UNIVERSITI TEKNOLOGI MARA

CHM209: INTERMEDIATE ORGANIC CHEMISTRY

Course Name (English)	INTERMEDIATE ORGANIC CHEMISTRY APPROVED
Course Code	CHM209
MQF Credit	2
Course Description	This course introduces students to the structures, reactions and preparations of diazonium salts, heterocyclic compounds such as pyrolle, furan, thiophene and pyridine; polymer and polymerization of natural and synthetic rubber; carbohydrates, amino acids and proteins. Other properties, the importance and uses of diazonium salts, addition and condensation polymerization; polyamides, polyesters, polycarbonates; disaccharides, polysaccharides, amino acids and proteins in industries are also discussed.
Transferable Skills	Transfer skill of Organic Chemistry. Demonstrate ability to identify knowledge and understanding confidently in a variety of context.
Teaching Methodologies	Lectures, Blended Learning
CLO	CLO1 State the IUPAC name, the concept of isomerism and the properties of diazonium salts, heterocyclic compounds, stereoisomers, polymers, carbohydrates, amino acids and proteins. CLO2 Draw and analyze the structures of diazonium salts, heterocyclic compounds, stereoisomers, polymers, carbohydrates, amino acids and proteins. CLO3 Write and recommend the complete chemical reactions for the synthesis of diazonium salts, heterocyclic compounds, stereoisomers, polymers, carbohydrates, amino acids and proteins.
Pre-Requisite Courses	No course recommendations

Topics
1. Diazonium Salts 1.1) Structure and synthesis of diazonium salts 1.2) Diazotization process 1.3) The effect of temperature to the diazotization process 1.4) Reactions of diazonium salts 1.5) Nucleophilic substitution reactions: Reaction with cuprus halide (Sandmeyer reactions), cuprus cyanide, potassium iodide, fluoroboric acid (Schiemann reaction), hypophosphorous acid and acid hydrolysis reaction. 1.6) Electrophilic substitution reactions: reaction of diazonium salts with strong activating group to form azo dyes (coupling reaction) 1.7) The effect of pH on the coupling reaction of diazonium salts 1.8) The importance of diazonium salts in industries
2. Heterocyclic Compounds 2.1) Structure and nomenclature of five-membered ring heterocylic compounds (pyrolle, furan and thiophene) 2.2) Electrophillic substitution reactions of pyrolle, furan and thiophene: Friedal-Crafts acylation, halogenation, nitration and sulfonation. 2.3) Structure and nomenclature of six-membered ring heterocyclic compound (pyridine). 2.4) Electrophillic substitution reactions of pyridine (bromination, sulfonation and nitration) 2.5) Nucleophillic substitution reactions of pyridine 2.6) Site-chain reactions of pyridine (halogenation and oxidation) 2.7) Diazotization of pyridine

3. Stereochemistry
3.1) Classification of isomers (structural and stereoisomers)
3.2) Introduction to chiral, achiral molecules, stereogenic center/asymmetric carbon, superimposable and nonsuperimposible mirror images, plane of symmetry and enantiomers.
3.3) Draw the stereoisomer with one symmetric carbon by using perspective formula and Fisher Projection
3.4) Draw and name the enantiomers
3.5) Draw the stereoisomer with two symmetric carbon by using perspective formula
3.6) Identify the diastereomer and the meso compound
3.7) Assigning R and S configurations (Cahn-Ingold-Prelog system) using Fischer projection and wedge-dash 3-dimensional structures.

4. Polymer and Polymerisation
4.1) Introduction and classification of polymer
4.2) Addition polymerization through various processes
4.3) Free radical initiating by organic peroxide – examples of monomers and polymerization steps (Initiation and propagating steps).
4.4) Cationic initiating by Lewis acids - examples of monomers and polymerization steps (Initiation and propagating steps).
4.5) Anionic initiating by Lewis Bases - examples of monomers and polymerization steps (Initiation and propagating steps).
4.6) Addition copolymerization and the structural formation of copolymers (block, graft, alternating, random, isotactic, syndiotactic and atactic)
4.7) Ziegler-Natta Catalyst
4.8) Mechanism of Ziegler-Natta Catalyst
4.9) Advantages of addition of Ziegler Natta Catalyst
4.10) Diene polymers in synthetic and natural rubber
4.11) Polymerization and cis-/trans- configuration of 1,3-butadiene
4.12) Vulcanization process of 1,3-butadiene
4.13) Types of homopolymer and copolymer
4.14) Condensation polymerization
4.15) Synthesis of polyamides (nylon 6, nylon 6,6, Kevlar)
4.16) Polyesters (Dacron and Kordel)
4.17) Polycarbonates
4.18) Polymer structure and properties (crystalline, amorphous, thermoplastic, thermosetting)

