CURRICULUM PLAN

Even Semester (2025-2026)

Name of the Teacher: Dr. Sajid Iqbal

Course: B.Sc. (H) Chemistry, Year- III, Semester- VI

Name of Paper and Class Assigned: DSC 18: Photochemistry and Spectroscopy (Physical Chemistry VI), 2 Period per Week

Contents	Allocation of Lectures	Month wise schedule to be followed	Tutorial/Assignment/ Presentation etc.
Unit-1: Introduction to Molecular Spectroscopy and Photochemistry: Interaction of electromagnetic radiation with molecules and various types of spectra; Born Oppenheimer approximation. Characteristics of electromagnetic radiation. Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitized reactions, and quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.	6	1st week of January – 3rd week of January	• Syllabus Overview • Reference Books • Understanding the concept
Unit-2: Rotational, Vibrational, Raman and Electronic Spectroscopy Rotational spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic molecules, isotopic substitution, classification of molecules based on moment of inertia, applications of rotation spectroscopy (e.g. microwave appliances) Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches. Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, Jablonski diagrams, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.	10	3rd week of January – 4th week of February	• Understanding the concept • Numerical Problem • Assignment • Solving previous year's questions

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.			
Unit-3: NMR and ESR Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low-resolution spectra, different scales (δ and T), spin-spin coupling and high resolution spectra, interpretation of PMR spectra of simple organic molecules like methanol, ethanol and acetaldehyde. Principles of ESR spectroscopy, hyperfine structures, ESR of simple radicals	10	2nd week of March – 4th week of April	• Understanding the concept • Problem Discussion • Presentation • Class Test • Solving previous year's questions