جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Applied Quantum Mechanics - MSE 304

Division	Physical Science and Engineering Division
Course Number	MSE 304
Course Title	Applied Quantum Mechanics
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	01:00 PM - 02:30 PM | Sun Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Aurelien Christophe Francois M. Manchon	aurelien.manchon@kaust.edu.sa	+966128084410	3232, 3, Ibn Sina (bldg. 3)	Upon appointment

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	Introduction to non-relativistic quantum mechanics. Summary of classical mechanics and electrodynamics. Postulates of quantum mechanics, wave functions, operator formalism and Dirac notation. Stationary state problems, including quantum wells and tunneling. Harmonic oscillator. Time evolution. Approximation methods for time-independent as well as time-dependent interactions.
Course Description from Program Guide	Introduction to nonrelativistic quantum mechanics. Summary of classical mechanics and electrodynamics. Postulates of quantum mechanics, wave functions, and operator formalism. Stationary state problems, including quantum wells. Harmonic oscillator. Angular momentum and spin. Atoms, molecules, and band theory of solids. Time evolution, Approximation methods for time-independent as well as time-dependent interactions, including electromagnetism. Scattering theory. Modern applications.
Goals and Objectives	-Objective 1: The student will be able to **formulate and explain** fundamental concepts of quantum mechanics -Objective 2: The student will learn to **Solve** Schrodinger equation to **obtain** eigenvectors and energies -Objective 3: The student will learn to **calculate** and **describe** the propagation of a particle in a simple, 1 dimensional potential -Objective 4: The student will learn to **calculate** a Transition Rate by **applying** perturbation theory
Required Knowledge	The student should know about Fourier Transform, Taylor series expansion, basic matrix manipulation, 1st and 2nd order differential equations, as well as standard classical mechanics and electrostatics.
Reference Texts	A.F.J. Levi, *Applied Quantum Mechanics*, Second Edition, Cambridge University Press, ISBN-13 978-0-521-86096-3 ISBN-10 0-521-86096-2
Method of evaluation	**30.00**% - Final exam **30.00**% - Midterm exam **40.00**% - Homework /Assignments

Nature of the assignments	There will be four homework amounting for 10% of the total grade each. Each homework consists of sets of problems. Students are usually given two weeks to solve these problems and hand over a written report.
Course Policies	The students are expected to attend all classes and to hand over the homeworks on time. No deadline extension will be granted.
Additional Information	

Tentative Course Schedule
(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 01/22/2017 Thu 01/26/2017	Introduction - Chapter 2.1 Bohr Atom & De Broglie Model - Chapter 2.2
2	Sun 01/29/2017 Thu 02/02/2017	Schrodinger Equation - Chapter 2.2 Wave-packet evolution - Chapter 2.2
3	Sun 02/05/2017 Thu 02/09/2017	Quantum Well I - Chapter 3 Quantum Well II - Chapter 3
4	Sun 02/12/2017 Thu 02/16/2017	Current Flow - Chapter 3 Particle Tunneling - Chapter 3
5	Sun 02/19/2017 Thu 02/23/2017	Kronig-Penney Potential - Chapter 4
6	Sun 02/26/2017 Thu 03/02/2017	Resonant Tunneling - Chapter 4
7	Sun 03/05/2017 Thu 03/09/2017	Midterm exam The Postulates of Quantum Mech. - Chapter 5
8	Sun 03/12/2017 Thu 03/16/2017	Eigenstates, Operators & Dirac Notation - Chapter 5 Uncertainty Principle - Chapter 5
9	Sun 03/19/2017 Thu 03/23/2017	Eigenstates and Operators - Chapter 5 Fermions and Bosons - Chapter 7
10	Sun 03/26/2017 Thu 03/30/2017	Density of States - Chapter 5 The Harmonic Oscillator - Chapter 6
11	Sun 04/02/2017 Thu 04/06/2017	The Harmonic Oscillator - Chapter 6
12	Sun 04/09/2017 Thu 04/13/2017	The Harmonic Oscillator - Chapter 6 The Hydrogen Atom - Chapter 11
13	Sun 04/16/2017 Thu 04/20/2017	The Hydrogen Atom - Chapter 11
14	Sun 04/23/2017 Thu 04/27/2017	TI-Perturbation Theory - Chapter 10
15	Sun 04/30/2017 Thu 05/04/2017	TI-Perturbation Theory - Chapter 10 TD-Perturbation Theory - Chapter 8
16	Sun 05/07/2017 Thu 05/11/2017	
17	Sun 05/14/2017 Thu 05/18/2017	
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Note

The instructor reserves the right to make changes to this syllabus as necessary.