Course Specification
(Bachelor)

Course Title	Organic Chemistry
Course Code:	CHM 1225
Program:	Bachelor of Science in Chemical Laboratories
Department:	Chemistry
College:	Science
Institution:	Imam Mohammed Ibn Saud Islamic University
Version:	2024- -1
Last Revision Date:	15 September 2024

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A. General information about the course:

-1. Course Identification

1. Credit hours: 4 (3, 3, 0)					
4 (3 Lectures, 3 Lab, 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 3/ Second year					
4. Course general Description:					
This course is designed to provide the students of chemical laboratories majors with continuous information about important organic chemistry in terms of aromaticity and benzene reactions, carboxylic acid derivatives and their reactions, understanding the stereochemistry of compound configuration in 3D visualization, important reactions such as nucleophilic substitution and elimination, and amines and heterocyclic compounds.					
5. Pre-requirements for this course (if any)**:**					
Principles of Organic Chemistry, CHM 1120					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
The main objective of this course is to cover all important topics of organic chemistry by introducing students to the chemistry of other carbonyl functional groups, the chemistry of aromaticity and benzene, stereochemistry, and heterocycle compounds. In addition, important types of reactions (e. g., Nucleophilic substitution, Elimination, addition, and re-arrangement are considered these course objectives as an introductory to the reaction mechanism					

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	**Recognize the functional groups of organic compounds (alcohols, aldehydes, ketones, carboxylic acids and derivatives, amines, aromatics, heterocycles, polyenes)**	**K1**	▪ **Six hours weekly, containing lectures and laboratory activities.** ▪ **A Private study, including a Homework**	**Direct:** • **exams,** Quizzes • **Homework Laboratory Reports** • **Participation**
1.2	**Define the aromaticity of aromatic systems and their chemical behavior in various reagents.**	**K1, K3**	▪ **Two hours of weekly lectures** **Self-study**	**Direct:** ✓**exams, quizzes** ✓**Oral Discussion** ✓**Homework** ✓**Participation**
1.3	**Outline the reaction mechanism(s) involved with each function group**	**K1, K4**	▪ **Six hours weekly containing lectures and laboratory activities.** ▪ **Group Discussions**	**Direct:** ✓**exams, quizzes** ✓**Laboratory Reports** ✓**Oral Discussion**

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.1	**Compare the functional groups in terms of reactivity and structure.**	**S1**	**Introduce some solved and unsolved examples for Comparison between Functional Groups of Organic Compounds**	**Direct:** ✓ Questions in Lectures. ✓ Short Quizzes and Exams. ✓ Participation ✓ Oral Discussion, ✓ Laboratory Reports
2.2	**Design synthetic approach to organic molecules**	**S1, S2**	✓ **Interactive lectures** ✓ **Problem-solving** ✓ **Brainstorming sessions** ✓ **Group discussion**	**Direct:** ✓ Questions in Lectures. ✓ Short Quizzes and Exams.
2.3	**Predict the behavior of the Functional Group towards Chemical Reactions.**	**S1, S2**	✓ **Lectures** ✓ **Oral Discussions.** ✓ **Brainstorming Exercises**	**Direct:** ✓ Questions in Lectures. ✓ Short Quizzes and Exams.
2.4	**Use laboratory instruments and perform chemical experiments during laboratory Class field tasks.**	**S1, S2, S4**	✓ **Group Discussions** ✓ **Laboratory Experiments**	**Direct:** ✓Laboratory report Marks. ✓Discussion marks ✓Giving marks for participation in the lab.
3.0	**Values, autonomy, and responsibility**			
3.1	**Appraise teamwork and create awareness to maintain scientific integrity during assessments, projects, and mini-projects.**	**V2**	• **Group discussion, assignments, and homework** • **Lab-reports** • **Virtual labs and demonstrations.**	Direct ✓Oral tests, ✓lab performance, ✓Lab-reports, ✓Sheets Marks ✓Assignments and homework marks ✓Mini projects
3.2	**Show personal values and attributes such as honesty, empathy and respect for others**	**V1, V2**	• **Teamwork and class discussions**	Direct ✓ lab reports ✓ Mini projects

