



## Course Specifications

<b>Course Title:</b>	<b>Chemistry of Natural Products</b>
<b>Course Code:</b>	<b>CHEM 436</b>
<b>Program:</b>	<b>Bachelor in Chemistry</b>
<b>Department:</b>	<b>Chemistry</b>
<b>College:</b>	<b>Science</b>
<b>Institution:</b>	<b>Jazan University (JU)</b>

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## A. Course Identification

<b>1. Credit hours:</b>	<b>3 hrs.</b>
<b>2. Course type</b>	
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"/>
<b>3. Level/year at which this course is offered:</b>	<b>7<sup>th</sup> level /Fourth year</b>
<b>4. Pre-requisites for this course (if any):</b>	<b>None</b>
<b>5. Co-requisites for this course (if any):</b>	<b>None</b>

### 6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom and Lab	30 and 30	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	30
3	Tutorial	0
4	Others (specify)	0
	<b>Total</b>	<b>60</b>

## B. Course Objectives and Learning Outcomes

### 1. Course Description

Course Title	Course Number	Contact Hours (CH)		Credit unit (CU)	Year	Level	Pre-requisite
		Lec.	Prac.				
Chemistry of Natural Products	CHEM 436	2	2	3	Fourth	7 <sup>th</sup>	None

**Course objectives:** They are to identify the following.

1. The main classes of natural products and their types.
2. Terpenoid; its classification and methods of isolation.
3. Amino and fatty acids, alkaloids, their importance, types and means of extraction.
4. Natural phenolic compounds and their extraction, isolation and structure elucidation

#### Syllabus: A-Theoretical contents

Definition and classification of different classes of natural products and their isolation by different chromatographic methods- Structure elucidation by means of physical and chemical methods. Some chemical reactions and biosynthesis of terpenes, steroids, alkaloids and natural phenolic (flavonoids, xanthonenes, anthraquinones and coumarins)

#### Syllabus: B-Practical contents

Preparation and identification of some organic compounds, (such as aspirin - Benzoyl Glycine – benzamide - phthalimide - picric acid - P- nitro-acetanilide, etc.)

\*See attachment

### 2. Course Main Objective

This course aims to provide students with the basic knowledge about the main classes of natural products, means of extraction, isolation, structure characterization, and their most important uses

### 3. Course Learning Outcomes

CLOs		Aligned PLOs
1	<b>Knowledge and Understanding</b> <i>Upon completion of the course, student will be able to:</i>	
1.1	Demonstrate broad and understanding knowledge about different classes of natural products, their importance and identification, the physical and chemical properties of different secondary metabolites. (M)	K1
1.2	Describe the chromatographic procedures that used in extraction and isolation of each class of natural products and the ways for structure elucidation of simple natural secondary metabolites (M)	K2
2	<b>Skills :</b> <i>Upon completion of the course, student will be able to:</i>	
2.1	Demonstrate critical thinking ability to isolated compounds using different structure elucidation methods (P)	S1
2.2	Apply their experimental basics and skills to use laboratory equipment, modern instructions, and classical techniques to Perform experiments to prepare a simple organic compound (M)	S2
2.3	Examine and follow proper procedures and regulations for safe handling, use, and disposal of chemicals. (P)	S3
2.4	Make effective use of communication, modern library searching and information technology about Natural products (I)	S4

<b>3</b>	<b>Values:</b> <i>Upon completion of the course, student will be able to:</i>		
3.1	Working as a group leader in cooperation with other colleagues.	(P)	V1

## C. Course Content

No	List of Topics	Contact Hours
1	Introduction to natural products, classification, general methods of extractions, isolation and structure elucidation	4
2	Classification and identification of terpenoids, methods of extraction, chemical properties and structure elucidation	8
3	Classification and identification of alkaloids, methods of extraction, chemical properties and structure elucidation	8
4	Classification and identification of phenolics, isolation and chemical properties	5
5	Miscellaneous natural products	5
6	Selected experiments on preparation, isolation and purification of simple organic compounds	30
<b>Total</b>		<b>60</b>

## D. Teaching and Assessment

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

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge and Understanding</b>		
1.1	Demonstrate broad and understanding knowledge about different classes of natural products, their importance and identification, the physical and chemical properties of different secondary metabolites. (M)	Lectures, directed reading, group discussion and assignments	MCQ and short answer questions
1.2	Describe the chromatographic procedures that used in extraction and isolation of each class of natural products and the ways for structure elucidation of simple natural secondary metabolites (M)	Lectures, directed reading, group discussion and assignments	MCQ and short answer questions
<b>2.0</b>	<b>Skills</b>		
2.1	Demonstrate critical thinking ability to isolated compounds using different structure elucidation methods (P)	Lectures, directed reading, group discussion and assignments	Written, questions, problems and class discussions
2.2	Apply their experimental basics and skills to use laboratory equipment, modern instructions, and classical techniques to Perform experiments to prepare a simple organic compound (M)	Lab work, group work	Practical sheet and final exam
2.3	Examine and follow proper procedures and regulations for safe handling, use, and disposal of chemicals. (P)	Lab work	MCQ safety exam
	Make effective use of communication, modern library searching and information technology about	Group Discussion and research	Presentation and assessment research

	Natural products (I)		
<b>3.0</b>	<b>Values</b>		
3.1	Working as a group leader in cooperation with other colleagues. (P)	Group work and projects	Presentation and assessment research

## 2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework assignment	3	1%
2	Quiz 1	5	2%
3	Oral presentation	7	0%
4	Homework assignment	8	1%
5	Mid-term exam	9	15%
6	Research project report	11	1%
7	Quiz in lab safety	14	0%
8	Final practical exam	15	20%
9	Final examination sheet in the practical part	15	10%
10	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:**

Student Academic Counseling:

Members of staff will be available for academic counseling on daily basis for at 4h/day during office hours.

