UNIVERSITI TEKNOLOGI MARA

CHM456: ORGANIC CHEMISTRY I

Course Name (English)	ORGANIC CHEMISTRY I APPROVED
Course Code	CHM456
MQF Credit	4
Course Description	This course is an introduction to the structures and physical properties of carbon compounds namely hydrocarbons, aromatic compounds, alkyl halides, alcohols and their derivatives. Basic aspects of bonding, structures and stereochemistry, nomenclature, chemical reactions and structure-activity relationships are presented. The acid-base chemistry of organic compounds, reaction pathways, conformational analysis, nucleophilic substitution and elimination reactions will be discussed.
Transferable Skills	Analysis, problem solving, communication, team work, knowledge
Teaching Methodologies	Lectures, Lab Work
CLO	CLO1 Discuss the basic concepts of structure and bonding, HOMO-LUMO orbital interactions, chemical reactivity and acid-base involved in chemistry of carbon compounds CLO2 Relate the basic concepts of structure and stereochemistry to reactivity of carbon compounds CLO3 Write chemical reactions for the interconversions of functional groups and the reaction mechanisms of addition, elimination, nucleophilic substitution, and electrophilic substitution reactions CLO4 Plan, conduct, observe experiments in organic chemistry CLO5 Write laboratory reports for conducted experiments
Pre-Requisite Courses	ORGANIC CHEMISTRY I (CHM456)

Topics
1. Carbon Compounds and Chemical Bonds 1.1) 1.1 Structure of carbon compounds 1.2) 1.2 Chemical bonds: ionic and covalent bonds 1.3) 1.3 Polar and nonpolar molecules: Formal charge and resonance 1.4) 1.4 Intermolecular forces 1.5) 1.5 Hybridization, Atomic and Molecular orbitals
2. Introduction to Organic Reactions 2.1) 2.1 Reactions and mechanisms: substitution, elimination, addition and rearrangement 2.2) 2.2 Homolysis and heterolysis of covalent bonds, homogenic and heterogenic of bonds 2.3) 2.3 Acid-base reactions: 2.4) 2.2.1 Carbocations and carbanions 2.5) 2.2.2 Strengths of acids and bases: Ka and pKa 2.6) 2.2.3 Structure and acidity: resonance and inductive effects
3. Stereochemistry 3.1) 3.1 Isomerism: 3.2) 3.1.1 Structural and geometric isomers: position, functional groups, E and Z 3.3) 3.1.2 Optical isomers: chirality, racemic mixture,meso compound, specific rotation 3.4) 3.2 Molecules with more than one stereocenter

4. Alkanes and cycloalkanes
4.1) 4.1 Structure, HOMO-LUMO Interaction of orbitals and Nomenclature
4.2) 4.2 Physical Properties
4.3) 4.3 Bond Rotation and Conformational Analysis of Butane
4.4) 4.4 Stability of Cycloalkanes: Ring Strain and Conformation of Cyclohexane
4.5) 4.5 Synthesis of Alkanes: Hydrogenation of Alkenes and Alkynes, Reduction of Alkyl Halide, Alkylation of terminal Alkynes
4.6) 4.6 Reaction of Alkanes with Halogens: Chlorination of Methane

5. Alkyl Halides
5.1) 5.1 Structure, HOMO-LUMO Interaction of orbital and Physical Properties of Alkyl Halides
5.2) 5.2 Nucleophilic Substitution Reactions
5.3) 5.2.1 Nucleophiles and Leaving Groups
5.4) 5.2.2 SN2 Reaction: Kinetics, Mechanism and Stereochemistry
5.5) 5.2.3 SN1 Reaction: Mechanism, Carbocations and Stereochemistry
5.6) 5.2.4 Factors affecting SN2 and SN1 Reactions
5.7) 5.3 Elimination Reactions of Alkyl Halides
5.8) 5.3.1 E2 Reactions
5.9) 5.3.2 E1 Reactions
5.10) 5.4 Substitution versus Elimination

6. Alkenes and Alkynes
6.1) 6.1 Alkenes: Nomenclature, Structure, HOMO-LUMO Interaction of orbital and Physical Properties
6.2) 6.2 Reactions and Mechanisms
6.3) 6.2.1 Synthesis of Alkenes via Elimination Reactions: Dehydrohalogenation, Dehydration, Debromination
6.4) 6.2.2 Addition Reactions : and Markovnikov's and AntiMarkovnikov's Rule
6.5) 6.3 Alkynes: Nomenclature, Structure and Physical Properties
6.6) 6.4 Reactions and Mechanisms
6.7) 6.4.1 Addition, Hydration, Oxidation (epoxidation) and Reduction

7. Alcohols and Ethers
7.1) 7.1 Structure, Nomenclature and Physical Properties
7.2) 7.2 Synthesis of Alcohols from Alkenes
7.3) 7.3 Reactions of Alcohols, Alcohols as Acids; Conversion to Alkyl Halides; Oxidation to Carbonyl Compounds
7.4) 7.4 Synthesis and Reactions of Ethers
7.5) 7.5 Phenols: Structure and Nomenclature; Synthesis and Reactions

8. Benzene and Aromaticity
8.1) 8.1 Introduction: Benzene, Nomenclature; Structure and Stability; Huckel's Rule
8.2) 8.2 Other Aromatic Compounds and Heterocyclic Aromatic Compounds
8.3) 8.3 Reactions of Aromatic Compounds
8.4) 8.3.1 Electrophilic Aromatic Substitution
8.5) 8.3.2 Halogenation; Nitration and Sulfonation
8.6) 8.3.3 Friedel-Craft's Alkylation and Acylation

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	Assignment 1	5%	CLO1
Assignment	Assignment 2	5%	CLO2
Practical	Practical skills	5%	CLO4
Practical	Written report submitted for each experiment	15%	CLO5
Test	Cumulative of three test, each test 10%	30%	CLO3

Reading List

Recommended Text

- **T. W. Graham Solomons,Craig Fryhle 2009, *Organic Chemistry*, 9 Ed., 1-8, 10, 11, 14, 15, John Wiley & Sons US [ISBN: 0470401419]**

Article/Paper List

This Course does not have any article/paper resources

Other References

- **Book McMurry J 2007, *Organic Chemistry*, Brooks and Cole, US**
- **Book Smith, J. G. 2007, *Organic Chemistry 2ed.*, McGraw Hill, US**
- **Book Wade, L. G. 2010, *7th Edition. Organic Chemistry*, US**
- **Book Seyhan Ege 2004, *5th Edition, Organic Chemistry: Structure and Reactivity* , Houghton Mifflin, US**
- **Book Pavia, Lampman, Kriz and Engel 2004, *2nd Edition, Introduction to Organic Laboratory Techniques: A Small Scale Approach* , Thomsom Brooks/Cole, US**