Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NCYC520	Molecular Spectroscopy	3	1	0	4

Course Objective
• Application of Quantum Chemistry in order to elucidate different types of molecular spectra (rotational, vibrational, electronic) • Exposure to LASER and modern spectroscopic techniques
Learning Outcomes
• Understanding the fundamentals of molecular spectroscopy • Learning the analysis of simple and complex spectra • Theoretical knowledge of different types of LASERS and modern day spectroscopic techniques

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction to spectral energy domains and measurement of spectra, Implications of discrete energy levels, Interaction of radiation with matter, Transition dipole moment, Transition moment integral, Electronic transition, origin of line widths in molecular spectra, Einstein's treatment, selection rule	11L	Students will learn fundamentals of interaction of energy with matter.
2	Rotational (Microwave) spectroscopy: The rigid diatomic rotor, intensity of rotational transitions, degeneracy, allowed rotational energy levels. Classification of polyatomic rotors and the non- rigid rotor, symmetric and asymmetric tops	6L	Students will learn the fundamentals of microwave spectroscopy
3	Molecular vibrations - Infrared spectroscopy, harmonic and anharmonic oscillators, Morse potential, IR selection rules,	5L	Students will learn the fundamentals of vibrational spectroscopy
4	Raman spectroscopy, polarizability and Raman selection rules	4L	Students will learn the fundamentals of Raman spectroscopy
5	Molecular electronic spectra, Electronic transitions, Franck-Condon principle. Polarization of transitions,	7L	Students will learn the fundamentals of electronic spectroscopy and the application of Group theory to vibrational, Raman and electronic spectroscopy
6	NMR and ESR spectroscopy	5L	Students will learn the fundamentals of spin resonance spectroscopy and apply it to correlate to basic proton NMR
7	Photophysical processes, Non-Linear Spectroscopy, Lasers and Masers	4L	Students will learn basics of LASER
Total		**42L**	

Text Books:

1. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash, 4th Edition, Tata McGraw-Hill Education, 1994.

Reference Books:

2. Fundamentals of Photochemistry, Rohatgi-Mukherjee, New Age International (P) Limited.
3. Modern Spectroscopy, J. M. Hollas, 4th Edition,Wiley.
4. Molecular Spectroscopy, G. M. Barrow, McGraw-Hill Book Company
5. Symmetry and Spectroscopy, Harris and Bertolucci, Dover Publications.