C. Course Content

No	List of Topics	Contact Hours
1.	**Carboxylic Acid Derivatives:** Nucleophilic Acyl Substitution Reactions: Naming of acid halides, acid anhydrides, esters, amides, thioesters, Acyl phosphates, Nucleophilic Acyl Substitution Reactions, Reactions of Carboxylic Acids, Chemistry of Acid Halides, Chemistry of Acid Anhydrides, Chemistry of Esters, Chemistry of Amides, Chemistry of Thioesters and Acyl Phosphates: Biological Carboxylic Acid Derivatives, Polyamides and Polyesters: Step-Growth Polymers	3
2.	**Carbonyl Alpha-Substitution Reactions:** Keto–Enol Tautomerism, Reactivity of Enols: alpha-substitution Reactions, Alpha Halogenation of Aldehydes and Ketones, Alpha Bromination of Carboxylic Acids, Acidity of Alpha Hydrogen Atoms: Enolate Ion Formation, Reactivity of Enolate Ions, Alkylation of Enolate Ions	3
3.	**Carbonyl Condensation Reactions:** Carbonyl Condensations: The Aldol Reaction, Carbonyl Condensations versus Alpha Substitutions, Dehydration of Aldol Products: Synthesis of Enones, Using Aldol Reactions in Synthesis, Mixed Aldol Reactions, Intramolecular Aldol Reactions, The Claisen Condensation Reaction, Mixed Claisen Condensations	6
4.	**Amines and Heterocycles:** Naming Amines, Structure and Properties of Amines, Basicity of Amines, Basicity of Aryl amines, Biological Amines and the Henderson–Hasselbalch Equation, Synthesis of Amines, Reactions of Amines, Reactions of Aryl amines, Heterocyclic Amines	3
5.	**Overview of Organic Reactions:** Kinds of Organic Reactions; How Organic Reactions Occur: Mechanisms; Radical and Polar Reactions; An Example of a Polar Reaction: Addition of HBr to Ethylene; Using Curved Arrows in Polar Reaction Mechanisms	6
6.	**Benzene and Aromaticity:** Naming Aromatic Compounds; Structure and Stability of Benzene; Aromaticity and the Hückel 4n+2 Rule; Aromatic Ions; Aromatic Heterocycles: Pyridine and Pyrrole; (Polycyclic Aromatic Compounds	3
7.	**Chemistry of Benzene: Electrophilic Aromatic Substitution**: Electrophilic Aromatic Substitution Reactions: Bromination, Other Aromatic Substitutions, Alkylation and Acylation of Aromatic Rings: The Friedel–Crafts Reaction, Substituent Effects in Electrophilic Substitutions, Trisubstituted Benzenes: Additivity of Effects, Nucleophilic Aromatic Substitution, Benzyne, Oxidation of Aromatic Compounds, Reduction of Aromatic Compounds, Synthesis of Polysubstituted Benzenes	6
8.	**Synthetic Polymers:** Chain-Growth Polymers Stereochemistry of Polymerization: Ziegler–Natta Catalysts Copolymers Step-Growth Polymers, Olefin Metathesis Polymerization, Polymer Structure and Physical Properties.	3

