هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	**Quantum Mechanics II**
Course Code:	**451Phys**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**
Version:	**2022**
Last Revision Date:	**22/12/2022**

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	3 hours				
2. Course type					
a.	University ☐	College ☐	Department☒	Track☐	Others☐
b.	Required ☒	Elective☐			
3. Level/year at which this course is offered: 11/YEAR 4		Level 11/4Year			
4. Course General Description This course is the continuation of Quantum Mechanics1. It mainly encompasses approximation techniques such as perturbation theory, variational principle, WKB method and Born approximation. These approximation techniques will be applied to calculate the energy and wave corrections to the perturbed simple harmonic oscillator, relativistic correction to the hydrogen atom and to study the interaction of radiation with matter and scattering.					
5. Pre-requirements for this course (if any): 352Phys					
6. Co- requirements for this course (if any): NA					
7. Course Main Objective(s) **This course is designed to provide students with the following:** - the formulation of quantum mechanics that can be used in obtaining the first and second order energy and wave function corrections for non degenerate and degenerate cases. - the transition probabilities for a two-level system using time-dependent perturbation theory, approximately obtain the lowest ground state energy by optimizing variational parameters of the trial function, and generating scattering amplitudes and cross sections using Born-approximation.					

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	30	91%
2.	E-learning		
3.	Hybrid • Traditional classroom • E-learning	3	9%
4.	Distance learning		

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	3
5.	Others (specify)	
	Total	33

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

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	**Discuss** the basics of the formulation of quantum theory	PLO1.1	Lectures, discussion comparisons	**Direct** (formative and summative): In-class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**Describe** the absorption, stimulated emission, and spontaneous emission processes, the idea of variational principle, perturbation theory, quantum tunneling and quantum scattering.	PLO1.2	Lectures, discussion	**Direct** (formative and summative): In-class interactive questioning, quizzes, written exams **Indirect:** student survey
…				
2.0	Skills			
2.1	**Derive** the first and second order energy and wave function corrections using time-independent perturbation techniques, the expectation value of the Hamiltonian and show it is always greater or equal to the ground state energy using the variational technique.	PLO2.2	Lectures, discussion	**Direct** (formative and summative): In-class interactive questioning, quizzes, written exams **Indirect:** student survey

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
2.2	**Obtain** the transition probabilities for two-level system using time-dependent perturbation theory. cat and cbt for two-level system using time-dependent perturbation.	PLO2.2	Lectures, discussion, Tutorial	**Direct** (formative and summative): In-class interactive questioning, quizzes, written exams **Indirect:** student survey
2.3	**Calculate** the first and second order energy and wave function corrections,the lowest ground state energy using variational technique and the fact that the ground state energy is the lowest possible energy.	PLO2.1	Lectures, discussion, Tutorial	**Direct** (formative and summative): In-class interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Estimate** the energy using the WKB approximation for some selected potentials, the total cross section of selected system using scattering theory.	PLO2.1	Lectures, discussion, Tutorial	**Direct** (formative and summative): In-class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	Values, autonomy, and responsibility			
3.1	**Develop** skills of working in groups in group assignments and discussions and bear individual	PLO3.1	Discussion, question, and answer	**Direct** (formative and summative): In-class interactive

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
	responsibility in the assigned tasks			questioning, quizzes, written exams **Indirect:** student survey
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Time-independent perturbation theory	8
2.	Time-dependent perturbation theory	8
3	The Variational method	8
4	The WKB approximation	4
5	Born approximation (The Scattering theory)	5
Total		33

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Mid-term exam**	6	20%
2.	**Assessment tasks**	Distributed	30%
3.	Final exam	12	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	D. J. Griffiths, "Introduction to Quantum Mechanics," 2nd Edition, Pearson Prentice Hall, Upper Saddle River, New Jersey, 2005.
Supportive References	**Introductory Quantum Mechanics; R. Liboff, 4th Edition, Addison-Wesely, 2002.** **• Quantum Mechanics; Sara M. McMurry, Addison-Wesely, 1994.**
Electronic Materials	quantummechanics.com ; quantum/Fayman.com
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (projector, smart board, software)	Data show- smart board
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, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	
The extent to which CLOs have been achieved	Students, Faculty members	Direct/ Indirect
Other		Indirect

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	DEPARTMENT BOARD
REFERENCE NO.	PHYS2304
DATE	28/2/2023

Approved by:

Head of Physics Department

Dr. Hussain Alathlawi