

**M.Sc. DEGREE (FIVE YEAR INTEGRATED) V SEMESTER EXAMINATION IN
PHOTONICS NOVEMBER 2011**

CEL 1505 MOLECULAR SPECTROSCOPY
(2007 admissions onwards)

Time : 3 Hours

Maximum Marks : 50

PART A(Answer ANY FIVE questions)

(5 × 2 = 10)

- I. (a) The intensity of $J = 0 \rightarrow J = 1$ transition is often not the most intense rotational line. Why?
 (b) The frequency of OH stretching vibrations in CH_3OH is 3300cm^{-1} . Estimate the frequency of OD stretching vibration in CH_3OD .
 (c) Explain predissociation.
 (d) How many normal modes can be observed in the IR absorption spectra of H_2O and CO_2 ? Diagram the normal modes.
 (e) Explain mutual exclusion principle with examples.
 (f) Explain how D_0 and D_e are estimated from the known values of $\bar{\nu}_e$ and x_e .
 (g) What is screening constant? Explain.
 (h) Explain the resonance condition in ESR.

PART B

(4 × 10 = 40)

- II. A. Discuss rotational spectrum of a rigid rotator. Outline effect of isotopic substitution on the rotational spectra of molecules.
OR
 B. With necessary diagrams and theory explain the spectra exhibited by a vibrating diatomic molecule.
- III. A. Discuss the vibrational Raman Spectra with rotational fine structure. What are the advantages of using laser as a Raman source?
OR
 B. Explain the IR spectrum exhibited by a symmetric top molecule. What are the advantages of FTIR technique.
- IV. A. Explain how Franck-Condon principle accounts for the intensities of spectral lines in vibrational electronic spectra. Discuss rotational fine structure of electronic vibration spectra.
OR
 B. Explain Deslandres table. Discuss the information that can be obtained from the vibrational analysis of electronic vibration spectra. What are progressions and sequences?
- V. A. Discuss chemical shift, quadrupole effect and the effect of magnetic field in the case of Mosbauer spectroscopy.
OR
 B. With schematic diagram discuss the basic requirements of a typical NMR spectrometer. Explain why TMS is generally used as a reference compound.
