Course Specification
(Bachelor)

Course Title:	Organic Chemistry (2)
Course Code:	CHM 1221
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammed Ibn Saud Islamic University
Version:	2024 V 1
Last Revision Date:	13 October 2024

Table of Contents

A. General information about the course:

-1. Course Identification

1. Credit hours: 4 (3 Lectures, 0 Tutorials, 3 Lab)					
4 (3 Lectures, 0 Tutorials, 3 Lab)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 3 / Year 2					
4. Course general Description:					
The course covers an introduction to Stereochemistry, the Electrophilic Aromatic Substitution, Organic Functional Groups of Alcohols, Aldehydes, Ketones, Ethers, Epoxides, Carboxylic Acids, Carboxylic Acid Derivatives, Amines, Biomolecules as Amino Acids, Protein and Lipids will be included. A mechanistic Approach to Reactions will be in Short cut. The Chemistry Laboratory is taken simultaneously with the course and cover the following experiments which is in direct relation with the course.					
5. Pre-requirements for this course (if any)**:**					
CHM1121 Organic Chemistry (1)					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					

At the end of this course the student will be able to:

- **To define the Aromaticity of Aromatic Systems.**
- **To list the Chemical Behavior of Aromatic Systems to a variety of reagents.**
- **To outline the Functional Groups of Organic Compounds.**
- **To state the Reactivity of Functional Groups.**
- **To recognize the potential importance of the Organic Chemistry in biomolecules**
- **To name Organic Compounds according to IUPAC system.**
- **Use glassware and equipment's in Organic Laboratory, and safely handle chemicals.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**90**	**100%**
2	E-learning	**0**	**0**
3	Hybrid • Traditional classroom • E-learning	**0**	**0**
4	Distance learning	**0**	**0**

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**45**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		90

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To define the Aromaticity of Aromatic Systems, and its Chemical Behavior to a variety of reagents.**	**K1; K3**	• Six hours are weekly, containing lectures and laboratory activities. • A Private study including home exam.	▪ Quizzes Assignments ▪ Discussions. ▪ Participation.
1.2	**To outline the Functional Groups of Organic Compounds and their reactivity.**	**K1; K3**	• six hours weekly containing lectures and Laboratory activities • Group discussion	• Quizzes • Assignments. • Oral Discussion • Laboratory Reports
1.3	**To list the Potential importance of Organic Chemistry in Biomolecules**	**K3**	• Six hours are weekly for lectures and laboratory activities ▪ Think, talk, and review Organic Chemistry in Biomolecules	▪ Quizzes ▪ Home exam ▪ Oral Discussions.
2.0	Skills			
2.1	**To evaluate the Functional Groups in terms of the reactivity and structures.**	**S1; S2**	Introduce some solved and unsolved examples of Comparison between	• Questions in Lectures. • Short Quizzes and Exams.

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
			Functional Groups of Organic Compounds	• Participation • Oral Discussion, • Laboratory Reports • Home Exam.
2.2	**To summarize the behavior of Functional Group towards Chemical Reaction.**	**S1; S2; S3**	• Group Discussions • Laboratory Experiments	• Questions in Lectures. • Laboratory Reports • Short Quizzes and Exams. • Oral Discussion
2.3	**To illustrate a simple mechanism based on the Chemical Reactivity of Functional Group.**	**S1; S3**	• Lectures • Oral Discussions. • Brainstorming Exercises	• Questions in Lectures. • Short Quizzes • Exams.
2.4	**To perform chemical experiments during Laboratory Classes, field tasks, and using Laboratory Instruments**	**S2; S4**	• Encourage the students to use the Chemicals, Glasswares and Instruments with caring and safety • Laboratory activities. •	• Assignments • Laboratory Report.
3.0	Values, autonomy, and responsibility			
3.1	**To demonstrate responsibility for their own learning and motivate for Team Work.**	**V1; V2**	• Brain Storms Exercises • Group Discussion	• Oral Discussion. • Group Discussion • Assignments

