

M-33/2110**10475/N**

**Fundamentals of Spectroscopy-331
(Semester-III)
(SYLL-DEC-2019)**

[Time: Two Hours]**[Maximum Marks: 55]****Note: Attempt any four questions. All questions carry equal marks.**

1.	Derive an equation for Induced Quantum transition.	13.75 Marks
2.	a) Explain how the spectrum is represented in UV, visible and IR regions of the spectrum. Give schematic diagram of a grating spectrometer. b) The bond length of HF molecule is 0.093 nm. Calculate a) moment of inertia, b) rotational constant c) rotational energy of the 4 th and 5 th rotational levels and d) the frequency of the transition between J=4 to J=5 in s ⁻¹ and cm ⁻¹ .	6.75 Marks 7 Marks
3	a) Define natural line width? b) For IR radiation of 5 μ m, what is the wave number in cm ⁻¹ c) Define Oblate symmetric Top molecules d) Out of C ₂ D ₂ and CH ₄ which will be IR active.	13.75 Marks
4.	a) What are the various parameters affecting vibrational frequency? Explain b) Describe P, Q and R Branches of spectra. How are they obtained?	6.75Marks 7 Marks
5.	a) Write a short note on Quantum theory of Raman Effect. What do you understand by molecular polarizability? b) Explain Franck-Condon Principle. Also describe Fortrat Diagram.	6.75 Marks 7 Marks
6	Discuss instrumentation and theory of NMR Spectroscopy. Give examples?	13.75 Marks
7	a) What is Karplus Equation? Discuss Dihedral Angle? b) How can you explain Proton magnetic spectrum of nitrobenzene?	7 Marks 6.75 Marks
8	a) Why the g-value is variable in ESR Spectroscopy. Give examples? b) What are the applications of ESR-Spectroscopy?	7 Marks 6.75 Marks
9	Explain Zero Field Splitting in ESR-Spectroscopy. Give examples?	13.75 Marks