هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Quantum Chemistry**
Course Code:	**CHEM 447**
Program:	**Bachelor in Chemistry**
Department:	**Chemistry**
College:	**College of Science**
Institution:	**Jazan University (JU)**

Table of Contents

A. Course Identification

1. Credit hours: 3 Workload: 182 ECTS: 6.5
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: Level 7 / Year 4
4. Pre-requisites for this course (if any)**:** ***Math 202***
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**	**45 CH**	**100%**
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	**45**
2	**Laboratory/Studio**	**0**
3	**Tutorial**	**0**
4	**Others** (specify)	**0**
	Total	**45**

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.*				
Quantum Chemistry	**CHEM 447**	**3**	**-**	**3**	**Fourth Year**	**seventh Level**	**Math 202**

Course objectives: They are to identify the following.

- learning the nature of the classical mechanics as well as its failure to describe microscopic particles
- learning the historical development of the quantum theory and its postulates
- application of quantum theory for H-atom as an example of simple chemical systems

Syllabus: A-Theoretical contents

classical mechanics – black body radiation and photoelectric effect – Hydrogen electronic spectra – Compton-effect – De Broglie relation and dual nature of microscopic particles- Schrödinger equation- solution of SE for a particle in one (two and three) dimensional box – solution of SE for rigid rotor – solution of SE for harmonic oscillator – solution of SE for H-atom.

2. Course Main Objective

This course aims to give students the basic principles quantum theory and its applications on some chemical systems

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Demonstrate a broad knowledge and understanding the course topics as, classical mechanics – black body radiation and photoelectric effect – Hydrogen electronic spectra – Compton-effect – De Broglie relation and dual nature of microscopic particles- Schrödinger equation,	K. 1
1.2	Describe the difference between classical and quantum mechanics, photoelectric effect, the contribution of scientists (Max Planck, Einstein, De Broglie, Heisenberg, Bohr, Balmer, and Schrödinger) to the quantum theory.	K. 2
2	**Skills :**	
2.1	Demonstrate the knowledge and numeracy skills in quantum mechanical solution of the rigid rotor and harmonic oscillator and the validity of the Schrödinger equation to model the particle in a box problem	S. 1
2.4	make effective use of communication, and online technology about quantum chemistry topics in order to improve their basic knowledge in writing (report and paper/ poster) with a good verbal and clear scientific language.	S.4

C. Course Content

No	List of Topics	Contact Hours
1	Historical Development of the quantum theory	12
2	Schrödinger equation	6
3	Postulates of the theory	6
4	Evaluation of the quantum theory	6
5	Applications of the theory	12
6	***Presentation Session***	3
Total		45CH

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	Demonstrate a broad knowledge in the course topics as, classical mechanics – black body radiation and photoelectric effect – Hydrogen electronic spectra – Compton-effect – De Broglie relation and dual nature of microscopic particles-Schrödinger equation,	Lectures, group discussion and assignments	Examinations, tests, quizzes, and assignments
1.2	Describe the difference between classical and quantum mechanics, photoelectric effect, the contribution of scientists (Max Planck, Einstein, De Broglie, Heisenberg, Bohr, Balmer, and Schrödinger) to the quantum theory.	Lectures, group discussion and assignments	Examinations, tests, quizzes, and assignments
2.0	**Skills**		
2.1	Demonstrate the knowledge and numeracy skills in quantum mechanical solution of the rigid rotor and harmonic oscillator and the validity of the Schrödinger equation to model the particle in a box problem	Lectures, Group discussion, Examination and assignments	Examinations, tests, quizzes, and assignments
2.4	make effective use of communication, and online technology about quantum chemistry topics in order to improve their basic knowledge in writing (report and paper/ poster) with a good verbal and clear scientific language.	"research activities / project-based learning / Technology-enabled learning "	assignments and reports / projects / seminars / reports

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment (H.W. 1)**	**5**	**5**
2	**Mid-term exam (MID. 1)**	**8**	**15**
3	**Homework assignment (H.W. 2)**	**11**	**5**
4	**Mid-term exam (MID. 2)**	**14**	**15**
5	**Presentation Session**	**14**	**0**

#	Assessment task*	Week Due	Percentage of Total Assessment Score
6	**Final Exam**	**17**	**60**
	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:

- ***Instructor will be available for academic counseling on daily basis for at 4h/day during office hours.***
- ***The office hours are listed in the instructor time table and delivered to students in the first lecturer in each semester.***
- ***Instructor is available in a WhatsApp group with student.***
- ***E-mail and Telephone number are delivered to student for any help during semesters.***

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• **Molecular Quantum Mechanics, Atkins PW, Friedman RS 4th ed. Oxford: Oxford University Press; 2005.** • **Quantum Chemistry: A Unified Approach, David B. Cook, 2nd Edition, imperial College Press; 2012.**
Essential References Materials	Non
Electronic Materials	• Faculty - Department of Chemistry - Simon Fraser University (sfu.ca) • Chemistry BSc (Hons) - Undergraduate Courses - University of Liverpool • Periodic Table of Elements and Chemistry (chemicool.com) • The Orbitron: a gallery of atomic orbitals and molecular orbitals (shef.ac.uk) • Home | Department of Chemistry (queensu.ca) • 11.2: Quantum Numbers for Electrons - Chemistry LibreTexts • Search - Chemistry LibreTexts
Other Learning Materials	• ***www.wikipedia.org/*** • المعرفة (marefa.org) Courses | Chemistry & Biochemistry | Academics | WPI

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	1 Lecture room(s) for groups of 50 students.

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	Smart board, Data show, Black board, internet
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Chemical Models, scientific videos

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

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