No. of Printed Pages : 04 **Roll No. .....**

18BB1854

M. Sc. EXAMINATION, 2020

(Second Semester)

(C Scheme) (Re-appear)

CHEMISTRY

CH508C

Spectroscopy-I (Molecular Spectroscopy)

Time : 2½ *Hours*] [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Four* questions in all. All questions carry equal marks.

1. (a) What do you mean by electromagnetic radiations and discuss their interaction with matter.

(b) Derive an expression for Non-rigid rotator and also explain different energy levels with allowed and forbidden transitions.

2. (a) The far infrared spectrum of HI molecule consists of a series of equally spaced lines with spacing equal to 11.6 cm^{-1}. Calculate (i) the moment of inertia and (ii) the inter-nuclear distance.

(b) Write a note on Isotopic Effect.

3. (a) Discuss the Classical Theory of Raman Spectroscopy.

(b) A sample was excited by the 4359 Å line of mercury. A Raman line was observed at 4448 Å. Calculate the Raman shift in cm^{-1}.

(c) Which of the following molecules will show Rotational Raman spectrum and why ?

CH_4, H_2O, NH_3, CH_3Cl, SF_6, C_2H_6.

4. (a) Discuss the rotational-vibrational spectra of diatomic molecules and explain, how P, Q and R branches appear in spectrum.

(b) Why are the anti-stokes lines less intense than the stokes lines in the Raman Spectrum and how has the use of the laser source of exciting radiation helped in Raman spectroscopy.

5. (a) State and illustrate with suitable potential energy curves the Frank-Condon Principle in the vibronic spectrum of diatomic molecule.

(b) Write notes on the following :

(i) Dissociation Energy

(ii) Vibrational coarse structure.

6. (a) Explain in detail the electronic spectra of diatomic molecules.

(b) Write a short note on Intensity of vibrational electronic bands.

(c) Write a short note on Charge Transfer Complexes.

7. (a) What is the basic principle of NMR spectroscopy and derive the relationship between frequency and magnetic field.

(b) Calculate the NMR frequency (in MHz) of the proton in a magnetic field of intensity 1.395 Tesla.

(c) Why is the NMR spectrum of NH_3 broad whereas for NH_4^+ is sharp ?

8. (a) Discuss the various types of relaxation processes in NMR spectroscopy.

(b) Calculate the relative Boltzmann population of the proton spins in the lower state to that in upper state in a magnetic field of flux density 1.5 Tesla at room temperature.

(c) What do you mean by coupling constant ? Discuss its significance.