 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FOURTH SEMESTER – **NOVEMBER 2012**

# PH 4807 - SPECTROSCOPY

Date : 07/11/2012 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

**PART - A**

Answer **ALL** questions (10x2=20)

1. How are molecules classified on the basis of moment of inertia? Give one example each.
2. The rotational constant for HCl 35 is observed to be 10.5909 cm-1. Calculate the value of B for HCl 37.
3. Show by sketch the fundamental vibrational modes of CO2 molecule.
4. Why are stokes lines more intense than antistokes lines?
5. What is continuum in the electronic spectra of a diatomic molecule?
6. Explain the term progressions
7. State the advantages of TMS when recording NMR spectra?
8. What is spin-lattice relaxation?
9. Give the principle of UPES?
10. Mention any two advantages of surface spectroscopy

**PART - B**

Answer any **FOUR** questions (4x7.5 = 30)

1. a. Explain the factors that determine the intensity of a spectral line. Obtain an expression for J at which maximum population occurs. (5)

b. The rotational spectrum of BrF shows a series of equidistant spectral lines spaced 0.71433 cm-1 apart. Find which transition will give rise to the most intense line at 300 K. (2.5)

1. a. Outline briefly each section of IR spectrometer. (5.5)

b. Calculate the frequency of NO molecule whose force constant is 1609 Ncm-1. (7)

1. State and explain Franck-Condon principle. Explain how the intensity of spectral line is explained on the basis of it.
2. Obtain the expression for T1 relaxation time in terms of transition probability
3. Explain how RAIRS spectroscopy is used for characterizing surfaces

**PART - C**

Answer any **FOUR** questions (4x12.5 =50)

1. a) Explain with theory, the spectrum of symmetric top molecule.

b) The three consecutive lines in the rotational spectrum of HBr are 84.544, 101.355 and 118.112 cm-1. Find the values of rotational constant, centrifugal distortion constant and vibrational frequency.

1. Explain the theory of pure rotational Raman spectra of linear molecule and symmetric top molecule.
2. Explain band origin and band head in the rotational fine structure of electronic vibration spectra. Will there be a band at the band origin?
3. Discuss briefly the theory of NMR and explain the working of the spectrometer
4. Explain the principle and application of electron energy loss spectroscopy.