## F. Learning Resources and Facilities

### 1. Learning Resources

<b>Required Textbooks</b>	كيمياء المنتجات الطبيعية – الجزء النظري, أ.د. طاهر حسن, جامعة البعث, مديرية الكتب المطبوعات الجامعية Chemistry of Natural Products, S. V. Bhat, B. A. Nagasampagi, S. Minakshi, Springer, 2005
<b>Essential References Materials</b>	Chemistry of Natural Products, Ayodhya Singh, Campus Books International, 2004 - Natural Products Isolation, S. D. Saker, Z. Latif, A. I. Gray, 2 <sup>nd</sup> ed., Humana Press, Totowa, New Jersey, 2006.
<b>Electronic Materials</b>	<a href="https://chem.libretexts.org/Special:Search?qid=&amp;fpid=230&amp;fpth=&amp;query=Natural+products&amp;type=wiki">https://chem.libretexts.org/Special:Search?qid=&amp;fpid=230&amp;fpth=&amp;query=Natural+products&amp;type=wiki</a> <a href="https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Basic_Principles_of_Organic_Chemistry_(Roberts_and_Caserio)/30%3A_Natural_Products_and_Biosynthesis">https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Basic_Principles_of_Organic_Chemistry_(Roberts_and_Caserio)/30%3A_Natural_Products_and_Biosynthesis</a>
<b>Other Learning Materials</b>	<a href="http://www.wikipedia.org">www.wikipedia.org</a> <a href="https://www.slideshare.net/ShvetaArya/chemistry-of-naturalproducts">https://www.slideshare.net/ShvetaArya/chemistry-of-naturalproducts</a>

### 2. Facilities Required

Item	Resources
<b>Accommodation</b> (Classrooms, laboratories, demonstration)	1 Lecture room (s) for each group of 25 students. One Laboratory for each group of 15 students.

rooms/labs, etc.)	
<b>Technology Resources</b> (AV, data show, Smart Board, software, etc.)	AV, data show, Smart Board, software, etc.)
<b>Other Resources</b> (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	In addition to glassware and chemicals some equipment are required for teaching the practical part such as: 1- UV/Vis Spectrophotometer 2- IR spectrophotometer 3- NMR spectrometer 4- Polarimeter

## G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and Assessment	Student	Likert-type Survey (CES) Indirect
Extent of achievement of course learning outcomes	Instructor & Course coordinator	Class room evaluation (direct & indirect)
Quality of learning resources	Program coordinator	Indirect
Exam Quality assessment	Assessment committee	Indirect

**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

<b>Council / Committee</b>	<b>Chemistry Department Council</b>
<b>Reference No.</b>	42 / 35 /102 112
<b>Date</b>	17 /09 /1442 Corresponding to 28 / 04 /2021

## CHEM 436 LAB

	Experiment	Equipments, Chemicals and Tools	Week Due	Remarks
1-	Lab Safety		First week	The required equipment and tools for teaching the practical part are: UV/Vis Spectrophotometer IR spectrophotometer NMR spectrometer Polarimeter Hotplate magnetic stirrer Condensers Separating funnels different sizes Rotary evaporator Melting point apparatus - Heating mantle - TLC sheets - Capillary tubes
2-	Preparation of Aspirin	Salicylic acid, acetic anhydride	Second week	
3-	Preparation of acetanilide	Aniline acetic anhydride	Third week	
4-	Preparation of p-nitroacetanilide	Acetanilide, Nitric acid, and Sulphuric acid	Fourth week	
5-	Preparation of Phthalimide	Phthalic anhydride and Urea	Fifth week	
6-	Preparation of Phthalyl glycine	Phthalic anhydride and Glycine	Sixth week	
7-	Preparation of benzoin	Benzaldehyde and Potassium cyanide	Seventh week	
8-	Preparation of benzophenone Oxime	Benzophenone and hydroxylamine hydrochloride	Eighteenth week	
9-	Preparation of 7-hydroxycoumarine	Resorcinol, ethyl acetoacetate, and sulphuric acid	Ninth week	
10-	Extraction of caffeine from green tea	Green tea, chloroform, and separating funnel	Tenth and Eleventh week	
11-	IR spectra of selected prepared compounds	Infra-Red Spectroscopy apparatus	Twelfth week and Thirteenth week	
12-	Revision		Fourteenth week	
13-	Quiz and Final exam		Fifteenth week	