MOLECULAR SPECTROSCOPY: A PHYSICAL CHEMIST'S PERSPECTIVE

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INTENDED AUDIENCE : Chemistry, Physics and UG students of Engineering

COURSE OUTLINE :
This is a comprehensive course on molecular spectroscopy. We start with dispersive and Fourier transform spectroscopic techniques, go on to derive selection rules from Time dependent perturbation theory, develop a quantum mechanical treatment of spin resonance spectroscopy and then move on to a discussion of spectra of polyatomic molecules using symmetry. This course is the same as CH 442 of IIT Bombay

ABOUT INSTRUCTOR :
Prof. Anindya Datta is a Professor of Chemistry in IIT Bombay, with research interest in ultrafast spectroscopy and time resolved fluorescence microscopy. He has been teaching experience of 17 years. 14 Ph. D. students have graduated from our laboratory. Eight more are working towards their degree. He received Excellence in Teaching Award from our institute in 2017 and have taught two NPTEL courses: one on Molecular Spectroscopy and another on Symmetry in Chemistry.

COURSE PLAN :

Week 1 : Introduction, Disperive spectrometers ,Fourier Transform spectrometers, Signal to Noise Ratio, Microwave Spectroscopy of diatomic molecules
Week 2 : Derivation of selection rules for microwave spectra, Simple harmonic oscillator, Selection rule, Rovibrational spectra
Week 3 : Anharmonic perturbation, Raman effect, Raman spectroscopy
Week 4 : Time dependent perturbation theory,Interaction of radiation with matter,Fermi’s golden rule
Week 5 : Einstein treatment, Lasers and lineshapes, Laser spectroscopy
Week 6 : Magnetic resonance,Classical treatment of relaxation,Pulse sequences
Week 7 : Perturbation theory for weak coupling,Variation method for strong coupling,Double resonance techniques
Week 8 : Nuclear quadrupole resonance,Zeeman effect,Field effect on diatomic vibrotor
Week 9 : Hyperfine interactions,Electronic spectra of diatomic molecules,Fortrat diagram
Week 10 : Matrix vector formulation of vibration of polyatomic molecules,Normal modes of vibration,Symmetry of normal modes and IR/Raman activity
Week 11 : Summary
Week 12 : Revision