هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification

(Bachelor)

Course Title:	**Organic Chemistry (1)**
Course Code:	**CHM 1121**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	2024 V1
Last Revision Date:	12 October 2024

Table of Contents

A. General information about the course:

-1. Course Identification

1. Credit hours: (4)					
3 (1 Lectures, 3 Lab, 2 Tutorials)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 2 / Year 1					
4. Course general Description:					
This course is an introduction to the chemistry of carbon. It presents the concepts of bonding, structure, and classification of compounds by functional groups, as well as reactions of aliphatic hydrocarbons, alkyl halides, alcohols, and ethers, from a mechanistic viewpoint. Stereo-chemical principles are emphasized.					
5. Pre-requirements for this course (if any)**:**					
CHM 1101 General 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:					

- **Determine the concepts of chemical bonding and hybridization for Organic Compounds.**
- **Name Aliphatic Organic Compounds and its derivatives according to IUPAC system.**
- **Describe the preparation and reactions of Aliphatic Organic Compounds**
- **Recognize the types of organic reactions.**
- **Outline chemical behaviors of Aliphatic Organic Compounds.**
- **Recognize the Aromaticity System for Organic Compounds.**
- **Use glassware and equipment in the organic chemistry 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**	**15**
2.	**Laboratory/Studio**	**45**
3.	**Field**	**0**
4.	**Tutorial**	**30**
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 state Organic Compound names according to the IUPAC system.**	**K1, K3**	▪ Six hours are weekly, containing lectures and laboratory activities. ▪ A Private study including home exam.	Short quizzes
1.2	**To describe the chemical behavior and Stereochemistry of Aliphatic Organic Compounds.**	**K1, K2**	▪ Six hours are weekly containing lectures and group discussion ▪ Laboratory activities and discussion.	• Homework • Assignment marks • Written exams
1.3	**To define the basic reactions covered in the required basic organic chemistry course.**	**K3**	▪ Six hours are weekly for laboratory activities ▪ Think, talk, and review the basic reactions in the organic chemistry course	• Quizzes and MCQs, • laboratory report
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
2.1	**To differentiate between saturated and unsaturated organic compounds.**	**S1**	Introduce some solved and unsolved examples of differentiation between Saturated and Unsaturated Organic Compounds.	Short quizzes and multiple Choice Questions
2.2	**To summarize chemical reactivity with chemical structure**	**S1, S2, S3**	• Group Discussions • Laboratory Experiments	• Homework assignment, • Examination and laboratory sheet
2.3	**To evaluate synthesis and reactivity of aliphatic compounds**	**S1, S3**	▪ Lectures and Oral Discussions. ▪ Brainstorming Exercises	Examination and laboratory report
2.4	**To Perform chemical experiments during Laboratory Classes field tasks and using Laboratory Instruments**	**S2; S4**	▪ Lectures and Oral Discussions. ▪ Brainstorming Exercises	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks
3.0	**Values, autonomy, and responsibility**			
3.1	**To demonstrate responsibility for their own learning and motivate for Team Work.**	**V1; V2**	▪ Brainstorms Exercises ▪ Group Discussion	• Oral Discussion. • Group Discussion and Assignments

C. Course Content

No	List of Topics	Contact Hours
1.	**Atomic Structure**: The nucleus, Orbitals, Electron Configurations, Development of chemical bonding theory, Valence bond Theory, sp3, sp2, sp Hybrid orbitals and the structure of Methane, Ethane, Ethylene and acetylene, The Nature of the chemical bonds, Drawing Chemical Structures.	**3**
2.	**Covalent Bonds:** Acids and Bases. Polar Covalent Bonds, Formal Charges, Resonance, Rules of Resonance Forms, Drawing for Resonance Forms, Acids and bases, The Brønsted-Lowry definition, Acid base Strength, Predicting Acid – base	**3**