C. Course Content

No	List of Topics	Contact Hours
1.	**Benzene and aromaticity**: Names of aromatic hydrocarbons, Disubstituted benzenes, Structure and stability of benzene, Molecular orbital description of benzene, Aromaticity and Huckel 4n+2 rule, Aromatic heterocycles	3
2.	**Chemistry of Benzene**: Brominating of Aromatic Rings, Other Aromatic Substitutions, and Alkylation of Aromatic Rings: The Friedel–Crafts Reaction, Acylation of Aromatic Rings, Substituent Effects in Aromatic Rings, An	6

	Explanation of Substituent Effects. Tri-substituted Benzenes: Additivity of Effects, Nucleophilic Aromatic Substitution, Benzene, Oxidation of Aromatic Compounds, Reduction of Aromatic Compounds, Synthesis Strategies.	
3	**Alcohols and Phenols:** Naming Alcohols, Properties of Alcohols and Phenols: Hydrogen Bonding, Properties of Alcohols and Phenols: Acidity and Basicity, Preparation of Alcohols: an Overview, Alcohols from Reduction of Carbonyl Compounds, Alcohols from Reaction of Carbonyl Compounds with Grignard Reagents, Some Reactions of Alcohols, Oxidation of Alcohols, Protection of Alcohols, Preparation and Uses of Phenols, Reactions of Phenols, Spectroscopy of Alcohols and Phenols.	6
4	**Ethers and Epoxides; Thiols and Sulfides**: Naming Ethers, Structure, Properties, and Sources of Ethers, The Williamson Ether Synthesis, Alkoxy-mercuration of Alkenes, Reactions of Ethers: Acidic Cleavage, Reactions of Ethers: Claisen Rearrangement, Cyclic Ethers: Epoxides, Ring-Opening Reactions of Epoxides, Crown Ethers, Thiols and Sulfides,	3
5	**Aldehydes and Ketones**: Naming Aldehydes and Ketones, Preparation of Aldehydes and Ketones, Oxidation of Aldehydes and Ketones, Nucleophilic Addition Reactions of Aldehydes and Ketones, Relative Reactivity of Aldehydes and Ketones, Hydration, Cyanohydrin Formation, Imine and Enamine Formation, Nucleophilic Addition of Hydrazine: The Wolff–Kishner Reaction, Nucleophilic Addition of Alcohols: Acetal Formation.	6
6	**Carboxylic Acids and Nitriles**: The Importance of Carboxylic Acids (RCO_2H), Naming Carboxylic Acids and Nitriles, Structure and Physical Properties of Carboxylic Acids, Dissociation of Carboxylic Acids, Substituent Effects on Acidity, Substituent Effects in Substituted Benzoic Acids, Substituent Effects in Substituted Benzoic Acids, Preparation of Carboxylic Acids, Reactions of Carboxylic Acids: An Overview, Reduction of Carboxylic Acids, Chemistry of Nitriles, Preparation of Nitriles by Dehydration, Hydrolysis: Conversion of Nitriles into Carboxylic Acids.	3
7	**Carboxylic Acid Derivatives and Nucleophilic Acyl Substitution Reactions**: Naming Carboxylic Acid Derivatives, Nucleophilic Acyl Substitution, Nucleophilic Acyl Substitution Reactions of Carboxylic Acids, Chemistry of Acid Halides, Chemistry of Acid Anhydrides, Chemistry of Esters, Chemistry of Amides, Thioesters and Acyl Phosphates: Biological Carboxylic Acid Derivatives, Polyamides and Polyesters: Step-Growth Polymers, Spectroscopy of Carboxylic Acid Derivatives.	6
8	**Amines**: Naming Amines, Structure and Bonding in Amines, Properties and Sources of Amines, Basicity of Amines, Basicity of Substituted Arylamines, Synthesis of Amines, Reactions of Arylamines, Tetraalkylammonium Salts as Phase-Transfer Catalysts,	6
9	**Stereochemistry:** Enantiomers and the Tetrahedral Carbon, The Reason for Handedness in Molecules (Chirality Optical Activity) Pasteur's discovery of Enantiomers, Sequence Rule for Specifying Configuration, Diastereomers, Meso-Compounds, Racemic Mixtures and the Resolution of Enantiomers, Stereochemistry of Reactions: addition of H_2O to an Achiral Alkene, Sterochemistry of Reactions: addition of H_2O to an a chiral Alkene, Chirality at nitrogen, phosphorus and Sulfur, Chirality in Nature and Chiral Environments.	6

