Form: Course Syllabus	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Dean Council Approval Decision	23/01/2023
	Number of Pages	06

1.	Course Title	Advanced Organic Chemistry
2.	Course Number	0303993
3.	Credit Hours (Theory, Practical)	(3,0)
	Contact Hours (Theory, Practical)	(3,0)
4.	Prerequisites/ Corequisites	-
5.	Program Title	PhD
6.	Program Code	None
7.	School/ Center	Science
8.	Department	Chemistry
9.	Course Level	The university of Jordan
10.	Year of Study and Semester (s)	Science
11.	Other Department(s) Involved in Teaching the Course	-
12.	Main Learning Language	English
13.	Learning Types	First semester 2024/2025
14.	Online Platforms(s)	Microsoft Teams
15.	Issuing Date	
16.	Revision Date	■Face to face learning ☐Blended ☐Fully online

17. Course Coordinator:

Name Prof Dr. Jalal Zahra
Contact hours:

Office number: 300 Phone number: 22163

Email: zahra@ju.edu.jo Contact hours: 12-1 Sunday, Tuesday

18. Other Instructors:

Name:

Office number:

Phone number:

Email:

Name:

Office number:

Phone number:

Email:

Contact hours:

Name:

Office number:

Phone number:

Email:

Contact hours:

This course consists of 2 modules that can possibly be expanded to more topics in the advances in organic chemistry:

1. multicomponent reactions

This Module explores multicomponent reactions (MCRs), where three or more reactants combine in a single reaction step to produce complex molecular structures. MCRs are vital tools in synthetic chemistry, known for their efficiency, atom economy, and capacity to generate diverse molecular architectures. The course will cover fundamental principles, essential mechanisms, and various applications of MCRs in organic synthesis, emphasizing recent advancements in the field.

2. Advanced Organic Chemistry: Stereochemistry, Mechanisms, and Reactive Intermediates

This module explores the stereochemistry of organic molecules, the principles that govern reaction mechanisms, and the stability and reactivity of various organic intermediates. A strong understanding of these concepts is essential for designing selective reactions and predicting their outcomes. The course will cover the following topics: - Pericyclic Reactions - Woodward-Hoffmann and Baldwin Rules

- Hückel and Möbius Rules - Frontier Molecular Orbitals - Reactive Organic Intermediates, including: - Carbocations - Carbenes and Nitrenes - Carbanions - Free Radicals - Photochemical Reactions and Sonochemistry.

20. Program Student Outcomes (SO's): (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

SO1. Develop chemistry expertise, focus on theory and practice, and contribute to advancing knowledge in a specific research field.
SO2. Conduct original, high-quality research that advances knowledge in chemistry by developing complex projects using innovative methodologies.
SO3. Mentor junior researchers and students and demonstrate leadership in the scientific community through collaboration, peer review, and knowledge exchange.
SO4. Recognize the ethical implications and responsibly use chemistry solutions to tackle global challenges.
SO5. Participate in ongoing professional development to stay up to date with the latest research and innovations.

21. Course Intended Learning Outcomes (CLO's): (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

CLO 1. Understand the principles and mechanisms of multicomponent reactions (MCRs).

CLO 2. Design and execute synthetic routes using MCRs.

CLO 3. Apply MCRs to synthesize complex organic molecules.

CLO 4. Critically evaluate the advantages and limitations of MCRs in modern synthetic chemistry.

Course CLOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
1		√				
2		√	√	√		
3		√	√	√		√
4					√	√

22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program SO's / Course CLO's	SO (1)	SO (2)	SO (3)	SO (4)	SO (5)
CLO (1)	√	√			
CLO (2)	√	√			√
CLO (3)	√	√			√
CLO (4)					√

`23. Topic Outline and Schedule:

The following topics are listed regarding module 1

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types Face to Face (FF) Blended (BL)	Platform Used	Synchronous (S) Asynchronous (A)	Evaluation Methods	Learning Resources
1	1.1	Foundational concepts of multicomponent reactions (MCRs)	CLO (1)	FF	on campus	S		textbook
	1.2	Historical development of MCRs	CLO (1)	FF	on campus	S		textbook
2	2.1	Single Reactant Replacement (SRR)	CLO (1)	FF	on campus	S		textbook
	2.2	Examples and applications (SRR)	CLO (2)	FF	on campus	S		textbook
3	3.1	Reaction-Operator Strategy	CLO (1)	FF	on campus	S		textbook
	3.2	Examples and applications Reaction-Operator Strategy	CLO (2)	FF	on campus	S		textbook
4	4.1	Modular Reaction Sequences (MRS)	CLO (1)	FF	on campus	S		textbook
	4.2	Examples and applications (MRS).	CLO (2)	FF	on campus	S		textbook

