هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Quantum Physics-1
Course Code:	2033202-3
Program:	Bachelor in Physics
Department:	Physics Department
College:	College of Science
Institution:	Taif University

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 8th Level/ 3rd Year
4. Pre-requisites for this course (if any)**: 2033102-3 / 2033103-2 / 2033105-4**
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**	5	100%
2	**Blended**	0	0%
3	**E-learning**	0	0%
4	**Distance learning**	0	0%
5	**Other**	0	0%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	50
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify)	0
	Total	50

B. Course Objectives and Learning Outcomes

1. Course Description

General Review. The origin and evolution of quantum mechanics. Concepts of Quantum Mechanics. Applications of Schrodinger equation. Angular Momentum. The Hydrogen Atom.

2. Course Main Objective

*To introduce students to the birth of Quantum Physics by Planck.
*To introduce students to the duality nature of particles and waves.
*To point out the postulates of Quantum Physics and their importance in understanding this new subject, Quantum Physics.
*To draw the attention of students to the main equation in Quantum Physics, SchrÖdinger equation.
*To study applications of SchrÖdinger equation in one-dimension.
*To teach the students the operators and their importance in Quantum Physics and other disciplines.
*To solve the "Hydrogen Atom" problem using SchrÖdinger equation, spherical polar coordinates, and separation of variables.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and understanding**	
1.1	Describe Schrödinger equation and the fundamental postulates of quantum mechanics.	K1
1.2	Understanding the physics of quantum mechanics and their applications	K2
2	**Skills:**	
2.1	Explain physical phenomena and concepts relevant to the course and their applications.	S3
2.2	Solve problems in quantum physics	S2
3	**Values:**	
3.1	Show responsibility for working independently and for continuous improvement of personal capabilities.	V1
3.2	Communicate the physics wealth in Quantum Physics with others.	

C. Course Content

No	List of Topics	Contact Hours
1	General Review: The origin and evolution of quantum mechanics: □ Black body radiation □ Photoelectric effect □ Compton effect □ Hydrogen spectral lines □ De Broglie's hypothesis and the duality nature □ Heisenberg's uncertainty principle □ Wave function and wave packet	6
2	Concepts of Quantum Mechanics: □ Postulates of Quantum Mechanics □ Eigenvalue equation □ Position operator and Linear momentum operator □ Hamilton operator □ Commutator relations □ Hermitian operator □ Expectation value □ Schrödinger wave equation □ Probability density □ Continuity equation	12
3	Applications of Schrödinger equation: □ Free particle □ Particle inside a box (one dimension) □ Potential step □ Potential barrier □ Potential well □ Particle inside a box (two and three dimensions) □ The Harmonic Oscillator	12
4	Angular Momentum: □ Basic properties □ angular momentum operators □ Commutation relations	10

	□ Eigenvalues of angular momentum operators □ Eigenfunctions of angular momentum operators □ Raising and lowering angular momentum operators	
5	The Hydrogen Atom: □ Schrödinger equation □ Spherical polar coordinates □ Separation of variables □ Quantum numbers (good quantum numbers) □ Energy levels □ Wave functions	10
Total		50

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	Describe Schrödinger equation and the fundamental postulates of quantum mechanics.	Lecture	Written exam and Homework reports
1.2	Understanding the physics of quantum mechanics and their applications	Lecture Discussion	Written exam
2.0	**Skills**		
2.1	Explain physical phenomena and concepts relevant to the course and their applications.	Lectures	Written exam and Homework reports
2.2	Solve problems in quantum physics	Problem solving	Written exam; and summarizing research papers
3.0	**Values**		
3.1	Show responsibility for working independently and for continuous improvement of personal capabilities.	Group discussion	Project and Class performance
3.2	Communicate and explain the physics wealth in Quantum Physics- 1 with others.	Groups discussion	Homework reports and projects
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Activities	Periodically	10%
2	Midterm exam	6th	30%
3	Short exam	9th	10%
4	Final exam	12th	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 :

1. 6 Hours per week during office hours, in the instructor's office or by appointment.
2. Also teaching staff are available for individual student consultations during office hours.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1) R. L. Liboff ; Introductory Quantum Mechanics; Addison-Wesley Publishing Company, Massachusetts, (1980).
Essential References Materials	2) S. Gasiorowicz , Quantum Physics, John Wiley and Sons, New York (1974).
Electronic Materials	http://hyperphysics.phy-astr.gsu.edu/
Other Learning Materials	MATHEMATICA, MATHLAB

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture room with max 60 seats
Technology Resources (AV, data show, Smart Board, software, etc.)	data show, Smart Board, software
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student Feedback on Effectiveness of Teaching	Students	Indirect
Evaluation of Teaching	Pear reviewer Program coordinator Departmental council Faculty council	Indirect
Improvement of Teaching	Program coordinator Relevant committee	Direct

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Quality of learning resources	Students Instructor Faculty	Indirect
Extent of achievement of course learning outcomes,	Program coordinator Instructor	Direct
Course effectiveness and planning for improvement	Program coordinator Instructor	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	Department Council / Committee of academic development
Reference No.	
Date	October 2, 2022