Course Specification
(Bachelor)

Course Title:	Heterocyclic Organic Chemistry
Course Code:	333 CHEM-3
Program:	Bachelor of Science in Chemistry
Department:	Physical Sciences
College:	Science
Institution:	Jazan University (JU)
Version: :	TP-153 2024
Last Revision Date:	05 /05/ 2024

Table of Contents

A. General information about the course: ..... **Error! Bookmark not defined.**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods 5

C. Course Content 6

D. Students Assessment Activities 7

E. Learning Resources and Facilities 7

F. Assessment of Course Quality 8

G. Specification Approval 8

H. Attachments 9

1- Practical Work 9

2- Blue Print 11

A. General information about the course:

1. Course Identification

1. Credit hours: (3 hrs…)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (Level 7/ year4)

4. Course general Description:

1. Course Description

Course Title	*Course Number*	*Contact Hours (CH)*		*Credit unit (CU)*	*Year*	*Level*	*Pre- requisite*
		Lec.	*Prac.*				
Heterocyclic Organic Chemistry	333CHEM3	**2**	**2**	**3**	**3**	7	**232CHEM3**

Course objectives:

1. Identification and classification of heterocyclic organic compounds.
2. To identify the physical properties of heterocyclic organic compounds.
3. Study of the addition reactions, the electrophilic and nucleophilic substitution reactions on a five and six-membered ring with one and two heteroatoms.

❖ Syllabus: A-Theoretical contents

- Definition, classification and nomenclature of heterocyclic organic compounds
- Aromaticity of Heterocyclic compounds
- Synthesis of five membered pyrrole, furan, thiophene, physical properties of heterocyclic compounds
- Chemical properties Addition reactions, Electrophilic and nucleophilic substitutation reactions of five membered and derivatives
- Synthesis of five membered two atoms ring pyrazole , imidizaole isoxazole , oxazole, and physical properties of heterocyclic compounds
- Chemical properties Addition reactions, Electrophilic and nucleophilic substitutation reactions of five membered two atoms
- Synthesis of six-membered rings one atom azine and two atoms diazine such as pyridine , pyridazine, pyrimidine and derivatives
- Chemical properties Addition reactions, Electrophilic and nucleophilic substitutation reactions of six membered one and two atoms
- Synthesis ,physical properties and reactions of fuse ring five or six -membered such as indole, carbazole, quinoline and isoquinoline
- The role that heterocyclic compounds play in life

❖Syllabus: B-Practical contents

Investigation and identification of organic compounds

5. Pre-requirements for this course (if any):
232 CHEM3
6. Co-requisites for this course (if any):
None
7. Course Main Objective(s):
This course aims to provide student with basic knowledge of heterocyclic organic compounds, their physical and chemical properties and their most important chemical reactions.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	30
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		60

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**; (Upon completion of the course, student will be able to)			
1.1	*Demonstrate a broad, knowledge and understanding in heterocyclic topic as Nomenclature of heterocyclic compounds , Five-Membered rings with one hetero atom , Fused benzene ring Five-Membered rings with one hetero atom , Five-Membered rings with two hetero atom, Six-Membered rings with one hetero atom , Fused benzene ring Six-Membered rings with one hetero atom , important of Biological activities of heterocyclic compounds (P)*	*K(1.1)*	*lecture / discussion Seminars /presentation*	*Objective question*
1.2	*Describe the aromatic character of some heterocyclic compounds and giving explanation to some of their synthetic methods. (P)*	*K (1.2)*	*lecture / discussion Seminars /presentation*	*Objective question*
2.0	**Skills**; (Upon completion of the course, student will be able to)			
2.1	*Demonstrate the knowledge and skills to interpret products obtained from different reaction conditions regarding heterocyclic chemistry (P)*	*S(2.1)*	*lecture / discussion / Seminars /Individual presentation*	*Objective question*
2.2	*Apply their experimental basics and skills to use laboratory equipment, modern instrumentation, and classical techniques for carrying out experiments as well as accurately record and analyze the results of such experiments. (P)*	*S(2.2)*	*Lab work, group work*	*Objective question , lab report rubric*
2.3	*Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals. (I) ~~Apply their~~*	*S(2.3)*	*lab demonstrations / hands-on student learning activities*	*Quiz in Safety*

