TISHK INTERNATIONAL UNIVERSITY
FACULTY OF EDUCATION
Department of PHYSICS EDUCATION,
2022-2023 Spring
Course Information for PHYS 406 QUANTUM PHYSICS

Course Name:	QUANTUM PHYSICS

Code	Regular Semester	Theoretical	Practical	Credits	ECTS
PHYS 406	8	3	-	3	4

Name of Lecturer(s):	Azeez Abdullah Azeez
Teaching Assistant:	None
Course Language:	English
Course Type:	Main
Office Hours	Tuesday-Thursday by appointment
Contact Email:	azeez.abdullah@tiu.edu.iq Tel:07504542010
Teacher's academic profile:	B.Sc in Physics Salahaddin University-Erbil 1998 M.Sc in Superconductivity Salahaddin University-Erbil 2004 Ph.D in Materials Science Leicester University, Leicester,UK 2014
Course Objectives:	The course first introduces the emergence of Quantum Mechanics. Then it introduces Schrödinger equations with solutions in simple potentials, including harmonic oscillator, spherically symmetric potentials with hydrogen-like atoms. Proverbs of quantum mechanics are introduced; Dirac notation and Heisenberg matrix representation of quantum mechanics is discussed together with approximate methods (variation method, perturbation theory, Born approximations). Program covers spin and angular momentum representations and addition rules and identical particles treatment.
Course Description (Course overview):	This is the first course in the undergraduate Quantum Physics sequence. It introduces the basic features of quantum mechanics. It covers the experimental basis of quantum physics, introduces wave mechanics, Schrödinger's equation in a single dimension, and Schrödinger's equation in three dimensions.

COURSE CONTENT

Week	Hour	Date	Topic
1	3	29/1-2/2/2023	General Introduction
2	3	5-9/2/2023	The emergence of Quantum Mechanics
3	3	12-16/2/2023	Black Body Radiation
4	3	19-23/2/2023	The Failure of Classical Mechanics and Wave-Particle Duality
5	3	26/2-2/3/2023	Wave-packets and uncertainty principle
6	3	5-9/3/2023	Wave function
7	3	12-16/3/2023	Models of Atoms
8	3	19-23/3/2023	Quantum Mechanical Model of Atom
9	3	26-30/3/2023	Schrodinger equation
10	3	2-6/4/2023	Midterm Exam
11	3	9-13/4/2023	Expectation values
12	3	16-20/4/2023	wave-particle duality
13	3	23-27/4/2023	Hydrogen Atom
14	3	30/4-4/5/2023	Free particles and step potentials
15	3	7-11/5/2023	Barrier potential and tunneling
16	3	14-18/5/2023	Bound states and Harmonic Oscillator
17	3	21-25/5/2023	Tunneling microscope
18	3	28/5-1/6/2023	Final Exam
19	3	4-8/6/2023	Final Exam

COURSE/STUDENT LEARNING OUTCOMES

1	Understanding the emergence of Quantum Mechanics and the failure of Classical Mechanics.
2	How particle behavior in the microscopic world differs from the one in the macroscopic world
3	Applying principles of quantum mechanical to calculate observables on known wave functions.
4	Solving Schrödinger equation for simple potentials.
5	Apply variation method, time-independent perturbation theory and time-dependent perturbation theory (first order) to solve simple problems.

COURSE'S CONTRIBUTION TO PROGRAM OUTCOMES
(Blank : no contribution, I: Introduction, P: Profecient, A: Advanced)

	Program Learning Outcomes	Cont.
1	Discuss concepts and principles of physics.	P
2	Conduct proper experiments safely and interpret the data in physics teaching physics.	P
3	Use the results of recent education and subject-specific developmental research when designing, implementing and justifying their own practice as a teacher.	P
4	Apply analytical and theoretical skills to model and solve physics problems.	P

5	Identify students' misconceptions and deal with them in classroom.	P
6	Prepare physics lessons with appropriate learning materials and teaching methods.	P
7	Effectively assess, plan, teach, organize, and manage physics classrooms.	P
8	Use appropriate methods and techniques to improve students' critical thinking, creative thinking and problem-solving skills in physics.	
9	Use required modern methods and techniques for student-centered teaching by considering individual and cultural differences of students.	
10	Effectively use a variety of teaching technologies and techniques and classroom strategies to foster student learning.	
11	Communicate effectively and work collaboratively within the context of a global society.	
12	Exhibit character and decision-making skills embodying professionalism and ethical behavior.	

Prerequisites (Course Reading List and References):	*Key references: 1. Quantum Physics (3rd edition), by Stephen Gasiorowicz.2003 *Useful references: 2. Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles" by Robert & Eisberg. 3.Quantum Mechanics Concepts and Applications Nouredine Zettili 2005 *Magazines and review (internet): https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2013/
Student's obligation (Special Requirements):	1- Students must turn off all cell phones and pagers when entering any classroom. 2-There will be a homework which is important for developing an understanding of the course material due (almost) every week. All homework has equal weight. You must hand in your own work and put the explanation in your own words. 3- Questions in lecture are always good, and are strongly encouraged. 4- I strongly encourage collaboration, an essential skill in science, by making a presentation writing a report and so on. 5- After each assignment handling there will be a very short quiz covering the material in class.
Course Book/Textbook:	My Quantum Mechanics booklet
Other Course Materials/References:	Related webpages from internet https://www.britannica.com/science/quantum-mechanics-physics
Teaching Methods (Forms of Teaching):	Lectures, Exercises, Presentation, Project, Assignments, , ,

COURSE EVALUATION CRITERIA

Method	**Quantity**	**Percentage (%)**
Seminar	1	10
Attendance	1	10
Quiz	1	10
Homework	1	10
Presentation	1	10
Presentation	1	10
Final Exam	1	40
Total		**100**

Examinations: Essay Questions, Fill in the Blanks, Multiple Choices, Short Answers, , ,

Extra Notes:

ECTS (ALLOCATED BASED ON STUDENT) WORKLOAD

Activities	**Quantity**	**Workload Hours for 1 quantity***	**Total Workload**
Theoretical Hours	19	3	57
Practical Hours	19	0	0
Final Exam	1	16	16
Seminar	1	16	16
Attendance	1		0
Quiz	1		0
Homework	1		0
Presentation	1		0
Presentation	1		0
Total Workload			**89**
ECTS Credit (Total workload/25)			**4**

Peer review

Signature:	Signature:	Signature:
Name:	Name:	Name:
Lecturer	Head of Department	Dean