## Unit III

6. Define quantum theory and classical theory of Raman effect. **16**

7. (a) Discuss the principle of IR and NMR spectra in the structure elucidation of organic compounds. **8**

   (b) Discuss the spin active nuclei, shielding and deshielding term with suitable examples. **8**

## Unit IV

8. Discuss the following :

   (a) Demonstrate double resonance by providing *two* examples of inorganic molecules **8**

   (b) Assessment of the reaction rate in a fast exchange reaction. **8**

9. Examine *six* applications of spin-spin coupling alignment in inorganic chemistry. supported by relevant examples. **16**

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# 31118

## M. Sc. EXAMINATION, 2025

(Second Semester)

(2020-21 Onwards)

(Re-appear Only)

CHEMISTRY

General Spectroscopy

*Time :* 3 *Hours*] [*Maximum Marks :* 80

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

**Note** : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

**1.** Attempt all questions : **8×2=16**

(a) Define electromagnetic radiation.

(b) Write *two* examples each of linear and symmetric polyatomic molecules.

(c) Define isotopic substitution.

(d) Define overtones and combination bands.

(e) Define principle of UV spectroscopy.

(f) What is nuclear spin quantum number and write its value for 1H, 13C, 15N ?

(g) What do you understand by first exchange reaction ?

(h) Define double resonance.

## Unit I

**2.** (a) Illustrate in pictorial fashion the various, rather arbitrary, regions into which electromagnetic radiations has been divided. **8**

(b) Discuss various factors which determine the width. **4**

(c) Define resolving power. **4**



**3.** Discuss the effect of isotopic substitutions rotational spectra of linear and symmetric top polyatomic molecule. **16**

## Unit II

**4.** (a) Define simple harmonic vibrations. **4**

(b) The fundamental and first overtone transitions of $^{14}N^{16}O$ are centered at 1876.06 $cm^{-1}$ and 3724.20 $cm^{-1}$. Calculate equilibrium vibrational energy, anharmonicity constant, zero-point energy and force constant. **6**

(c) Derive the expression for vibrational energy for a diatomic molecule behaving as simple harmonic oscillator. **6**

**5.** (a) Define Frank-Condon principle with suitable pictorial representation. **4**

(b) Discuss the interaction of rotation and vibrations of polyatomic molecules. **6**

(c) Write a note on Fortrat diagram. **6**