Course Specifications

Course Title:	**Molecular Spectroscopy**
Course Code:	**4024577-2**
Program:	**Chemistry**
Department:	**Chemistry**
College:	**Faculty of Applied Science**
Institution:	**Umm Al-Quar University**

Table of Contents

A. Course Identification

1. Credit hours:	2 h (**theoretical**)
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**7th level/fourth Year**
4. Pre-requisites for this course (if any)**:**	**Quantum Chemistry**
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**	30	100
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	30
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	8
3	**Library**	3
4	**Projects/Research Essays/Theses**	3
5	**Others**(specify) Quizzes and Exam preparation	20
	Total	64

***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

Molecular Spectroscopy course provide the students with the necessary theoretical background of the optical spectroscopic techniques to study physical process in the molecules with emphasis on the absorption techniques.

2. Course Main Objective

By the end of this course student will be able to :

1.describe the fundamental principles of molecular spectroscopy.

2. apply quantitative reasoning and problem-solving skills with quantum chemistry as a context to explain the different types of molecular spectra.
3. develop physical intuition, mathematical reasoning, and problem solving skills.
4. be further prepared for the necessarily rigorous sequence in chemistry courses need the molecular spectroscopy.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Recognize the meaning of Electromagnetic radiation	K2
1.2	Identify the laws of absorption and emission of radiation.	K2
1.3	identify the absorption spectra in the microwave and infrared region	K2
1.4.	Name the types of molecules based on the symmetry of their structures	
1.5	describe how quantum treatment is used to study the rigid rotor and the harmonic oscillator.	K6
1.6	list the different electronic transition in organic compounds in the UV/Vis region using quantum theory.	K6
1.7	recognize the absorption spectra in the Radio wave region	K2
1.8	Recognize classical and qualitative description of the Nuclear magnetic resonance (NMR)	K6
1.9	Define the symmetry –symmetry elements and different symmetry operations – Point groups – retaliation between the symmetry and spectroscopy and the molecular orbital theory	K6
2	**Skills :**	
2.1	apply the laws of absorption and emission of radiation for any kind of radiation	S2
2.2	analyze the spectra of different region of electromagnetic radiation based on quantum chemical and symmetry aspects.	S5
2.3	Compare between classical and qualitative description of the Nuclear magnetic resonance (NMR)	S4
2.4	Apply the symmetry elements and operation on different compounds	S3
3	**Competence:**	
3.1	Manage resources, time and collaborate with members of the group.	C1
3.2	Work effectively both in a team, and independently on solving chemistry problems.	C2
3.3	Communicate effectively with his lecturer and colleagues	C1
3.4	Use IT and web search engines for collecting information**.**	C3

C. Course Content

No	List of Topics	Contact Hours
1	**1-** Introduction to molecular structure and electromagnetic radiation	2
2	**2-** Rotational spectra- Rigid rotor	6

3	**3-** Vibrational spectra – harmonic oscillator	6
4	**4-** Electronic spectra	4
5	**5-** NMR	4
6	**6-** Molecular symmetry and spectroscopy	6
Total		28

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	Recognize the meaning of Electromagnetic radiation	Lecture and web based study	quiz
1.2	Identify the laws of absorption and emission of radiation.	Lecture	quiz
1.3	identify the absorption spectra in the microwave and infrared region	Lecture	exam
1.4.	Name the types of molecules based on the symmetry of their structures	discussion	quiz
1.5	describe how quantum treatment is used to study the rigid rotor and the harmonic oscillator.	Lecture	exam
1.6	list the different electronic transition in organic compounds in the UV/Vis region using quantum theory.	discussion	quiz
1.7	recognize the absorption spectra in the Radio wave region	Lecture	Quiz
1.8	Recognize classical and qualitative description of the Nuclear magnetic resonance (NMR)	Lecture	Quiz
1.9	Define the symmetry –symmetry elements and different symmetry operations – Point groups – retaliation between the symmetry and spectroscopy and the molecular orbital theory	Lecture	exam
2.0	**Skills**		
2.1	apply the laws of absorption and emission of radiation for any kind of radiation	lecture	quiz
2.2	analyze the spectra of different region of electromagnetic radiation based on quantum chemical aspects.	lecture	exam
2.3	Compare between classical and qualitative description of the Nuclear magnetic resonance (NMR)	lecture	quiz
2.4	Apply the symmetry elements and operation on different compounds	lecture	exam
3.0	**Competence**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	Manage resources, time and collaborate with members of the group.	presentation	Observation of group's team work performance
3.2	Use university library and web search engines for collecting information and search about different topics.	project	Write a report
3.3	Work effectively both in a team, and independently on solving chemistry problems.	group discussion	Observation of group's team work performance
3.4	Communicate effectively with his lecturer and colleagues	group discussion	Observation by the instructor
3.5	Use IT and web search engines for collecting information.	presentation	Observation by the instructor

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework or activities.	--	10 %
2	First Periodic Exam.	8	20 %
3	Second Periodic Exam.	14	20 %
4	Final Exam.(2 hours exam)	16	50 %
5	**Total**		100%

***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 :

- **We have faculty members to provide counseling and advice.**
- **Office hours: During the working hours weekly.**
- **Academic Advising for students**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**- I.N. Levine, Molecular Spectroscopy, Wiley Interscience, New York, 1975.**
Essential References Materials	**- W. J. Moore, Physical Chemistry, 5th edition, Longman, 1972.** **- K. Anderson, Fundamental of Molecular Spectroscopy, John Wiley& Sons, 3rd Edition, 1992.**

	- J. Michael Hollas, Modern Spectroscopy, 4th ed. John, Wiley & Sons New York, 2004.
Electronic Materials	• http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• **Classrooms capacity (30) students.** • **Providing hall of teaching aids including computers and projector.**
Technology Resources (AV, data show, Smart Board, software, etc.)	▪ **Room equipped with computer and projector and TV.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• **No other requirements.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	questionnaire (indirect)
Extent of achievement of course learning outcomes	Program Leader	results data analysis (direct) and questionnaire (indirect)
Quality of learning resources	Course instructor	questionnaire (indirect)

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	Dr. Ahmed M. El Defrawy
Reference No.	
Date	

Received by: Dr. Ismail Althagafi **Department Head**

Signature: **Date: 20/12/2019**