LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

FOURTH SEMESTER – **APRIL 2014**

PH 4807 - SPECTROSCOPY

Date : 29/03/2014 Dept. No. Max. : 100 Marks

Time : 01:00-04:00

PART-A

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

1. Define the term hyperfine structure of spectral lines.
2. The rotational constant for HCl^{35} is observed to be 10.5979 cm^{-1}. Calculate the value of B for HCl^{37}.
3. State the rule of mutual exclusion.
4. What is depolarization ratio.
5. What is continuum in the electronic spectra of a diatomic molecule?
6. Explain the term progressions.
7. State the advantages of using TMS when recording NMR spectra?
8. What is spin-lattice relaxation?
9. Give the principle UPES?
10. Mention any two advantages of surface spectroscopy.

Part-B

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

11. 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 0.71623 cm^{-1} apart. Find which transition give rise to the most intense line at 305 K. (2.5)

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

    b) Calculate the frequency of NO molecule whose force constant is 1609 N/ cm^{-1}. (7)

13. State and explain Franck-Condon principle. Explain how the intensity of spectral line is explained on the basis of it. Sketch the spectrum.
14. Obtain the expression for T_1 relaxation time in terms of transition probability. State the range of values for solids and liquids.
15. Explain how AES spectroscopy is used for characterizing surfaces.

Part-C

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

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

    b) The three consecutive lines in the rotational spectrum of HBr are 83.644, 101.785 and 113.112 cm^{-1}.

17. Explain the theory of pure rotational Raman spectra of linear molecule and symmetric top molecule.

18. What is Fortrat pabola? Explain band origin and band head in the rotational fine structure of electronic vibration spectra. Will there be a band at the band origin.

19. Discuss briefly the theory of NMR and derive the frequency of resonance. Explain the working of the spectrometer

20. Explain the principle and application of electron energy loss spectroscopy.

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