

**K-5/2110****7408/N****Fundamentals of Spectroscopy-331  
(Semester-III)****[Time: Two Hours]****[Maximum Marks: 55]****Note: Attempt any four questions. All questions carry equal marks.**

1.	a) Derive an equation for the rate of transition. b) Derive Time-dependent Schrodinger wave equation and explain the terms involved.	6.75 Marks 7 Marks
2.	a) Derive an expression for simple Harmonic oscillator. Also write the vibrational energies of diatomic molecules. b) The difference between the successive rotational lines of CO molecule is $3.828 \text{ cm}^{-1}$ . Calculate the bond length of CO.	6.75 Marks 7 Marks
3	Discuss the following aspects of pure rotational spectra of a rigid diatomic molecule: a) Energies in various levels b) Selection Rule c) Position of spectral lines d) Intensities of spectral lines	13.75 Marks
4.	Write short notes on the following: a) Zero point energy b) Overtones c) Hot bands d) Combination bands	13.75 Marks
5.	a) How O, Q and S branches of vibrational Raman spectra are obtained? Describe b) Explain the various selection rules used in case of electronic spectrum of a molecule. Also discuss Fortrat parabola.	6.75 Marks 7 Marks
6	a) Explain the applications of NMR-Spectroscopy? b) What is the importance of g-value in NMR Spectroscopy? Give examples?	7 Marks 6.75 Marks
7	What is Chemical Shift and explain the factors affecting Chemical Shift?	13.75 Marks
8	What is ESR Spectroscopy? Explain it in detail and also give examples?	13.75 Marks
9	a) How can you compare NMR and ESR Spectroscopy? b) How can you explain McConnell's relationship? Give examples?	7 Marks 6.75 Marks