Subject Code : ECSPHA

SPECTROSCOPY AND LASER PHYSICS

UNIT – I : Microwave spectroscopy.

The rotation of molecules, its spectra, Diatomic molecules – rigid diatomic molecule – intensities of spectral lines, effect of isotopic substitution, Non-rigid rotator – its spectrum, Polyatomic molecules – linear, symmetric top, asymmetric top molecules- Techniques and instrumentation, chemical analysis by microwave spectroscopy.

UNIT – II : Infrared Spectroscopy.

Vibrating diatomic molecule – energy of diatomic molecule, harmonic and anharmonic oscillator, vibrating rotator – co-vibrating rotator spectrum, interaction of rotations and vibrations – vibrations of polyatomic molecules – fundamental vibrations and their symmetry – overtones and combination frequencies - Analysis by IR techniques - Techniques and instrumentation – Outline, single and double beam arrangement.

UNIT – III : Raman spectroscopy.

Theory of Raman effect. Pure rotational Raman spectra – linear, symmetric top, spherical top, asymmetric top molecules. Pure vibrational Raman spectra – Raman activity of vibration rule of mutual exclusion, overtones and combination vibrational spectra, nature of light polarized, vibration of spherical top molecules and other type of molecules. Structural determinations from Raman and IR spectroscopy, techniques and instrumentation.

UNIT – IV : Electronic spectroscopy.

Born – Oppenheimer approximation vibrational coarse structure (Progression), intensity of vibrational electronic spectra, (Franck –condon principle), dissociation energy and dissociation products. Vibrational fine structure (Rotation), fortart diagram, predissociation, diatomic molecular electronic spectra.

UNIT – V : Laser Physics.

Population inversion, Laser pumping, resonators – vibrational modes of resonators, number of modes per unit volume – open resonators, control resonators, Q factor, losses in the cavity, threshold condition, quantum yield - Ruby Laser – three level system, pumping power, spiking U^{3+} in CaF_2 laser, four level laser, Neodysmium –Nd: YAG -
Taser, Nd glass Taser HO3+ : YLF laser.

Book for Study:

1. Fundamentals of molecular spectroscopy C.N.Banwell, Tata McGraw Hill Publishing Co. Ltd., 3rd Edition (1972).
2. Lasers and non linear optics, B.B. Laud Wiley Eastern Ltd., (1985).