THE FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE

Department of Physics

PHY 305 - Introduction to Use of Computers in Natural Resources

COURSE PARTICULARS

Course Code: PHY 501
Course Title: Quantum Mechanics 2
No. of Units: 3
Course Duration: Two hour of theory and one hour of tutorial per week for 15 weeks.
Status: Compulsory
Course Email Address: PHY501@gmail.com
Course Webpage: http://www.fwt.futa.edu.ng/courseschedule.php?coursecode=FWT%20204
Prerequisite: PHY 401

COURSE INSTRUCTORS

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COURSE DESCRIPTION

This course introduces application of Quantum mechanics. It covers approximate solutions to quantum mechanical equations, introduces the perturbation methods and the rules governing electronic transitions. It also covers application of quantum mechanics to selected phenomena like atomic physics, molecular physics and solid state physics.

COURSE OBJECTIVE

The objectives of this course are to:

- introduce students to applied modern physics
- provide students with opportunities to develop basic advanced physics skills necessary for solving real life quantum mechanical problems.

COURSE LEARNING OUTCOMES / COMPETENCIES

Upon successful completion of this course, the student will be able to:
(Knowledge based)

- understand the purpose and use of mathematical tools of quantum mechanics;
- understand the use of Approximation Methods for Stationary States solution in quantum mechanics;
- understand the Time-Dependent Perturbation Theory as applied to quantum mechanics;
- understand the Scattering Theory as applied to quantum mechanics;

(Skills)

- applying mathematical and physics skills to solve modern physic problems

GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

Class Attendance	5%
Assignments	5%
Test(s)	30%
Final Examination	60%
TOTAL	**100%**

GENERAL INSTRUCTIONS

Attendance: It is expected that every student will be in class for lectures and also participate in all practical exercises. Attendance records will be kept and used to determine each person's qualification to sit for the final examination. In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible with any of the instructors, indicating the reason for the absence.

Academic Integrity: Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances are prohibited. You are not allowed to make copies of another person's work and submit it as your own; that is plagiarism. All cases of academic dishonesty will be reported to the University Management for appropriate sanctions in accordance with the guidelines for handling students' misconduct as spelt out in the Students' Handbook.

Assignments and Group Work: Students are expected to submit assignments as scheduled. Failure to submit an assignment as at when due will earn you zero for that assignment. Only under extenuating circumstances, for which a student has notified any of the instructors in advance, will late submission of assignments be permitted.

Code of Conduct in Lecture Rooms and Laboratories: Students should turn off their cell phones during lectures. Students are prohibited from engaging in other activities (such as texting, watching videos, *etc*.) during lectures. Food and drinks are not permitted in the laboratories.

READING LIST

[1] Nouredine Zettili (2009). Quantum Mechanics Concepts and Applications. Second Edition. John Wiley and Sons, Ltd., Publication, USA. 692p.

[1] Alastair I. M. Rae (2002). Quantum Mechanics. Fourth Edition, IOP Publishing Ltd, UK 295p.

[2] David K Ferry (2001). *Quantum Mechanics An Introduction for Device Physicists and Electrical Engineers*. Second Edition. IOP Publishing Ltd. 295p, UK. 355p.

Legend
1- Available in the University Library
2- Available as Personal Collection

COURSE OUTLINE

Week	Topic	Remarks
1	Time-Independent Perturbation Theory	During this first class, the expectation of the students from the course will also be documented.
2 & 3	• Nondegenerate Perturbation Theory • Degenerate Perturbation Theory • Fine Structure and the Anomalous Zeeman Effect	Tutorial session will be introduced.
4 & 5	The Variational Method • Theory • The ground state of Helium • The hydrogen molecule ion	
6	The Wentzel–Kramers–Brillouin Method • General Formalism • Bound States for Potential Wells with No Rigid Walls • Bound States for Potential Wells with One Rigid Wall • Tunneling through a Potential Barrier	
7 & 8	Time-Dependent Perturbation Theory • Transition Probability • Transition Probability for a Constant Perturbation • Transition Probability for a Harmonic Perturbation	MID-SEMESTER TEST
9 & 10	Adiabatic and Sudden Approximations • Adiabatic Approximation • Sudden Approximation	

11 & 12	Scattering Theory • Scattering and Cross Section • Scattering Amplitude of Spin-less Particle • The Born Approximation • Partial Wave Analysis • Scattering of Identical Particles	
13 & 14	Application of the perturbation methods to selected phenomena like atomic physics, molecular physics and solid state physics.	
15	REVISION	This is the week preceding the final examination. At this time, evaluation will be done to assess how far the students' expectations for the course have been met.