spectroscopy.
18. Write a note on Nuclear Quadrupole splitting in Mossbauer Spectroscopy.

Part C

III. Answer any Two questions. Each question carries 5 weight **(2x5=10)**

19. Explain the electronic spectra of polyatomic molecules by a) Chemical analysis of the molecule and b) Change in shape on excitation.
20. Discuss the vibrational coarse structure of electronic spectra.
21. Discuss the instrumentation of CW and pulsed NMR spectrometers.
22. Elaborate on the principle and applications of Nuclear Quadruple resonance spectroscopy.