LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - **PHYSICS**

THIRD SEMESTER – **NOVEMBER 2013**

PH 3815 - SPECTROSCOPY

Date : 07/11/2013 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

PART - A

Answer **ALL** questions (10 x 2 = 20)

1. What are S-branch lines in Raman spectroscopy?
2. The fundamental vibrational frequency of HCl is 2989 cm^{-1}. Find the force constant of the HCl bond.
3. Explain microwave active and microwave inactive molecules using suitable examples.
4. The rotational constant of NO is 1.7201cm^{-1}. Calculate the moment of inertia of the molecule.
5. What is double resonance?
6. Distinguish between the terms "sequence" and "progression".
7. An NMR signal for a compound is found to be 25 Hz downward from TMS operating at 400 MHz. Calculate shift in ppm.
8. Explain C^{13} NMR spectroscopy.
9. What is fluorescence spectroscopy?
10. What is the difference between inelastic scattering and elastic scattering?

PART - B

Answer any **FOUR** questions (4 x 7.5 = 30)

11. a) Explain the effect of isotopic substitution on the pure rotational spectra of diatomic molecules with a suitable example.

    b) The first rotational lines of $^{12}C^{16}O$ is observed at 3.84235 cm^{-1} and that of ^{13}C ^{16}O at 3.67337cm^{-1}. Calculate the atomic weight of ^{12}C, assuming the mass of ^{16}O to be 15.9949.

12. (a) Outline the theory of Raman Effect on the basis of classical theory.

    (b) Distinguish between the molecular structures of N_2O and NO_2 on the basis of IR Raman lines.

13. Sketch the Fortrat Parabola? Explain how this is used to calculate the position of band head

14. Explain the working of NMR spectrometer.

15. Explain the functioning of XPES and UPES.

PART - C

Answer any **FOUR** questions (4 x 12.5 = 50)

16. Explain with necessary theory, the spectrum of a linear diatomic molecule of rigid rotator type. Outline the correction for non-rigid type.

17. Describe the theory of diatomic vibrating- rotator and explain the spectrum on the basis of Born's approximation. The fundamental and first overtone of NO molecule is centered at 1876.06 cm^{-1} and 3724 cm^{-1} respectively. Calculate the equilibrium vibration frequency and anharmonicity constant.

18. Give the selection rules associated with the study of rotational fine structure of vibration spectra. Explain the origin of P,Q and R bands and derive the energy expressions associated with the spectrum observed.

19. Explain the role of Doppler Effect and uncertainty principle in obtaining Mossbauer spectrum. With a block diagram explain a Mossbauer spectrometer.

20. Explain the electron energy loss spectroscopy in detail.

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