9.	**Reactions of Alkyl Halides: Nucleophilic Substitutions and Eliminations:** The Discovery of Nucleophilic Substitution Reactions; The SN2 Reaction; The SN1 Reaction.	3
10.	**Reactions of Alkyl Halides: Nucleophilic Substitutions and Eliminations:** Elimination Reactions: Zaitsev's Rule; The E2 Reaction and the Deuterium Isotope Effect; The E2 Reaction and Cyclohexane Conformation; The E1 and E1cB Reactions; Summary of Reactivity: SN1, SN2, E1, E1cB, and E2	3
11.	**Stereochemistry:** Enantiomers and the Tetrahedral Carbon; The Reason for Handedness in Molecules: Chirality; Optical Activity; Pasteur's Discovery of Enantiomers; Sequence Rules for Specifying R/S Configuration.	3
12.	**Stereochemistry:** Diastereomers; Meso Compounds; Racemic Mixtures and the Resolution of Enantiomers; A Review of Isomerism. Chirality in Nature and Chiral Environments	3
Total		**45**
Laboratory Topics		
Lab 01	**Laboratory Instructions and Safty**: Laboratory instructions and The laboratory rules, Common Laboratory Techniques: Filtration, Decolorization, Drying and drying agents, Reflux, Reporting results,	3
Lab 02	**Nitration of Aromatic Compounds: Preparation of nitrobenzaldehyde).**	3
Lab 03	**Sulfonation of Aromatic Compounds**	3
Lab 04	**Nucleophilic Substitution Reactions of Alkyl Halides.**	3
Lab 05	**Reactivity of an aldehyde with a ketone in the presence of base, Aldol Condensation.**	3
Lab 06	**Preparation of Aspirin.**	3
Lab 07	**Oxidation of Benzaldehyde-Green Chemistry**	3
Lab 08	**Mannich Reaction: The acid-catalyzed reaction of an enolizable aldehyde or ketone with an imminium ion, followed by a base to give a β-aminoaldehyde of a β-aminoketone**	3
Lab 09	**Identifications and differentiation of alcohol (primary, secondary, tertiary alcohols) and Phenols**	3

Lab 10	Shiff base: Reaction of N-nucleophiles with aldehyde	3
Lab 11	Saponification, Preparation of Soap.	3
Lab 12	Synthesis of acetanilidine; Reaction of aniline with acetic anhydride	3
Lab 13	Synthesis of azo dye: Coupling between 2-naphthol and 4-aminobenzenesulfonic acid	3
Lab 14, 15	Review and Lab Reports Overview	6
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm 1	6th/ 7th week	10 %
2.	Midterm 2	11th/ 12th week	10 %
3.	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4. .	Laboratory	All the semester	30 %
5	Final Exam	16thweek	40 %
6.	Total	All weeks	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	John E. McMurry, **Organic Chemistry**, Cengage Learning; 9th edition (2015), ISBN-10 : 1305080483, ISBN-13 : 978-1305080485
Supportive References	1. Paula Bruice, **Organic Chemistry**, Pearson; 8th edition (January 5, 2016), ISBN-10 : 0134074580, ISBN-13 : 978-0134074580

	2. Francis Carey (Author), Robert Giuliano, ***Organic Chemistry*** - McGraw Hill; 10th edition (January 7, 2016), ISBN-10 : 0073511218, ISBN-13 : 978-0073511214. 3. Michael B. Smith, **Organic Chemistry: An Acid-Base Approach**, CRC Press; 3rd edition (2022), ISBN-10 : 0367768704, ISBN-13 : 978-0367768706. 4. Harold Hart, Christopher M. Hadad, Leslie E. Craine, David J. Hart, **Organic Chemistry: A Short Course** , Cengage Learning; 013 edition (2011), ASIN : B00B7MAHD0
Electronic Materials	
Other Learning Materials	• Blackboard

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• **Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students.** • **In each laboratory, a list of safety and precautions are provided.** • **In each lab has proper ventilation, and well equipped with instruments.** • **In each lab, containers for solid waste, liquid waste, and crushed glasses.** • **Each lab has a small pharmacy for first aid in case of an accident** • **In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs**
Technology equipment (projector, smart board, software)	**The rooms 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 cylinders)** • **Appropriate fine chemicals and solvents (distilled Water ammonium nitrate)** **Analytical balance (3 digits), Set gas laws with the glass jacket Data acquisition set for gas laws with glass jacket, PC, Windows® 95 or higher, calorimeter, thermometer, 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.
Other		

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.	**3 (NO. 1/3)**
DATE	**5/3/1446- 8/09/2024**