Total		45
No	**List of Experiments**	**Contact hours**
1	Introduction; Safety in the Chemistry Laboratory; Notebook outline; and Laboratory Equipment.	3
2	Nitration of Aromatic Compounds: Preparation of m-Nitrobenzaldehyde	3
3	Friedel-Craft Reaction; Alkylation of benzene to form sec-Butylbenezen	3
4	Conversion Alcohols to Alkyl Halides. (Synthesis of tert-Pentyl Chloride from t-pentylalcohol)	6
5	The Cannizaro Reaction: The Disproportionation Of Benzaldehyde	3
6	The Aldol Reaction: Synthesis of Dibenzalacetone	3
7	Esterification Reaction: Synthesis of n-Butyl Acetate	3
8	Synthesis of Aspirin: Ester Formation	3
9	Oxidation of Benzaldehyde	3
10	Saponification	3
11	Synthesis of acetanilide	3
12	Synthesis of Oximes	3
13	Preparation of Imines (Schiff base)	3
14	The Diels-Alder Reaction of Anthracene with Maleic Anhydride	3
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes, Attendance, Participation, Home Exams	All the semester	10 %
2.	Laboratory	All the semester	30 %
3.	Midterm 1	Around 6th & 7th week	10 %
4.	Midterm 2	Around 11th & 12th week	10 %
5.	Final Exam	Around 16th- 17th week	40 %
6.	Total		100%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	***Organic Chemistry, John E. McMurry. Mary Finch (Cengage Group),*** 8th ed (2012), ISBN-10: 0495118370 | ISBN-13: 978-0495118374. 2012
Supportive References	• ***Organic Chemistry. Paula YurkanisBruice,*** 2Ed, PRENTICE HALL, Upper saddle River New Jersey 07458), 1998, ISBN-10: 0321803221. • ***Organic Chemistry, Morrison, R. T.; Boyd, R. N.*** "", 6th edition, Prentice Hall of India, (1996), ISBN-10: 0136436692. • ***U N D E R S TA N D I N G T H E PRINCIPLES OF ORGANIC CHEMISTRY: A LABORATORY COURSE. Brooks/Cole, Cengage Learning, (2011),*** Library of Congress Control Number: 2009939414, ISBN-13: 978-0-495-82993-5, ISBN-10: 0-495-82993-5. • ***Williamson, K. A. & Masters, K. M. Macroscale and Microscale Organic Experiments,*** 6th Edition. Cengage Learning, (2010), ISBN-10 : 0538733330, ISBN-13 : 978-0538733335
Electronic Materials	• Blackboard • http://www.chemweb.com • http://www.chemistry.com • http://www.orgsyn.org
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students. • Each Laboratory should be equipped with a maximum 25 seats
Technology equipment (projector, smart board, software)	The rooms and laboratories are equipped with data show, Smart Board, WI-FI access.
Other equipment (depending on the nature of the specialty)	• Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cyliders, dishes, funnels, Buchner, Buchner flasks, condensers) • Appropriate fine chemicals and solvents (benzaldehyde, toluene, nitric acid, suphuric acid, acetone, tert butyl bromide, methyl bromide, salicylaldehyde, hydroxyl amine hydrochloride, aniline, acetic anhydride, acetyl chloride, ethanol, dichloromethane, pet. Ether, diethyl ether) • Analytical balance (3 digits), Drying oven • Filter papers , clamps, stands

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Direct:** Questionnaire.
	Course Responsible	**Direct**: Course e-Portfolio. Indirect: Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of Students assessment	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Quality of learning resources	**Students**	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
The extent to which CLOs have been achieved	**Course Responsible**	**Direct:** Exams - Course e-Portfolio. **Indirect**: Second examiner checklist-Course report.
	Program Leaders	**Indirect**: Exams.
Lab Performance	**Students**	**Direct**: Lab reports, Final Lab exam, Course e-Portfolio.
	Course Responsible	

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**7 (NO. 2/3)**
DATE	**29/3/1446 - 2/10/2024**