	4.3	Strategy IV: Protecting Groups	CLO (1)	FF	on campus	S		textbook
5	5.1	Condition-Based Divergence (CBD)	CLO (1)	FF	on campus	S		textbook
	5.2	Examples and applications (CBD)	CLO (2)	FF	on campus	S		textbook
6	6.1	Condition-Based Divergence (CBD)	CLO (1)	FF	on campus	S		textbook
	6.2	Examples and applications	CLO (2)	FF	on campus	S		textbook
7	7.1	Combination of MCRs (MCR2)	CLO (1)	FF	on campus	S		textbook
	7.2	Examples and applications (MCR2)	CLO (2)	FF	on campus	S		textbook
8	8.1	Carbenes, their synthesis, reactivity, and applications in MCRs and catalysis. Diazomethane makes methyl esters from carboxylic acids	CLO (1)	FF	on campus	S		textbook
	8.2	Photolysis of diazomethane produces a carbene How do we know that carbenes exist? Ways to make carbenes	CLO (1)	FF	on campus	S		textbook
9	9.1	Carbenes can be divided into two types How do carbenes react? Carbenes react with alkenes to give cyclopropanes Insertion into C–H bonds	CLO (1)	FF	on campus	S		textbook
	9.2	Rearrangement reactions Nitrenes are the nitrogen analogues of carbenes Alkene metathesis	CLO (1)	FF	on campus	S		textbook
10	10.1	Carbene-Promoted Multicomponent Reactions introduction	CLO (1)	FF	on campus	S		textbook
	10.2	MCRs Involving Carbenes as Key Components MCRs of Dimethoxycarbenes	CLO (3)	FF	on campus	S		textbook
11	11.1	MCRs of NHCs (N-Heterocyclic Carbenes)	CLO (3)	FF	on campus	S		textbook
	11.2	FCCs as Reagents: Approach to Highly Substituted Carbo- and Heterocycles NHCs as Organocatalysts in MCRs	CLO (3)	FF	on campus	S		textbook
12	12.1	MCRs Involving Carbenes as Catalysts	CLO (3)	FF	on campus	S		textbook
	12.2	NHCs as Organocatalysts in Mcrs	CLO (4)	FF	on campus	S		textbook
13	13.1	Metal-Catalyzed Mcrs Involving Nhcs as Ligands	CLO (3)	FF	on campus	S		textbook

	13.2	Synthetic Utility: Carbenes as Components	CLO (3)	FF	on campus	S		textbook
14	14.1	Nhcs as Catalysts/Ligand	CLO (3)	FF	on campus	S		textbook
	14.2	Rearrangement in Synthesis.	CLO (3)	FF	on campus	S		textbook
15	15.1	Seminar	CLO (4)	FF	on campus	S		textbook
	15.2	Seminar	CLO (4)	FF	on campus	S		textbook
16							Final Exam	

24. Evaluation Methods:

Opportunities to demonstrate the achievement of the CLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	CLO/s Linked to the Evaluation activity	Period (Week)	Platform
Midterm Exam	30	1-6	1,2	8	Paper exam
seminars	30		3,4		oral
Final	40	all	1,2,3,4	16	Paper exam

25. Course Requirements:

(e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform…etc.):

26. Course Policies:

A- Attendance policies:
B- Absences from exams and submitting assignments on time:
C- Health and safety procedures:
D- Honesty policy regarding cheating, plagiarism, misbehavior:
E- Grading policy:
F- Available university services that support achievement in the course:

27. References:

1) Tietze, L. F., Brasche, G., & Gericke, K. M. *Domino Reactions in Organic Synthesis*. Wiley-VCH, 2006. ISBN: 3-527-29060-5.

2) **Zhu, J., & Bienaymé, H. (Eds.)** *Multicomponent Reactions*.
Wiley-VCH, 2005. ISBN: 3-527-30806-7.

3) Herrera, R. P., & Marqués-López, E. (Eds.)
Multicomponent Reactions: Concepts and Applications for Design and Synthesis.
Wiley-VCH, 2015. ISBN: 978-3-527-33996-8.

28. Additional information:

Name of the Instructor or the Course Coordinator: Dr. Jalal Zahra,Prof.	Signature:	Date: 21/11/2024
The Head of Graduate Studies Committee/ Department Chemistry **Dr. Murad AlDamen, Prof.**	**Signature:** **……..……**	**Date:** **……..……**
The Head of Department of Chemistry **Dr. Murad AlDamen, Prof.**	**Signature:** **……..……**	**Date:** **……..……**
Vice Dean for Graduate Studies and Scientific Research / School of Science **Dr. Kamal Sweidan, Prof.**	**Signature:** **……..……**	**Date:** **……..……**
The Dean of School of Science **Dr. Mahmoud I. Jaghoub, Prof.**	**Signature:** **……..……**	**Date:** **……..……**