

Course No.	Course Name	L-T-P-Credits
CY 401	Stereochemistry and Organic Reaction Mechanism	4-0-0: 4
Prerequisite: NIL		
Course Objectives:	The main objective of the course to describe the basics of stereochemistry and IUPAC nomenclatures of stereoisomers, stereoselective reactions and their mechanisms. The students will understand the organic reaction mechanisms. The course will also help the students to know the oxidation and reduction reactions of different organic functional groups.	
Course Outcomes:	After successful completion of the course, students will be able to: <ol style="list-style-type: none"> 1. Understand basic concepts of stereochemistry, IUPAC nomenclatures of stereoisomers, stereoselective reactions and their mechanisms. 2. Understand the mechanisms of various organic reactions. 3. Understand the use of various oxidizing and reducing agents in organic transformations. 	
SYLLABUS		
Module	Contents	Hours
I	Stereochemistry Recognition of symmetry elements and chiral structures, R-S nomenclature, stereoisomerism in acyclic and cyclic-system; Concept of stereogenic centre – chirotopic and achirotopic centre; homotopic and heterotopic ligands and faces. E-Z isomerism, optical isomerism, optical purity and optical activity in absence of chiral atom. Stereoselective synthesis: diastereoselective and enantioselective reactions.	12
II	Organic reaction mechanism Nucleophilic substitution reactions: (S_N1 , S_N2 , mixed S_N1 and S_N2 and S_Ni); elimination reactions: (E1, E2, E1cB reactions); addition reaction: mechanism and stereochemical aspects of addition reaction in carbon-carbon and carbon-oxygen bonds.	8
III	Linear free energy relationships (Hammett equations, Hammett plots, Taft equation), partial rate factor, kinetic and thermodynamic control reactions, kinetic isotope effects	4
IV	Oxidation Alcohols: Use of Cr(VI) based reagents (PCC, PFC, PDC); DMSO-based reagents (Swern, Pfitzner–Moffatt and Albright–Goldman); Tetrapropyl ammonium perruthenate (TPAP); oxidation by MnO_2	12

	<p>and Ag_2CO_3; oxidation of 1,2-diols by NaIO_4, $\text{Pd}(\text{OAc})_2$, Des-Martin periodinane.</p> <p>Carbon–Carbon double bond: Dihydroxylation by KMnO_4, OsO_4, and hypervalent iodine based oxidations; and silver carboxylate (Woodward and Prevost condition) oxidation by peroxy acids and periodic acid.</p> <p>Oxidation of allylic C–H bond by Collin’s reagent and SeO_2</p> <p>Ketone: Oxidation of α,β-unsaturated ketones, α-hydroxy ketones, Baeyer–Villiger oxidation of ketones, Sharpless Epoxidation; aziridination; electrooxidation of amines, alkenes and carboxylates</p>	
V	<p>Reduction</p> <p>Heterogeneous ($\text{H}_2/\text{Pd-C}$, $\text{H}_2/\text{Pt}_2\text{O}$, Lindler’s and Rosendmund’s reduction) and homogeneous catalytic hydrogenation; Meerwein-Ponndorf-Verley reduction and reduction by hydride transfer reagents (LiAlH_4, NaBH_4, Lithium trialkoxy aluminium hydrides, LiBH_4, DIBAL, NaCNBH_4 tributyltin hydride); Reduction by boranes and derivatives; reduction by alkali metals in liquid ammonia; Wolff–Kishner reduction; reduction with diimide. Electroreduction of carbonyl compounds, alkyl halides and nitro compounds. Enzyme catalysed reduction. Stereochemistry of reduction reactions.</p>	12

Essential Readings:

1. D. Nasipuri, “Stereochemistry of Organic Compounds”, New Age International Publishers, 3rd Edition.
2. P. Sykes, “A Guidebook to Mechanism in Organic Chemistry”, Pearson, 6th Edition.
3. W. Carruthers and I. Mendham, “Modern Methods of Organic Synthesis”, Cambridge, 4th Edition.
4. J. Clayden, N. Greeves, S. Warren, “Organic Chemistry”, Oxford, 2nd Edition.

Supplementary Readings:

1. P. S. Kalsi, “Organic Reactions and Their Mechanisms”, New Age International Publishers, 3rd revised Edition.
2. M. B. Smith, “March’s Advanced Organic Chemistry: Reaction, Mechanisms and Structure”, Wiley, 7th Edition.
3. E. E. Eliel and S. H. Wilen, “Stereochemistry of Organic Compounds”, Wiley.