هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification

(Bachelor)

Course Title:	Quantum Physics-1
Course Code:	2033202-3
Program:	BSc. of Physics
Department:	Physics
College:	Science
Institution:	Taif University
Version:	*Course Specification Version Number*
Last Revision Date:	15/10/2023

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3 hrs)					
2. Course type					
A.	☐University	☐College	☐Department	☐Track	Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (6th Level / 3rd Year)					
4. Course general Description:					
General Review. The origin and evolution of quantum mechanics. Concepts of Quantum Mechanics. Applications of Schrodinger equation. Angular Momentum. The Hydrogen Atom.					
5. Pre-requirements for this course (if any):					
Mathematical Physics (1) 203321-3 and Classical Mechanics (2) 203322-2					
6. Co-requisites for this course (if any):					
None					
7. Course Main Objective(s):					

- **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.**
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2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3	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**	45
2.	**Laboratory/Studio**	--
3.	**Field**	--
4.	**Tutorial**	--
5.	**Others (specify)**	--
Total		45

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	State and clarify the course elements and their importance in other disciplines and research.	K1	Lecture	Written exam and Homework reports
1.2	Recognize and taste the physical meanings in the course elements and all related 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	Justify the necessity of this course in other disciplines, and for higher level courses.	S2	Groups discussion	Written exam; and summarizing research papers
3.0	**Values, autonomy, and responsibility**			
3.1	Show responsibility for working independently and for continuous improvement of personal capabilities.		Group discussion	Project and Class performance
3.2	Communicate the physics wealth in Quantum Physics-1with others.		Groups discussion	Homework reports and projects

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	3
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 ▪ Eigenvalues of angular momentum operators ▪ Eigenfunctions of angular momentum operators ▪ Raising and lowering angular momentum operators	9
5	The Hydrogen Atom: ▪ Schrödinger equation ▪ Spherical polar coordinates ▪ Separation of variables ▪ Quantum numbers (good quantum numbers) ▪ Energy levels ▪ Wave functions	9
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments and Interaction during lectures	continuous	10%
2.	First Midterm exam	8th	20%
3.	Second Midterm exam	13th	20%
4.	Final exam	17th	50%

*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	R. L. Liboff; Introductory Quantum Mechanics; Addison-WesleyPublishingCompany, Massachusetts, (1980).
Supportive References	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. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture room with max 60 seats
Technology equipment (projector, smart board, software)	data show, Smart Board, software
Other equipment (depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	None	None
Effectiveness of Students assessment	Department	Indirect
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Program leaders	Direct
Other (Improvement of Teaching)	Program leaders	Direct

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	PHYSICS DEPARTMENT COUNCIL
REFERENCE NO.	NO. 4-45
DATE	27/09/2023 (12/03/1445)

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Physics Department
TU
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