



UNIVERSITI TEKNOLOGI MARA

CHM556: ORGANIC CHEMISTRY II

Course Name (English)	ORGANIC CHEMISTRY II APPROVED
Course Code	CHM556
MQF Credit	4
Course Description	This course is a continuation of the study of organic chemistry begun in Organic Chemistry I. This course begins with an introduction to the use of infrared and nuclear magnetic resonance (NMR) spectroscopy in the determination of the structures of organic molecules. The chemistry and physical properties of carbonyl containing compounds such as aldehydes, ketones, carboxylic acids and carboxylic acid derivatives forms the major part of the course. Reactions involving enolate anions as nucleophiles are discussed. The emphasis of this course is on the development of problem solving skills in the context of structure features, synthesis and mechanism of reactions of carbonyl compounds. The chemistry of amines and overview of carbohydrate are also included.
Transferable Skills	Writing mechanism for electrophilic addition and electrophilic aromatic substitution reactions Interconverting functional groups learned in Organic Chemistry I course. Writing organic laboratory reports Using separatory funnels for extraction and separation processes in laboratory Setting up distillation and reflux apparatus.
Teaching Methodologies	Lectures, Blended Learning, Lab Work, Discussion
CLO	CLO1 Interpret the structural features of organic compounds using Infrared Spectroscopy and Nuclear Magnetic Resonance spectroscopy. CLO2 Solve problems related to the reaction mechanisms for nucleophilic addition of carbonyl compounds and nucleophilic acyl substitution of carboxylic acids and their derivatives. CLO3 Construct synthetic routes for the interconversion of various types of aldehydes, ketones, carboxylic acids, carboxylic acid derivatives and amines. CLO4 Conduct experiments in organic chemistry. CLO5 Write scientific reports on experiments in organic chemistry.
Pre-Requisite Courses	ORGANIC CHEMISTRY II (CHM556)
Topics	1. Spectroscopy of Carbon Compounds 1.1) Introduction to Spectroscopy and Structural Identification 1.2) Infrared Spectroscopy 1.3) Proton and Carbon-13 Nuclear Magnetic Resonance Spectroscopy 2. Aldehydes and Ketones I: Oxidation, Reduction and Synthesis 2.1) Introduction: Nomenclature; Physical properties 2.2) Reduction 2.3) Synthesis of Aldehydes and Ketones Through Reduction of Acid Chlorides and Esters 2.4) Synthesis of Aldehydes through Oxidation of Alcohols 3. Aldehyde and Ketone II: Nucleophilic Additions to the Carbonyl Group 3.1) Reactivity of Carbonyl Group; Nucleophilic Addition 3.2) Cyanohydrin Formation; Synthesis of α -hydroxy acids and hydrolysis of nitriles 3.3) Addition of Organometallic Reagents; Grignard and alky lithium reagents 3.4) Addition of Water; Hydrates 3.5) Addition of Alcohols; Acetals and Hemiacetals 3.6) Addition of Amines 3.7) Wittig Reaction

4. Carbohydrates

- 4.1) Carbohydrate Structures; Fischer Projections; D and L Notations
- 4.2) Cyclization of Monosaccharides; Furanose and pyranose rings
- 4.3) Haworth Projections and Chair Forms; Anomers
- 4.4) Converting Fischer Projections to Haworth Projections
- 4.5) Mutarotation
- 4.6) Reactions of Carbohydrates
- 4.7) Disaccharides and Polysaccharides

5. Carboxylic Acids

- 5.1) Nomenclature; Physical Properties
- 5.2) Synthesis of Carboxylic Acids
- 5.3) Acidity of Carboxylic Acids
- 5.4) Decarboxylation of Carboxylic Acids

6. Derivatives of Carboxylic Acid

- 6.1) Nomenclature of Acid Derivatives
- 6.2) Acyl Functional Group Interconversion; Nucleophilic Acyl Substitution
- 6.3) Acylation of Enamines
- 6.4) Miscellaneous Reactions of Acid Derivatives

7. Reactions of α -Hydrogen

- 7.1) Acidity of α -Hydrogens: Enolate Anions; Keto and Enol Tautomers
- 7.2) Alkylation and Halogenation Reactions
- 7.3) Aldol Condensation
- 7.4) Claisen Condensation
- 7.5) Conjugate Addition of α,β -unsaturated Carbonyl Compounds; Michael Addition
- 7.6) Robinson Annulation
- 7.7) Acetoacetic Ester and Malonic Ester Synthesis; Formation of Enolates, Alkylation, Hydrolysis and Decarboxylation

8. Amines

- 8.1) Nomenclature; Structure; Classification; Physical Properties;
- 8.2) Basicity of Amines
- 8.3) Biologically Important Amines
- 8.4) Synthesis of Amines
- 8.5) Reactions of Amines

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Assignment	One Special assignment	20%	CLO1
	Practical	Lab Skill	5%	CLO4
	Test	One test	20%	CLO2
	Written Report	One Lab report	15%	CLO5

Reading List	Recommended Text	T. W. Graham Solomons, Craig B. Fryhle 2011, <i>Organic Chemistry</i> , 10 Ed., 25, John Wiley & Sons United States of America [ISBN: 9780470524596]
	Reference Book Resources	Randall G. Engel, Donald L. Pavia, Gary M. Lampman, George S. Kriz, <i>Introduction to Organic Laboratory Techniques</i> , 3 Ed., 8 [ISBN: 9780538733281]
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	