Course Specification
(Bachelor)

Course Title:	**Quantum Chemistry**
Course Code:	**CHM 1342**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammed Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 2 (2, 0, 0)					
2 (2 Lect, 0 Toturial, 0 Lab)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: Level 6/ 3th year					
4. Course general Description:					
This course deals with classical and quantum mechanics, black body radiation, atomic models and spectra, Schrodinger equation, operators, postulates of quantum mechanics, wave functions, particle in 1-D box, rigid rotor and harmonic oscillator.					
5. Pre-requirements for this course (if any)**:**					
MAT 1103 Mathematics for Chemistry – CHM 1242 Physical Chemistry (2)					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					

At the end of the course, Students should be able:

- **To provide students with the basic principles of quantum chemistry.**
- **To acquaint them with some concept of quantum chemistry in contrast with classical mechanics.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	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**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**0**
5.	**Others (specify)**	**0**
Total		**30**

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

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To describe the failure of classical mechanics in contrast to quantum mechanical phenomena.**	**K1; K2; K3;**	**Lecturing**	**Short quizzes**
1.2	**To define concepts relevant to quantum mechanics such as photoelectric effect, wave-particle duality.**	**K1; K2; K3;**	**Solving problems, Homework and assignment**	**Homework and assignment marks and written exams**
1.3	**To recognize the principles of the**	**K1**	**Discussions**	**Quizzes and MCQs**

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	translational motion, particle in a box.			
1.4	To outline the Structure and spectra of hydrogen atomic orbitals and energies of shells and sub shells.	K1; K3	Discussions	Quizzes and MCQs
2.0	Skills			
2.1	• To write the Schrodinger equation in its correct form and develop means of solving wave function equations.	• S1; S2; S3	Lecturing and oral discussion	Short quizzes and Multiples Choice Questions
2.2	• To analyze data and results through analytical thinking, with evaluation of the gained information.	• S1; S2; S3	Lectures	Homework assignment, and Examination
2.3	• To demonstrate ability to do oral communication and technical writing skills through writing and oral presentation of mini-reports, operate electronic mail and Network in communicating with others.	• S3	Lecturing and oral discussion	Examination
2.4	• To demonstrate skills to participate in class by asking questions and giving answers.	• S1; S2; S3	• Seminars • Encourage students to use electronic mailand blackboard to	• Presentation marks • Oral tests • Assignments and homework

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
			submit works and assessments.	
3.0	Values, autonomy, and responsibility			
3.1	To appraise working in groups.	V1, V2	• Group discussion, assignments and homework	• Oral tests, Assignments and homework marks

C. Course Content

No	List of Topics	Contact Hours
1.	**Classical Mechanics:** dawn of quantum mechanics, Black-Body radiation, Photo electric effect, dual nature of light, the uncertainty principle, Bohr model of the atom, spectral series, Rydberg formula for hydrogen spectrum.	10
2.	**Derivation of Schrodinger equation:** Operators and their properties, eigenfunctions and eigenvalues, postulates of quantum mechanics, Particle in 1-D box and Harmonic oscillator.	10
3	**Rigid-rotor model:** hydrogen atoms and hydrogen like atoms wave function, Normalized and orthogonal wave functions, translational motion. Classical and quantum mechanical treatment.	10
Total		30
Topics to be covered (Laboratories)		
No	**List of Experiments**	**Contact hours**
	None	

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam 1	6 th week	20 %
2.	Midterm Exam 2	12 th week	20 %
3.	Quizzes, Home Works, class participation, and mini projects	During the semester	20 %
4.	Final Exam	16-17th week	40 %

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
5.	**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	• ***Physical Chemistry,*** *Sanctuary, K. J. Laidler, J. H. Meiser, B. C., 4th Ed 2003, Houghton Mifflin CompanyISBN: 81-239-0645-5.* • ***Physical Chemistry.*** *Silbey, R., R. Alberty, and M. Bawendi. 4th ed, 2004,: John Wiley & Sons, New York, NY. ISBN: 9780471215042* • ***Physical Chemistry,*** *Ira N. Levine, 5th Edition, McGraw-Hill (ISBN: 0-07-231808-2)*
Supportive References	• ***Physical Chemistry****, Atkins, P. W., and J. de Paula. 8th ed. 2001, Freeman and Company, New York, NY: W.H. (ISBN: 9780716735397)*
Electronic Materials	Blackboard
Other Learning Materials	None

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students. •
Technology equipment (projector, smart board, software)	• The rooms are equipped with data show, Smart Board, WI-FI access.
Other equipment (depending on the nature of the specialty)	• none

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct: Questionnaire.
	Course Responsible	Direct: Course e-Portfolio. Indirect: Second examiner checklist-Course report.
	Peer Reviewer	Direct: Questionnaire. Indirect: External assessor report.
Effectiveness of Students assessment	Program Leaders	Direct: Course e-Portfolio. Indirect: Course report.
Quality of learning resources	Students	Indirect: Second examiner checklist-Course report.
	Faculty (Academic Advisory)	Direct: course Entrance/Exit. Indirect: Observations - Accreditation review.
	Program Leaders	Direct: Course e-Portfolio. Indirect: Course evaluation survey- Observations- Syllabus review- Accreditation review.
The extent to which CLOs have been achieved	Course Responsible	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Lab Performance	None	None

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**COUNCIL OF DEPARTMENT OF CHEMISTRY**
REFERENCE NO.	**7 (NO. 2/3)**
DATE	**29/3/1446 - 2/10/2024**