Course Specifications

Course Title:	Spectroscopy of Organic Compounds
Course Code:	314CHEM -2
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	King Khalid University

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A. Course Identification

1. Credit hours:	**2**
2. Course type	
a.	University ☐ College ☐ Department ■ Others ☐
b.	Required ■ Elective ☐
3. Level/year at which this course is offered:	**6th Level/3rd Year**
4. Pre-requisites for this course (if any)**:**	313CHEM-2
5. Co-requisites for this course (if any)**:**	**none**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	2	100%
2	**Blended**		
3	**E-learning**	0	0%
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	20
2	**Laboratory/Studio**	0
3	**Tutorial**	10
4	**Others** (specify)	0
	Total	30
Other Learning Hours*		
1	**Study**	10
2	**Assignments**	10
3	**Library**	5
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify)	0
	Total	30

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course covers the identification of organic compounds using several spectroscopic techniques such as Ultraviolet-Visible (UV-Vis), Infrared (IR), nuclear magnetic resonance (^{1}H, ^{13}C-NMR), and mass spectra (MS).

2. Course Main Objective: To enable students to

- develop fundamental understanding of spectroscopic techniques - their origin from the interaction of radiation with matter.
- learn the principles and the common application of spectroscopic techniques including UV-Vis, IR, one and two dimensional NMR and MS.
- Analyze and interpret spectroscopic data collected by the methods discussed in it.
- Elucidate the chemical structure of unknown organic compounds.
- Recognize the structure of unknown organic compounds using 1H-NMR and 13C-NMR.
- Solve problems related to the structure, purity and concentration of chemicals and to study molecular interactions by choosing suitable spectroscopic methods and interpreting corresponding data.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	•To state the fundamental concepts of the effect electromagnetic radiation of atoms and molecules. •To Identify the different type of the spectra (UV-IR-^{1}HNMR-^{13}CNMR-MS) and how can interpret it. •To know the running of some spectroscopic devices	K1 & K2
1.2	•To recognize the progress of chemical reaction using IR spectroscopy	K2 & K3
1.3	• To assign the chemical structural of unknown compounds using different spectroscopic tools.	K1, K2, K3
1...		
2	**Skills :**	
2.1	• To analyze the products of organic reactions using spectroscopic tools. •To distinguish between different classes of organic compounds using IR spectra	S1
2.2	• To explore the stereochemistry of cis-trans isomers and E- & Z-configuration using coupling constant value (J)	S2
2.3	• To explore the UV-Vis, IR, ^{1}H-, ^{13}C-NMR, and Ms spectra of different compounds	S2 & S3
2...		
3	**Competence:**	
3.1	To acquire the ability to propose suitable methods for analysis of unknown sample colleagues.	C1
3.2	To present an oral explanation for a spectral data of known compound.	C2
3.3	To interact positively with colleagues in a group work	C3
3...		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction (Empirical and molecular formula, Elemental analysis, Index of hydrogen deficiency)	2
2	Electromagnetic radiation and its interaction with organic molecules	2

3	The Infrared Absorption Spectroscopy	4
4	UV-Vis absorption Spectroscopy	4
5	^{1}H- Nuclear Magnetic Spectroscopy	6
6	^{13}C -Nuclear Magnetic Spectroscopy	2
8	Mass Spectrometry	4
9	Integrated Problems	6
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**		
1.1	• To state the fundamental concepts of the effect electromagnetic radiation of atoms and molecules. • To identify the different type of the spectra (UV-IR-^{1}HNMR-^{13}CNMR-MS) and how can interpret it. •To know the running of some spectroscopic devices	• Lectures • Public discussions and problem-solving • Work integrated link between the basic concepts of academic decision with the previous courses studied	• Two theoretical exams per semester and represent 40% of the final evaluation • Duties and reports through (Blackboard) and represents 10%
1.2	•To recognize the progress of chemical reaction using IR spectroscopy	Lectures , Interactive teaching sessions	Written exams, electronic quizzes
1.3	• To assign the chemical structural of unknown compounds using different spectroscopic tools.	Tutorials, problem solving sessions	Oral discussion and examinations
2.0	**Skills**		
2.1	•To analyze the products of organic reactions using spectroscopic tools. • To distinguish between different classes of organic compounds using IR spectra	• Lectures • websites • panel discussions among students • Reporting - solution duties	Written exams, oral exams
2.2	• To explore the stereochemistry of cis-trans isomers and E- & Z-configuration using 1H-NMR spectra	•Tutorials, problem solving sessions • Short tests the theory and laboratory • Assessment of student articles and reports	Oral discussion, written examinations
2.3	• To describe the UV-Vis, IR, ^{1}H-, ^{13}C-NMR, and Ms spectra of different	•Tutorials, problem solving sessions	Oral discussion, written examinations

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	compounds	• Short tests the theory and laboratory • Assessment of student articles and reports	
3.0	**Competence**		
3.1	To acquire the ability to propose suitable methods for analysis of unknown sample colleagues.	opened reports on selected topics	Class activities
3.2	To present an oral explanation for a subject in the area.	• Interactive teaching sessions	Oral presentation on a group report
3.3	To interact positively with colleagues in a group work	• Interactive teaching sessions	• Short tests • theoretical test • Test questions require simple interpretation of statistical information • Discussion within a group

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework (Blackboard), reports & discussions	Continuous	10%
2	First Mid-Term exam	6	20%
3	Second Mid-Term exam	12	20%
4	Final exam	15	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 :

The course instructor is available for at least ten hours every week in the office for any advice and support to the students.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Spectroscopic Identification of Organic Compounds by Robert M. Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce, John Wiley & Sons, New York, 8th Ed., 2015.**

	➢ **Organic Structures from Spectra by L. D. Field, S. Sternhell, J. R. Kalman, John Wiley & Sons, New York, 5th Ed., 2013.**
Essential References Materials	➢ **Spectrochimica Acta part A: Molecular and Biomolecular Spectroscopy** ➢ **Journal of Molecular spectroscopy** ➢ **Progress in nuclear magnetic resonance spectroscopy** ➢ **Journal of Magnetic Resonance** ➢ **Mass spectrometry**
Electronic Materials	♦ Blackboard: E-Learning Deanship (http://elc.kku.edu.sa/). ♦ https://www.wikipedia.org/ ♦ https://www.sciencedirect.com/ ♦ https://origin-scifinder.cas.org/scifinder/login ♦ https://onlinelibrary.wiley.com/ ♦ https://www.springer.com/gp
Other Learning Materials	• Labs contain at least 20 computer. • Chem draw or ChemBioOffice programs. • Internet access.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	♦ Lecture room equipped with 20 armchairs
Technology Resources (AV, data show, Smart Board, software, etc.)	Lecture room equipped with: ♦ Smart board ♦ Data show ♦ Computer (MS office, software programs that serve the course as Origin, SPSS, Chem. Draw and other related programs.)
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Data show devices connected with the computers, Smart board

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course delivery (teaching methods and assessment methods)	Students	Questionnaire
	Departmental Plan and curriculum committee; external reviewers	Report and workshops
	Program Leader	Meetings
Course contents (update)	Departmental Plan and curriculum committee; external reviewers	Report and workshops
Quality of learning resources	External reviewers	Reports

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 counsel
Reference No.	1/22/142
Date	15-9-1442