University of Management and Technology

School of Science (SSC)

Department of Physics

Course Code: PH-308
Course Title: Quantum Mechanics-II
Program: BS (PH/Math)

Course Outline (Spring 2021)

Lecture Schedule	Monday-Thursday (12:30 – 1:45)	Pre-requisite	Quantum Mechanics-II
Course Instructor	Dr. Tanvir Hussain	Contact	tanvir.hussain@umt.edu.pk
Course Description	Schrodinger equation in 3D: Canonical commutation relations for p and r, Separation of variables, The Angular Equation: Lagendre polynomials and Spherical Harmonics The Radial Equation, Infinite spherical well, The Hydrogen Atom: Bohar's formula by solving Schrodinger equation Hydrogen atom wave functions, Angular Momentum: L_z and L^2 commutation relations, Eigen values and eigenvectors of L_z and L^2 Th spin angular momentum: spin-1/2 spinors and Pauli matrices. Addition of Angular Momentums, Two particle systems, Complete Hamiltonian of atom, The periodic table, Free electron gas theory for solids, Band structure, Non degenerate perturbation theory, degenerate perturbation theory, Spin orbit coupling, The Zeeman effect, Hyper fine splitting, The variational principle, The ground State Helium, Time dependent perturbation theory, Emission and absorbation of radiations, Spontaneous emission, The adiabatic approximation, Scattering phenomenon		
Expected Outcomes	After successfully completing this course the student will: • Appreciate the fundamental structure of quantum physics. • Appreciate the great success that quantum mechanics has had in explaining nature. • Be able to apply the mathematical framework of quantum mechanics to physical situation. • Be adept at the use and understanding of mathematical formulation of quantum theory.		
Textbook	David J. Griffiths, "Introduction to Quantum Mechanics", 2nd Ed. Pearson, 2004.		
Reference Books	N. Zettili, "Quantum Mechanics: Concepts and Applications", 2nd Ed. Wiley, 2009 R. Shankar, "Principles of Quantum Mechanics", 2nd Ed. 1994		
Assignments	Problems will be assigned at regular intervals an assignment.	Quizzes	All quizzes will be announced well before time. No make-ups will be offered for missed quizzes.
Mid Term Examination	A 60-minutes exam will cover all the material covered during the first half of the semester.	Final Examination	A 120-minutes exam will cover all the material covered during the semester.
Attendance Policy	Students missing more than 20% of the lectures will receive an "SA" grade in the course and will not be allowed to take final exam.		

Department of Physics
Quantum Mechanics I
(PH-308)

Lecture Plan (Fall 2019)

Week	TOPICS	CH
1	Schrodinger equations in spherical coordinates	4.1
2	The Angular equation The radial equation	4.1.1 4.1.2
3	The radial equation The hydrogen atom	4.1.2 4.2
4	The hydrogen atom The angular momentum	4.2 4.3
5	Spin Addition of angular momentum	4.4 4.4.3
6	Two particle system (Fermions and Bosons) Exchange Forces and atoms	5.1 5.1.2 5.2
7	The free electron theory for solids Band Structure	5.3.1 5.3.2
8	Nondegenerate perturbation theory Degenerate perturbation theory	6.2.1 6.2.2
9	Spin-Orbit Coupling The Zeeman Effect	6.3.2 6.4
10	Hyperfine Structure The variational Principle -Theory	6.5 7.1
11	Ground State Helium The Hydrogen molecule ion	7.2 7.3
12	Time dependent perturbation theory-Two level systems Time dependent perturbation theory	9.1 9.1.2
13	Emission and absorption of radiations Emission and absorption of radiations	9.2 9.2
14	Spontaneous emission The adiabatic approximation	9.3 10.1
15	Scattering-Introduction Phase shifts	11.1 11.3