

Semester	AUG 2022
Open to semester	5,7,11,13,21
Course code	CH3134/CH6134
Course title	Symmetry and Group Theory
Credits	4 /4
Course Coordinator & participating faculty (if any)	Jeetender Chugh
Nature of Course	Lectures
Pre-requisites	General Chemistry –I: Physical Chemistry General Chemistry –IV: Fundamentals of spectroscopy Strongly recommended for students planning to take Quantum Chemistry and Molecular Spectroscopy.
Objectives (goals, type of students for whom useful, outcome etc)	The objective of the course is to recognize symmetry in molecules and understand its role in chemistry. The course will explore the role of symmetry in (A) determining molecular properties (e.g. optical activity, dipole moment), (B) classifying and assigning nomenclature to molecules, molecular states and molecular motions and (C) bringing about simplifications in the application of quantum mechanics to molecules, and (D) determining spectroscopic selection rules based on molecular symmetry. Group theory applied to the study of molecular symmetry has far reaching consequences in chemistry and the course will provide an indepth appreciation of this.
Course contents (details of topics /sections with no. of lectures for each)	<ul style="list-style-type: none"> • Introduction • Symmetry elements and operations • Schönflies notation of point group • Prediction of dipole moment and optical activity from the viewpoint of symmetry • Definition of group, subgroup, class • Matrix representation of a point group • Reducible & Irreducible representations • Great Orthogonality Theorem and its corollaries • Construction of character table and meaning of all the term in character table • Mulliken symbol for irreducible representation • Direct product of irreducible representations

	<ul style="list-style-type: none"> • Application to spectroscopy • Projection operator and its application to symmetry adapted linear combination (SALC) • Application to quantum mechanics • Construction of Molecular Orbital correlation diagram of simple and complex molecules
Evaluation /assessment	<p>End-Sem Examination-40%</p> <p>Mid-Sem Examination-40%</p> <p>Others-20% over four quizzes%</p>
Suggested readings (with full list of authors, publisher, year, edn etc.)	<ol style="list-style-type: none"> 1. Chemical Applications of Group theory: F. A. Cotton (Wiley Interscience) 2. Molecular symmetry & group theory: R. L. Carter (John Wiley & Sons) 3. Symmetry and Spectroscopy: D. C. Harris and M. D. Bertolucci (Dover) 4. Group Theory and Quantum Mechanics: Michael Tinkham (Dover)