MOLECULAR SPECTROSCOPY:
A PHYSICAL CHEMIST’S PERSPECTIVE

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TYPE OF COURSE : Rerun | Core| UG/PG
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.

ABOUT INSTRUCTOR:
Since 2002, Prof. Datta has taught courses on Chemical thermodynamics, kinetics, spectroscopy and group theory to undergraduate as well as graduate students in IIT Bombay. This year, he received an excellence in teaching award. He has also taught in IIT Goa and in several workshops and refresher courses across the country, for students as well as teachers. His area of research is ultrafast processes in Chemistry.

COURSE PLAN:

Week 01 : Introduction, Disperive spectrometers, Fourier Transform spectrometers, Signal to Noise Ratio, Microwave Spectroscopy of diatomic molecules

Week 02 : Derivation of selection rules for microwave spectra, Simple harmonic oscillator, Selection rule Rovibrational spectra

Week 03 : Anharmonic perturbation, Raman effect, Raman spectroscopy

Week 04 : Time dependent perturbation theory, Interaction of radiation with matter, Fermi’s golden rule

Week 05 : Einstein treatment, Lasers and lineshapes, Laser spectroscopy

Week 06 : Magnetic resonance, Classical treatment of relaxation, Pulse sequences

Week 07 : Perturbation theory for weak coupling, Variation method for strong coupling, Double resonance techniques

Week 08 : Nuclear quadrupole resonance, Zeeman effect, Field effect on diatomic vibrorot

Week 09 : 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