هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	Quantum Mechanics II
Course Code:	**451PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan 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: Level 7/ Year 4
4. Pre-requisites for this course (if any)**: 352 PHYS**
5. Co-requisites for this course (if any)**: NIL**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	39	87%
2	Blended	6	13%
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	45
2	Laboratory/Studio	--
3	Tutorial	
4	Others (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course 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 perturbed simple harmonic oscillator, relativistic correction to hydrogen atom and to study interaction of radiation with matter and scattering.

2. Course Main Objective

This course is designed to provide students with:

- the formulation of quantum mechanics that can be used in obtaining the first and second order energy and wave function corrections for nondegenerate and degenerate cases.
- the transition probabilities for two-level system using time-dependent perturbation theory, approximately obtain the lowest ground state energy by optimizing variational parameters of

the trial function, and generate scattering amplitudes and cross sections using Born approximation.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Discuss** basics of the formulation of quantum theory	**PLO1.1**
1.2	**Describe** stimulated emission and spontaneous emission processes	**PLO1.1**
2	**Skills :**	
2.1	**Obtain** the transition probabilities for two-level system using time-dependent perturbation	**PLO2.2**
2.2	**Estimate** the lowest ground state energy using variational technique and the fact that the ground state energy is the lowest possible energy.	**PLO2.1**
2.3	**Calculate** the first and second order energy and wave function corrections	**PLO2.1**
2.4	**Derive** the first and second order energy and wave function corrections using time-independent perturbation techniques	**PLO2.2**
2.5	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
3	**Values:**	
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	Short review of quantum formulation	**3**
2	Time-dependent perturbation theory	**9**
3	Time-independent perturbation theory	**9**
4	The Variational method	**9**
5	The WKB approximation	**6**
6	Born approximation (The Scattering theory).	**6**
7	Review	**3**
Total		**45**

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	**Discuss** basics of the formulation of quantum theory	Lectures, discussion comparisons	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**Describe** stimulated emission and spontaneous emission processes	Lectures, discussion	**Direct** (formative and summative): In class

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Obtain** the transition probabilities for two-level system using time-dependent perturbation	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.2	**Estimate** the lowest ground state energy using variational technique and the fact that the ground state energy is the lowest possible energy.	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	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Derive** the first and second order energy and wave function corrections using time-independent perturbation techniques	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.5	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	Discussion, question and answer	**Direct** In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	Discussion, question and answer	**Direct** In class interactive questioning, quizzes, written exams **Indirect:** student survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Assignment 1**	**3**	**4** (4%)
2	**First Mid-term exam**	**6**	**10** (10%)
3	**Assignment 2**	**9**	**3** (3%)
4	**Second mid-term exam**	**10**	**15** (15%)
5	**Assignment-3**	**13**	**3** (3%)
6	**Third-mid term**	**14**	**15** (15%)
9	**Final Exam**	**16**	**50** (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 group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Introduction to quantum mechanics, David J. Griffiths, Printice Hall, 1995.**
Essential References Materials	**Introductory Quantum Mechanics; R. Liboff, 4th Edition, Addison-Wesely, 2002.** • **Quantum Mechanics; Sara M. McMurry, Addison-Wesely, 1994.**
Electronic Materials	www.wikipedia.org; quantummechanics.com ; quantum/Fayman.com
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart boar
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
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	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**
Reference No.	**8**
Date	**1442/4/16**