5. Carbohydrates
5.1) Classification and structure of monosaccharides using Fischer projection
5.2) Aldohexoses (the family of aldose)
5.3) Ketohexoses – D-fructose.
5.4) D and L notification
5.5) Configuration of aldoses
5.6) Stereoisomer of aldose
5.7) Diastereomer
5.8) Epimer
5.9) Reactions of monosaccharides: reduction, oxidations, formation of ether, ester, glycosides linkages, Wohl degradation, Ruff degradation, Kiliani-Fischer synthesis and osazone formation.
5.10) Open-chain and cyclic structure of monosaccharides
5.11) Introduction to anomers and anomeric carbon
5.12) The conversion of monosaccharides to Fisher Projection, Haworth Projection, chair conformation and alpha-beta anomers
5.13) Structures of disaccharides and polysaccharides (maltose, lactose, sucrose, cellubiose, cellulose, and starch)

6. Amino Acids & Proteins
6.1) Structure of 20 amino acids
6.2) Configuration of amino acids (D- and L- amino acids)
6.3) Chirality and enantiomerism of amino acids
6.4) Characteristics of amino acids
6.5) Acid-base properties
6.6) Zwitterions, cationic and ionic structure of amino acids.
6.7) Isoelectric points and calculations
6.8) Synthesis of amino acids: amination of bromo carboxylic acid (Hell-Volhard-Zelinski reaction), Strecker synthesis and reductive amination of amino acids.
6.9) Peptide lingkages and the sequences of amino acids in peptides
6.10) Introduction to dipeptide, tripeptide and disulfide bonds
6.11) A peptide bond synthesis: Enzyme C-Terminal Analysis, Primary structure of polypeptides and proteins, Sanger Method and Edman Degradation.
6.12) Structure of 20 amino acids
6.13) Configuration of amino acids (D- and L- amino acids)
6.14) Chirality and enantiomerism of amino acids
6.15) Characteristics of amino acids
6.16) Acid-base properties
6.17) Zwitterions, cationic and ionic structure of amino acids.
6.18) Isoelectric points and calculations
6.19) Synthesis of amino acids: amination of bromo carboxylic acid (Hell-Volhard-Zelinski reaction), Strecker synthesis and reductive amination of amino acids.

6.20) Peptide lingkages and the sequences of amino acids in peptides
6.21) Introduction to dipeptide, tripeptide and disulfide bonds
6.22) A peptide bond synthesis: Enzyme C-Terminal Analysis, Primary structure of polypeptides and proteins, Sanger Method and Edman Degradation.

Assessment Breakdown	%
Continuous Assessment	100.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	online assignment	20%	CLO2
Presentation	online presentation	30%	CLO3
Writing Test	online test	50%	CLO1

Reading List

Reference Book Resources

- **J. McMurry 2008, *Organic Chemistry*, Thomson Brooks Cole Publishing Co.**
- **Janice Gorzynski Smith 2006, *Organic Chemistry*, McGraw-Hill International Edition New York**
- **Paula Yurkanis Bruice 2004, *3. Organic Chemistry*, fourth edition Ed., Prentice Hall-Pearson Education International**
- **Bettelheim, Brown and March 2001, *Introduction to General, Organic and Biochemisry*, sixth edition Ed., Thompson Learning Australia**
- **Donald L. Pavia, Gary M. Lampman, George S. Kriz 1999, *5. Introduction to Organic Laboratory Techniques: A Microscale Approach*, third edition Ed., Thomson Brooks/Cole**

Article/Paper List: This Course does not have any article/paper resources

Other References: This Course does not have any other resources