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	~~*experimental basics and skills to use laboratory equipment, modern instrumentation, and classical techniques for carrying out experiments as well as accurately record and analyze the results of such experiments.*~~ ~~P~~			
3.0	**Values, autonomy, and responsibility**; (Upon completion of the course, student will be able to)			
3.1	*Work as a group leader in cooperation with other colleagues (I)*	*V(3.1)*	*lab demonstrations / whole group and small group discussion*	*Practical group work Rubric*

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction of heterocyclic compounds Nomenclature of heterocyclic compounds Nomenclature of one ring heterocyclic compounds with one heteroatoms (N,O,S)	4
2.	Nomenclature of heterocyclic compounds: Nomenclature of one ring heterocyclic compounds with two or more heteroatoms (N,O,S). ~~9~~Nomenclature of fused ring heterocyclic compounds with one or more heteroatoms (N,O,S).	3
3	Five-Membered rings with one hetero atom ~~•~~ Pyrrole (Azole), Furan and Thiophene (Methods of preparation, Physical properties and structure, Chemical properties) ~~o~~ Reactions : (basicity ; acidity properties) .	5
4	Fuse ring Five-Membered rings with one hetero atom ~~•~~ Indole – benzofuran- benzothiophene (Methods of preparation, Physical properties and structure, Chemical properties.	3
5	Five-Membered rings with two hetero ~~atom~~ atoms ~~•~~ Pyrazole and Imidazole (Methods of preparation, Physical properties and structure , Chemical properties)	4

6	Six-Membered rings with one hetero atom \• Pyridine (Methods of preparation. Physical and chemical properties ~~and structure~~ ~~Chemical properties.~~ Derivative of pyridine (alkyl pyridine, amino pyridine) Six-Membered rings with two hetero atom Pyradiazine, pyrimidine, pyrazine (Methods of preparation. Physical properties and Chemical properties	3
7	Fused Six-Membered rings with one hetero atom Quinoline and isoquinoline (Methods of preparation. Physical properties and ~~structure, Chemical~~chemical properties.	4
8	Six membered rings with one oxygen atom (Pyran-Coumarin-4-Chromone) Six-membered rings with two different heteroatoms (Morpholine-piperazine-phenoxazine)	2
9	The role that heterocyclic compounds play in life	2
9	***Selected experiments related to the course topic***	30
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *		Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework assignment		3-8	2 %
2.	Lecture Quizzes		4-7	3 %
3.	Mid-term exam		9-12	15 %
4.	LAB	LAB Sheet	12	7 %
5.		Safety EXAM	11	3%
6.		Final practical exam	12	7 %
7.		Lab report	2-11	10 %
8.		Group work evaluation	2-11	3%
9.	Final Exam		12-14	50 %
...	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	Introduction to Heterocyclic Chemistry, Peter A. Jacobi ISBN: 978-1-119-41768-2 August 2018 272 Pages
Supportive References	1. Heterocyclic chemistry; Gilchrist, T. L. 3rd ed.; Addison Wesley Longman: Edinburgh Gate, 1997. 2. Heterocyclic chemistry; Joule, J. A.; Mills, K.; 4th ed.; Blackwell Science: Oxford, 2000. 3. Heterocyclic Chemistry, R. R. Gupta, M. Kumar, V. Gupta, Volume II: Five-Membered Heterocycles, Springer, ISBN 978-3-642-08460-7, 1999.
Electronic Materials	• https://b-ok.asia/book/829427/cae9f4 https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Map%3A_Organic_Chemistry_(McMurry)/15%3A_Benzene_and_Aromaticity/15.06%3A_Aromatic_Heterocycles-_Pyridine_and_Pyrrole
Other Learning Materials	Computer-based programs/ ChemDraw

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture room(s) for groups of 50 students
Technology equipment (projector, smart board, software)	Smart board, Data show, Black board, internet
Other equipment (depending on the nature of the specialty)	none

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Likert-type Survey CES) Indirect
Effectiveness of Students assessment	Instructor & Course coordinator	Classroom evaluation (direct & indirect
Quality of learning resources	Program coordinator	Indirect
The extent to which CLOs have been achieved	Assessment committee	Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Physical Sciences Department Council

