



Course Specifications

Course Title:	Physical Organic Chemistry
Course Code:	2043206-2
Program:	Bachelor in Chemistry
Department:	Department of Chemistry
College:	College of Sciences
Institution:	Taif University

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A. Course Identification

1. Credit hours: 2 (Theoretical)
2. Course type
a. University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/>
b. Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
3. Level/year at which this course is offered: 6 th Level/ 2 nd Year
4. Pre-requisites for this course (if any): Organic Chemistry 2 (2042203-3)
5. Co-requisites for this course (if any): NA

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	2 Theoretical hours/ Week	100 %
2	Blended	-	-
3	E-learning	-	-
4	Distance learning	-	-
5	Other	-	-

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	30
2	Laboratory/Studio	-
3	Tutorial	-
4	Others (specify)	-
	Total	30

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to give an extensive knowledge of physical organic chemistry, including methods of identification of organic reaction mechanism; methods of identification of reaction products and understanding the kinetics and thermodynamics of organic reactions.

2. Course Main Objective

The course concerns with studying in depth the molecular orbital theory, kinetics of organic reactions, photochemistry, acidity functions, the linear free energy relationships and Hammett equation.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge and Understanding:	
1.1	Define the physical organic chemistry and reaction mechanism	K1
1.2	Recognize the linear free energy relationships (Hammett equation)	K2
2	Skills:	
2.1	Apply the rules of reaction mechanism on different organic reactions	S1

CLOs		Aligned PLOs
2.2	Utilize energy concepts in organic reactions	S2
3	Values:	
3.1	Illustrate the concept of personal responsibility for achieving duties by teamwork	V1

C. Course Content

No	List of Topics	Contact Hours
1	Section 1: - Introduction, definition of the physical organic chemistry and reaction mechanism	2
2	Section 2: Identification of the reaction products - Detection of different mechanisms. - Identification of bonds breaking, and bonds formation. - Nature of intermediate. - Approval or disapproval of a mechanism.	2
3	Section 3: Kinetic Studies - Kinetic rate laws-1 st order- 2 nd order- 3 rd order- fractional order- mixed order and their role in reaction mechanism - Transition state theory. - Effect of temperature on reaction rate.	4
4	Section 4: Stereochemical Studies - Substitution reactions: S _N 1- S _N 2- Neighboring group participation. - Addition reactions: Trans addition, Cis addition, Addition to carbonyl compounds.	4
5	Section 5: Elimination reactions - Types of elimination reactions - Trans stereospecific eliminations - Cis stereospecific eliminations	4
6	Section 6: Identification of the reaction intermediates - Carbonium ions; Carbanions; Free radicals and Carbenes. - Tetrahedral addition intermediates. - Aryne intermediates. - Stable intermediates.	2
7	Section 7: Isotopic Studies - Primary isotope effect. - Non- kinetic uses of isotopes: Identification of bond cleaved - Identification of source of atom in the product- Identification of intermediate involved	4
8	Section 8: Intra- and inter-molecular rearrangements - Distinction between intra- and inter-molecular rearrangements - Determination of relative migratory aptitude.	4
9	Chapter 9: Substituents and solvent effects - Magnitude of substituent electronic effect. - Hammett equation.	2
10	Chapter 9: - Modified substituent constants, σ^+ and σ^- .	2

	- Implications from Hammett plots. - Solvent effect.	
Total		30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	Define the physical organic chemistry and reaction mechanism	Lecture	Written Exam
1.2	Recognize the linear free energy relationships (Hammett equation)	Lecture	Written Exam
2.0	Skills		
2.1	Apply the rules of reaction mechanism on different organic reactions	Discussion	Homework Assignments
2.2	Utilize energy concepts in organic reactions	Discussion	Homework Assignments
3.0	Values		
3.1	Illustrate the concept of personal responsibility for achieving duties by teamwork	Collaborative Learning	Individual presentations

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework Assignments (Electronic)	Throughout Semester	15%
2	Individual presentations	Throughout Semester	5%
3	Periodical Exam	7/8	15%
4	Mid Term Exam	11/12	15%
5	Final exam	16	50%

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Commitment to the rules of the Academic Advising Department at the university in accordance with the academic guidance manual approved by the university and the attached forms, there are different arrangements made by teaching staff to support student consultations including;

- Office hours: 8 hours per a week for each academic member.
- Academic guidance: an academic member has a number of students to guide them throughout degree journey.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	<ul style="list-style-type: none"> • Modern Physical Organic Chemistry, Eric V. Anslyn, Dennis A. Dougherty (2005), Latest Edition. University Science Books (USA). ISBN: 978-1891389313.
Essential References Materials	<ul style="list-style-type: none"> • A Guidebook to Mechanism in Organic Chemistry, Peter Sykes (1985), Latest Edition, John Wiley, Cambridge (UK). ISBN: 978-8177584332.
Electronic Materials	<ul style="list-style-type: none"> • Saudi Digital Library (SDL)
Other Learning Materials	<ul style="list-style-type: none"> • Learning Management System (Blackboard)

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	<ul style="list-style-type: none"> • Lecture hall with 100 seats.
Technology Resources (AV, data show, Smart Board, software, etc.)	<ul style="list-style-type: none"> • Computer and data show with Wi-Fi access.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and assessment	Students	Survey (indirect method)
Extent of achievement of course learning outcomes	Program leader	Reports (Direct method)
Quality of learning resources	Peer referees Students	Reports (Direct method) Survey (indirect method)

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

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

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department Council/ Quality assurance committee
Reference No.	7-3-1445
Date	27/2/1445 HJ 12/09/2023 G