

## Paper-X CHN504 – A Spectroscopy

- I Vibrational Spectroscopy** **8 Hrs**  
Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy, P,Q,R branches. Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal-ligand vibrations, normal co-ordinate analysis.
- II A Raman Spectroscopy** **12Hrs**  
Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle. Resonance Raman spectroscopy, coherent anti Stokes Raman spectroscopy (CARS).
- B Microwave Spectroscopy**  
Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.
- III Magnetic Resonance Spectroscopy Part-I** **16 Hrs**  
<sup>1</sup>H NMR Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant 'j'. Classification (ABX, AMX, ABC, A2B2 etc.) spin decoupling; basic ideas about instrument. advantages of FT NMR use of NMR in medical diagnostics.
- IV Magnetic Resonance Spectroscopy Part-II** **12 Hrs**  
NMR studies, of nuclei other than proton – <sup>13</sup>C, <sup>19</sup>F and <sup>31</sup>P, FT NMR, <sup>1</sup>H NMR