REFERENCE NO.	Psci2415
DATE	28/03/1446 Corresponding to 1 / 10 /2024

H. Attachments

1- Practical Work

1- EXP. Table

No.	List of Topics	APPARATUS	CHEMICALS	Week
1	Safe handling when using chemicals	Smart board, Data show, Black board, internet	NaOH, Conc. HNO_3, Conc. H_2SO_4, ethanol, benzene	1
2	Qualitative Analysis of Organic Compounds. Preliminary Tests - Physical Constants Analysis for elements present- Solubility tests	Flame distilled water - test tubes – Beaker- flask	Litmus paper Simple salts of organic compound such as (oxalic acid-benzoic acid-aniline HCl-Urea- Glucose 1-Naphthylamin 1-naphthole	1
3	Qualitative Analysis for Elements Lassaigne's Sodium Fusion Test - Heat Test. Heating with soda lime - Nitration - Sulphation Treatment with NaOH- Treatment with $FeCl_3$	Flame distilled water - test tubes – Beaker-flask	Litmus paper Simple salts of organic compound such as (oxalic acid-benzoic acid-aniline HCl-Urea- Glucose 1-Naphthylamin 1-naphthole Reagents :- NaOH, $FeCl_3$, conc. HNO_3, conc. H_2SO_4, soda lime,	2
4	Identification of organic compounds Combination of (H, C,O) [Carbohydrate, Carboxylic acid, phenols]	Flame distilled water - test tubes – Beaker-flask	Carbohydrate Molisch Test. Benedict's Test Barfoed's Test Bial's test Seliwanoff's Test Carboxylic acid Acidity test Nitration $FeCl_3$ test $CaCL_2$ test	3

No.	List of Topics	APPARATUS	CHEMICALS	Week
			Phthalein test Phenols Phenol, resorcinol, cresol 1-naphthol	
5	Combination of (H, C,O and metallic) [Salts of acid]	Flame distilled water - test tubes – Beaker-flask	Heat test Nitration $FeCl_3$ test $CaCL_2$ test Phthalein test	**1**
6	Combination of (H, C,O and N) [Amm. Salts, Amide, imides]	Flame distilled water - test tubes – Beaker-flask	Simple of amm. Salts Acidity test Nitration $FeCl_3$ test $CaCL_2$ test Phthalein test Urea, imide NaOH test $CuSO_4$	**4**
7	Combination of (H, C,O, N,S)	Flame distilled water - test tubes – Beaker-flask	Aniline H_2SO_4 Thiourea, Sulphaline acid	**1**
7	Combination of (H, C,O, N, X)	Flame distilled water - test tubes – Beaker-flask	Aniline HCl Chlorale	**1**
8	Review	Flame distilled water - test tubes – Beaker-flask	Carbohydrate Carboxylic acid Salts of acids Amm. salts	**2**
9	Final Exam.			**15**

2- Blue Print

Course Name	Heterocyclic Organic Chemistry
Course Code	333CHM-3

PLOs	K1	K2	S1	S2	S3	S4	V1	V2
CLOs	1.1	1.2	2.1	2.2	2.3	2.4	3.1	3.2
Marks	17	23	30	24	3	---	3	---

Learning Domain	PLOs	CLOs	Assessment Type	Assessment Tool	No of Questions	Marks of the Assessment	Weight of the Assessment
Knowledge & understanding	K1	1.1 (17 M)	Quiz	**Objective test**	3	3	3
			Homework		4	1	1
			Mid term		1	5	5
			Final Exam		1	10	10
	K2	1.2 (23 M)		**Objective test**			
			Homework	***Essay question***	3	1	1
			Mid term		2	5	5
			Final Exam		2	15	15
Skills	S1	2.1 (30 M)	Midterm	***Essay question***	2	5	5
			Final Exam		3	25	25
	S2	2.2 (24M)	Practical Sheet	Objective test	3	7	7
			Lab Report	Lab Report Rubric	---	10	10

Learning Domain	PLOs	CLOs	Assessment Type	Assessment Tool	No of Questions	Marks of the Assessment	Weight of the Assessment
			Final Lab Exam	Report of Lab Exam	7	7	7
	S3	2.3 (3 M)	*Safety EXAM*	Objective test	8	3	3
Value	V1	3.1 (3 M)	Continuous assessment	Group evaluation rubric	-	3	3
TOTAL		100					100