Course Syllabus

Last updated: 8/22/16

Course Information

(course number, course title, term, any specific section title)

Physics 6300-001 Quantum Mechanics I Fall 2016

Tues Wed Thurs 11:30PM-12:45 PM Room: PHY 1.103

Professor Contact Information

(Professor's name, phone number, email, office location, office hours, other information)

Prof. J. M. Izen Office: PHY 1.612 (972) 546 2540 joe@utdallas.edu

Office hours: Wednesday and Thursday, right after class.

Prof. Izen's office is a gun exclusion zone. Please wait at his office door for the oral notification required under state law and university policy before entering.

Teaching Assistant: Matthew Maisberger Office: PHA 1.107 mxm111131@utdallas.edu

Office hours: Monday 10 – 12 PM

Course Pre-requisites, Co-requisites, and/or Other Restrictions

(including required prior knowledge or skills)

An undergraduate quantum mechanics course at the level of Chapters 1 – 4 of Introduction to Quantum Mechanics by David Griffiths (probability density; linear algebra; fundamental principles of quantum theory, application to one and three dimensional systems under various potentials; free particle; bound particle; harmonic oscillator, angular momentum, addition of angular momentum, hydrogen atom). Phys 6300 is not intended as a first course in Quantum Mechanics (QM). Students without the proper preparation are encouraged to audit or register for Phys 4301, a first undergraduate QM course offered during the spring semester. Students should be familiar with Hamiltonian and Lagrangian formulations of classical mechanics, canonical transformations, and Hamilton–Jacobi theory for the fullest appreciation of the postulates of QM.

Course Description

Graduate QM I revisits the fundamentals, formalisms, and approximate techniques of QM in greater depth than is offered in an undergraduate course. The follow-on course, Grad QM II (Physics 6301) places a greater emphasis on applications. Material for Phys 6300 will be drawn from Chapters 1, 2, and 3 of Sakurai. If time permits, material from Chapter 4 will be included. The class will be asked to review some topics previously covered in undergraduate quantum mechanics independently.

Topics: Dirac formalism, kets, bras, operators and position, momentum, and matrix representations, change of basis, Stern-Gerlach experiment, observables and uncertainty principle, translations, wave functions, time evolution, the Schrödinger and Heisenberg pictures, simple harmonic oscillator, wave equation, WKB approximation, Feynman path integrals, rotations, angular momentum, spin, Clebsch-Gordan coefficients, tensor operators. Symmetry, as time permits.

Student Learning Objectives/Outcomes

Students will master the use of bra-ket notation that is common in physics literature, and will be able to articulate the difference between abstract states and operators and the representations of states and operators as wave functions in position or momentum space and matrix representations. Students shall be able to articulate the differing treatments of time dependence in the Schrödinger and Heisenberg pictures. A mastery of problem solving techniques from this class will prepare students for research problems they will encounter in their laboratories and in scientific literature.

Required Textbooks and Materials

Modern Quantum Mechanics, 2nd edition by J. J. Sakurai.
Introduction to Quantum Mechanics, 2nd Edition by David Griffiths
If you already own the 1st edition of Griffiths and/or the 1st edition (revised) of Sakurai, consult with Prof. Izen before replacing it with the 2nd edition.

Suggested Course Materials

Additional References that some students may find useful:
Principles of Quantum Mechanics, 2nd Edition by R. Shankar – a popular grad, QM text
Lectures on Quantum Mechanics by Gordon Baym – an older graduate-level text with a chatty style

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Assignments & Academic Calendar

(Topics, Reading Assignments, Due Dates, Exam Dates)

Mastering quantum theory requires that you flex your mathematical and philosophical muscles. Homework problems will be assigned from Sakurai, Griffiths, and additional sources. Assignments and other important course announcements will be posted via a WWW based discussion Yahoo®!Group typically by Thursday or Friday of each week. Please join the group by sending an email to phys6300–subscribe@yahoogroups.com and then follow the instructions in the return email. To unsubscribe your email, use phys6300–unsubscribe@yahoogroups.com. You may choose to read and send postings by email or via the WWW at http://groups.yahoo.com/group/phys6300/. It is your responsibility to join the group and check for postings. The Yahoo®!Group is also intended to be a discussion/question/answer forum for the class. You are expected to keep posts on topic, following commonly accepted practices of nettiquette.

Homework normally is to be turned in at the start of class on Tuesday. Exceptions will be clearly posted with the assignment. Your work should be neat, problems should be ordered, and pages should be **stapled**. Optionally, students may email a scan of their HW solution to the TA by the normal deadline.

Students may work on homework problems except "what is the underlined term" questions with classmates, but each student is required to write up his/her answers independently without consulting the team solution. Outright copying of a solution is NOT permitted. You are required to write all collaborating team members' names at the start of the problem. Failure to disclose all members of a collaborating homework group will be treated as plagiarism. I recognize that some students will master this material better by working in peer groups, however I reserve the right to restrict homework collaboration at my discretion. If you need additional help, you *should* be discussing the problem with the course TA or the instructor. Consulting or even having a solution key from a publisher, a former student, or any other source is expressly forbidden.

Grading Policy
(including percentages for assignments, grade scale, etc.)
Individual Homework problems are usually given equal weight and are graded on a 10 point scale. Homework will count towards 15% of the course grade. Exams will count for 85% of the course grade. There will a midterm exam and a final exam, each carrying equal weight.

Course & Instructor Policies
(make-up exams, extra credit, late work, special assignments, class attendance, classroom citizenship, etc.)

Notes, homework solutions, exams, and exam solutions that are provided to the class are strictly for personal use. They do not become the property of the student, and they may not be distributed, posted, or shared with anyone outside this class without the written permission of the instructor.

Seeking help from an instructor solution manual, a solution posted on the Internet, a homework solution from a student who has previously studied QM (except for the Teaching Assistant), or previous exams of this instructor is expressly forbidden. Violations will be prosecuted per the UTD Academic Dishonesty policy. My recommended penalty to the UTD Judicial Officer for any violation is likely to be a course grade of F. Possession of materials in violation of a copyright will be reported as permissible by law. Homework plays a crucial role in the mastery of Quantum Mechanics. Several past students have admitted, much to their regret, that copying QM homework from each other or the Internet contributed to their dismal test performance.

Video recordings of class will be made available on a best-effort basis via eLearning. Videos are strictly for the use of registered students currently enrolled, or people auditing with my permission. The recordings are the intellectual property of Prof. Izen. They may not be captured, downloaded, copied, or transferred by any means, and may only be used in their streamed format from the UTD net-id/password-authenticated campus server. Any unauthorized capturing, recording, or sharing of a class video recording, whether during this or a future semester, will be treated as an Academic Integrity violation and prosecuted under UTD's disciplinary policy. An Academic Integrity prosecution does not preclude an independent civil action.

Comet Creed
This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.

Please go to http://go.utdallas.edu/syllabus-policies for these policies.

Course description and timeline are subject to change at the discretion of the Professor.