	Reactions from *pKa* Values, Organic Acids and Organic bases, The Lewis Definition, Molecular Models. Noncovalent Interaction.	
3	**Alkanes and Their Stereochemistry**: Functional Groups, Alkane and Isomers, Naming Alkanes, Properties of Alkanes, Conformation of Ethane, Conformations of Other Alkane.	6
4	**Cyclolkanes and Their Steriochemistry**: Naming Cycloalkanes, *Cis- Trans* Isomerism in Cycloalkanes, Conformations of cycloalkanes, Axial and Equatorial bonds in cycloalkane, Conformational Monosubstituted Cycloalkanes, Conformational Disubstituted Cycloalkanes, Conformations of PolyCyclic cyclohexanes.**Group 18** elements (Noble Gas) :Introduction, Occurrence, extraction and uses, Physical properties, NMR active nuclei, Compounds of xenon, Fluorides, Chlorides, Oxides, Oxofluorides, Other compounds of xenon, Compounds of krypton and radon	6
5	**An Overview of Organic Reactions:** Kinds of organicreactions, How organic reaction occur, Mechanisms, Radical reactions, Polar reaction, Using curved Arrows in polar reactions Mechanisms, Describing a Reaction (Intermediates).	3
6	**Alkenes:** Structure and Reactivity, Industrial Preparation and Use of Alkenes, Calculating Degree of Unsaturation, Naming Alkenes, Sequence Rules: E, Z Designation Stability of Alkenes, Electrophilic Addation Reactions of Alkenes, Orintation of Electrophilic Additions: Markovnikov's rule, Carbocation Structure and Stability, The Hammond Postulate, Evidence for the Mechanism of Electrophilic Additions, Carbocations Rearrangements.	3
7	**Reactions and Synthesis of Alkenes**; Preparations of alkenes; A Preview of Elimination Reactions, Addition of Halogens to Alkenes, Addition of Hypohalous Acids of Alkenes. Addition of water to alkenes (Oxy-mercuration, hydroboration), Addition of Carbenes to alkenes, Reduction of Alkenes, Oxidation of Alkenes (Epoxidation, Cleavage to carbonyl Compounds), Radical Additions to Alkenes; Biological Addition of Radicals to alkenes.	3
8	**Alkynes**: Naming Alkynes, Preparation of alkynes, (Elimination Reactions of Dihalides); Reactions of Alkyne (Addition of HX and X2); Hydration of Alkynes); Reduction of Alkynes; Oxidative Cleavage of alkynes: Alkyne Acidity (Formation of Acetylide Anions); Alkylation of Acetylide Anions, An Introduction of Organic Synthesis.	3
9	**Organohalids**: Naming alkyl halides, Structure of Alkylhalides, Preparing of Alkyl Halides from Alkanes (Radical Halogenations), Preparation of Alkylhalides from Alkenes (Allylic Bromination), Stability of the Allyl Radicals, Preparaton of Alkyl Halidse from Alcohols, Reactions of Alkyl Halides (Grignard Reagents), Organometallic Coupling Reactions, Oxidation and Reduction inOrganic Chemistry.	6
10	**Reactions of Alkyl Halides: Nucleophilic Substitutions and Eliminations:** The Discovery of Nucleophilic Substitution Reactions, The SN2 Reaction, Characteristics of the SN2 Reaction, The SN1 Reaction, Characteristics of the SN1 Reaction, Biological Substitution Reactions, Elimination Reactions: Zaitsev's Rule, The E2 Reaction and the Deuterium Isotope Effect, The E2 Reaction and Cyclohexane Conformation, The E1 and E1cB Reactions, Biological Elimination Reactions, A Summary of Reactivity: SN1, SN2, E1, E1cB, and E2.	6
11	Revisions.	3

Total		45
No	**List of Experiments**	**Contact hours**
1	Laboratory Instructions and Safety: Laboratory instructions and The laboratory rules, Common Laboratory Techniques: Filtration, Decolonization, Drying and drying agents, Reflux, Reporting results,	3
2	Characteristics Physical Properties of Pure Organic Compounds: Solubility, Melting & Boiling points, and Physical Character. (Physical Properties).	3
3	Re-crystallization.	3
4	Extraction of known mixtures	3
5	Thin-Layer Chromatography	3
6	Distillation	3
7	Identification of Aliphatic and Aromatic compounds.	3
8	Detection Elements in an Organic Compound	3
9	Preparation of Alkenes from Alcohols: Cyclohexene from Cyclohexanol	3
10	*Qualitative Identification of other Functional Groups in Organic Compounds*: Identification and classification of Alkyl Halides	6
11	Identification and Classification of Alcohols	3
12	Identification and classification of Aldehydes and Ketones	3
13	Identification and classification of Carboxylic acids and Esters	3
14	Revision	3
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	16th- 17th week	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	• **Organic Chemistry,** John E. McMurry, Mary Finch (Cengage Group), 8ed (2012), ISBN-10: 0495118370 | ISBN-13: 978-0495118374**.**
Supportive References	• **Organic Chemistry.** Paula YurkanisBruice**,** 2nd Ed, 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.** Steven F. Pedersen and Arlyn M. Myers. Brooks/Cole, Cengage Learning, (2011), Library of Congress Control Number: 2009939414, ISBN-13: 978-0-495-82993-5, ISBN-10: 0-495-82993-5. • **Macroscale and Microscale Organic Experiments,** Williamson, K. A. & Masters, K. M. 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 classroom 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

Items	Resources
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.
Lab Performance	**Students**	**Direct:** Lab reports, Final Lab exam, Course e-Portfolio.

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**