هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Modern physics 2**
Course Code:	**PHY2402**
Program:	**BSc**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 4hrs
2. Course type a. University ☐ College ☐ Department ☑ Others ☐ b. Required ☑ Elective ☐
3. Level/year at which this course is offered: Level 5/2nd year
4. Pre-requisites for this course (if any): Modern physics 1
5. Co-requisites for this course (if any):

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	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	
4	Others (specify)	
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

The course will cover the principle of Modern physics, such as basic concepts of Quantum Mechanics, Quantum Theory of the Hydrogen Atom, Many-Electron Atoms and Molecules.

2. Course Main Objective

1. Explain that classical mechanics is an approximation of quantum mechanics.
2. Understand how to extract information from a wave function.
3. Explain How boundary conditions and normalization determine wave functions.
4. Understand the quantization of energy and of angular-momentum magnitude and direction.
5. Explain how atoms interact with a magnetic field.
6. Understand the different set of quantum numbers for each electron in an atom.
7. Show how an atom's electron structure determines its chemical behavior.
8. Explain that both magnitude and direction are quantized.
9. Understand the mechanism of the covalent bond
10. Show that a molecule may have many different modes of vibration.
11. Explain how fluorescence and phosphorescence occur.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Explain the electronic spectra of Molecules	K1-I
1.2	Describe the Electron Spin, the exclusion Principle, the Spin-Orbit Coupling and X-Ray Spectra.	K2-I
1.3		K1-I
1.4		K2-I
2	**Skills :**	
2.1	Solve Schrodinger equation for various cases	S1-P
2.2	Relate the atomic structure to bonding in molecules	S2-P
2.3		
3	**Values:**	
3.1	Show responsibility for self-learning to be aware with recent developments in modern physics.	V1-I
3.2	Collaborate with the others to resolve problems.	V2-I

C. Course Content

No	List of Topics	Contact Hours
1	**Quantum Mechanics** Quantum Mechanics, The Wave Equation, Schrodinger's Equation, Linearity and Superposition, Expectation Values, Operators, Schrodinger's Equation: Steady-State Form, Particle in a Box, Finite Potential Well, Tunnel Effect, Harmonic Oscillator.	10
2	**Many-Electron Atoms** Electron Spin, Exclusion Principle, Functions, Periodic Table, Atomic Structures, Explaining the Periodic Table, Spin-Orbit Coupling, Total Angular Momentum and X-Ray Spectra.	10
3	**Molecules** The Molecular Bond, Electron Sharing, The H_2^+ Molecular Ion, The Hydrogen Molecule, Complex Molecules, Rotational Energy Levels, Vibrational Energy Levels, and Electronic Spectra of Molecules.	10
4	**Practical Part:** Students will conduct various experiments in the practical part of the course. Each student will perform the experiment, collect data, extract result, and prepare a written report every week.	10
Total		40

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	Define the Quantum Theory of the Hydrogen Atom.	- Demonstrating the basic principles through lectures. - Discussing phenomena - Lecturing method: Board, Power point - Discussions	a) Quizzes b) Mid- term exam c) Final Exam d) Final practical exam e) Discussions during the lectures. f) Home work.
1.2	Describe the Electron Spin, Exclusion Principle, Spin-Orbit Coupling and X-Ray Spectra		
1.3	Define Hydrogen and Complex Molecules		
1.4	Explain the electronic spectra of Molecules.		
2.0	**Skills**		
2.1	Apply physical principles on physical phenomena.	- Define duties for each chapter, - Encourage the student to look for the information in different references -Ask the student to attend lectures for practice solving problem	1. Midterm's exam. Exams, short quizzes, practical exam 2.Asking about physical laws previously taught 3. Discussions of how to simplify or analyze some phenomena in solids.
2.2	Derive the physical laws and formulas related to the laws of modern physics		
2.3	Analyse the quantitative results.		
3.0	**Values**		
3.1	Show responsibility for self-learning to be aware of recent developments in modern physics.	• Enhance educational skills. • Develop their interest in modern physics. • Encourage the student to attend lectures regularly.	• Evaluate the efforts of each student in preparing the report. • Evaluate the work in team
3.2	Collaborate with the others to resolve problems.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes & Homework	All weeks	10 %
2	Lab. Reports and Exam	End of the term	20%
3	Midterm exam	5^{th}-6^{th} week	20 %
4	Final exam	End of the term	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: Each student will be supervised by an academic adviser in the physics department and the time table for academic advice will be given to the student each semester.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Arthur Beiser, "Concepts of Modern Physics", 6th Edition, McGraw-Hili Priml s, (2003).
Essential References Materials	J. Bernstein, Paul Fishbane and Stephen Gasiorowicz, Modern Physics, (2000, Hardcover).
Electronic Materials	The website of the course.
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms, laboratories .
Technology Resources (AV, data show, Smart Board, software, etc.)	
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
1. Following up the progress of students in the course.	Instructor	Homework & quiz
2. Evaluating the progress of student	Instructor	Questionnaires.
3. Evaluating the instructor	Student	Questionnaires.
4. Revision of Exam paper	Another staff member	Standers of the exam papers

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	
Reference No.	
Date	8/3/2022