KOT 121/3 – Organic Chemistry I

Course Objective:

(i) To introduce first year students to the nomenclatures and structures of organic compounds.
(ii) To instill concepts concerning electronic structures and bonding, organic acids and bases and stereochemistry.
(iii) To discuss certain types of organic reactions together with their reaction mechanisms and short synthesis of organic compounds.
(iv) At the end of this course, students should understand the significance between nomenclatures and structures, together with the chemical characteristics of organic compounds. They should also know all relevant reactions in connection with mechanistic concepts such as S_N1, S_N2, E1 and E2.

Topic	**Content**	**Number of lecture hours**	**Expected outcome – upon completion of this course, the student should be able to:**
1. Structure and Bonding	• Review of hybridized orbitals and chemical bonding • Resonance contributors and resonance hybrid structures •	1	• understand the concept of chemical bonding and molecular orbital theory. • draw resonance contributing structures and hybrid structures.
2. Acids and bases	• Introduction to acids and bases and pK_a	1	• know the properties of organic acids and bases and the relationship between structures and pK_a.
3.Introduction to Organic Molecules and Functional Groups	• Characteristic feature of an organic compound • Structures and physical properties of organic compounds	1	• know the types of functional groups and the characteristic of an organic compound • name several classes of organic compounds such as alkanes, alkynes, alkyl halides, ethers, alcohols and amines.

4. Alkanes	• Nomenclature, physical properties and reactions of alkanes and cycloalkanes • Structure and conformations of alkanes and Cycloalkanes • *cis-trans* isomerism in • cycloalkanes and stabilities in cycloalkanes.	3	• explain and predict trends in physical properties of alkanes. • correctly name alkanes, cycloalkanes and bicyclic alkanes. • draw the structure and give the molecular formula when given the name of an alkane. • compare the energies of alkane conformations and predict the most stable conformation. • compare the energies of cycloalkanes and explain ring strain. • draw accurate cycloalkane conformations and predict the most stable conformations of substituted cyclohexanes.
5.Stereochemistry	• Stereogenic centers in organic molecules • Enantiomers and R,S system of nomenclature • Physical properties of stereoisomers	5	• know the concepts of stereochemistry, asymmetric carbons and chirality in organic molecules. • determine the R,S configuration of stereogenicl centres. • identify enantiomers, diastereomers and meso compounds. • calculate specific rotations from polarimetry data.
6. Understanding organic reactions	• Writing equations for organic reactions • Kinds of organic reactions	2	• know the types of reactions such as addition reactions, substitution reactions and elimination reactions

	• Bond Breaking and Bond Making • Energy diagrams		• understand bond cleavage, radicals, carbocations, carbanions and bond formation. • understand the energy diagram for a reaction mechanism (reactant, transition state, product) • draw energy diagram for a one and two-step reaction mechanism
7. Alkyl halides and Nucleophilic Substitution	• Nomenclatures of alkyl halides • Physical properties,the leaving group and the nucleophile • Second-order Nucleophilic Substitution: The S_N2 reactions (factors affecting the reactions, reactivity, and stereochemistry) • First-order Nucleophilic Substitution: The S_N1 reactions (stereochemistry and rearrangements) • Comparisons of S_N1 and S_N2	2	• correctly name alkyl halides and identify them • understand the important a good leaving group and different types of nucleophile • predict the product of S_N1,S_N2 reactions including stereochemistry • draw the mechanism and energy profile of S_N1,S_N2 • predict and explain the rearrangement of cations in first-order reactions • predict which substitution will be faster, based on differences in substrate, base/nucleophile, leaving group, or solvent • use Zaitsev's rule to predit major and minor elimination products • decide whether SN2 or SN1 reactions will occur under a given reaction condition.
8. Alkyl halides and Elimination Reactions	• First-order Elimination: The E1 Reactions • Positional orientation of	3	• predict the product of E1 and E2 reactions including stereochemistry • draw the mechanism and energy profile of

	Elimination: Zaitsev's Rule • Second-order Elimination: The E2 Reactions (stereochemistry) • Comparisons of E1 and E2 elimination mechanisms		E1 and E2 reactions • predict and explain the rearrangement of cations in first-order reactions • use Zaitsev's rule to predit major and minor elimination
9. Alcohols, Ethers and Epoxides	• Nomenclature of alcohols, ether and epoxides • Physical properties of alcohols, ether and epoxides • Preparation of alcohols, ether and epoxides • Substitution reactions of alcohols • Elimination reactions of alcohols: dehydration • Reactions of ethers and epoxides	4	• correctly name alkyl halides and identify them • know the physical properties of alcohols, ether and epoxides • learn the reactions to prepare alcohols, ether and epoxides • write the mechanisms of substitution and elimination reactions of alcohols. • know the reactions of ethers and epoxides.
10. Alkenes	• Structures and nomenclature of alkenes • Cis-Trans and E,Z – Isomerism • Physical properties of alkenes • Preparation of alkenes • Addition of hydrogen halides • Regioselectivity of electrophilic addition	4	• name various alkenes and draw structure from name of alkenes. • understand the concept of cis-trans isomerism. • know the physical properties of alkenes • know how to prepare alkenes and understand the reaction of alkenes in organic synthesis • Write the mechanism of addition of hydrogen halides to alkenes.

	reactions • Addition of water and alcohols • Other reactions and synthesis		• Understand the concept of regioselectivity in terms of carbocation stability. • Write the mechanism of the addition of water and alcohols to alkenes. • Know several other addition reactions involving alkenes
11. Alkynes	• Structure, nomenclature, and properties of alkynes • Preparation of alkynes • Addition reactions of alkynes • Introduction of multistep synthesis	4	• Name alkynes from structures and vice versa. • Know how to prepare an alkynes • Understand the addition reactions to alkynes. • Design the synthesis of larger molecules using acetylide ions.
Total	•	30 lectures	•