PHY 341 - Quantum Mechanics I, Spring 2023 UMass Dartmouth

Lectures: MWF 12:00-12:50pm, Room SEng-102
Remote accommodation in case of need:
https://umassd.zoom.us/j/9637607654?pwd=cnBzQXFJUmx1MW12WHlLb0FkSlRKdz09
Zoom ID/code: 963 760 7654 / eigenstate
Text: *Introduction to Quantum Mechanics*, D Griffiths, 2nd ed.
Reference: *Quantum Mechanics*, D H McIntyre
Instructor: Dr. Jay Wang, 2-204B, jwang@umassd.edu, 508-999-9136
Office Hours: MWF 11-12pm, by appointment, or just stopping/zooming-by
Course site: https://jwang.sites.umassd.edu/p341/

Welcome to Quantum Mechanics I. This course is intended as an introduction to the theoretical development of Quantum Mechanics, including the wave function and Schrödinger's equation, basic principles of Quantum Mechanics and its application to simple but real systems like the atomic hydrogen.

The objectives are: to gain a fundamental understanding of physical concepts; to develop important analytical, mathematical, and computational problem-solving skills; and to inter-relate basic principles and practical applications.

Homework will be assigned regularly. There will be two tests and the final exam. This course values efforts like attendance, class participation, extra credit work, office visits, etc. The final grade will consist of homework, the tests and final exams, and effort indicators as follows:

Category	Percentage	Date	Grade Criteria
Homework	40%	Weekly	90≤ A <100
Test 1	15%	Feb 17, F	80≤ B <90
Test 2	15%	Mar 24, F	70≤ C <80
Final	20%	May 2, T	60≤ D <70
Effort	10%	24/7	0≤ F <60

Information

1. Lectures and recitations. Lectures cover materials found in and, sometimes, out of the text. Important elements will be emphasized in the lecture. But before- and after-class reading as assigned is required for successful completion of homework and exams. Recitation exercises will be held as needed to to go over problem solving/reviewing of covered material. Note, however, you are expected to do the bulk of homework. Group study is highly recommended.

2. Homework assignments. Homework will be assigned on a regular basis. It will include problems from text as well as handout including numerical problems on topics discussed in class. Each assignment is usually due in class one week following its assignment and coverage in lecture. The precise due date will be confirmed in class. You will have about one week to complete each assignment. Late homework will generally not be accepted, except for occasional, non-habitual cases which are subject to the two-day half-life rule.

Quantum mechanics is a beautiful and elegant theory. But no one seems to be born with the intuition of quantum mechanics. Therefore it is essential to be able to do as many problems as you can (homework and extra problems you find on your own) to develop a feel for quantum mechanics. The emphasis on computation in this class will help you develop intuition and master concepts of quantum mechanics per Physics Education Research.

Group study and brainstorming of ideas on homework is proven to be beneficial and strongly encouraged, as well as going to the tutor.

3. Exams. The tests are sectional and the final exam is comprehensive. They will emphasize the material covered in lectures. Unless other arrangements are made with the instructor prior to the test date, zero points will be given if the test is not taken. A typical test includes mostly problems and concepts, but may also contain topical mini essays. Partial credit will be given for relevant steps of problem solving.

The final exam will be given only at the scheduled time. It is in the usual classroom (SEng-102).

4. Extra credit/help. Opportunities exist for extra credit up to 10% toward your final grade. They may include effort and activities such as participating in group discussions in the classroom, doing extra credit assignment and course-related projects, writing a paper on a topic relevant to this course, etc. But, extra credit will be considered for the final grade only if your core-course performance is satisfactory (60% or better).

5. Other information.

- *Academic integrity.* Everyone is expected to do the coursework with academic honesty. If you want to play the piano, you have to actually do it. If you want to master physics, you have to actually do it. Cheating, such as straight copying in whatever form and presenting it as one's own, may seem like a short-term gain to some, but it damages the prospect of long-term success.

  To understand the stuff, you have to actually do it, make mistakes, and learn from them. Group study effectively facilitates and enhances this learning process.

  You are expected to be familiar with and follow the policies of academic integrity in the student handbook: https://www.umassd.edu/studentaffairs/studenthandbook/. Violations of academic integrity policies will be dealt with according to regulations described in the handbook.

- *Covid info.* Covid hasn't really left us, so continued vigilance is necessary. Please follow the latest covid protocols here: https://www.umassd.edu/covid/. Basically,

  - If you feel sick, stay home, and attend class virtually if you are able
  - Mask-wearing is welcome and encouraged
  - Stay up to date with recommended vaccinations and boosters

- *Asynchronous component.* From previous feedback and effectiveness, an asynchronous part with video-recorded course material will be posted on the course website, roughly once every couple of weeks. Once posted, *you are expected to have studied the material asynchronously before the next class.* You may ask questions about that material in class, of course, but it will not be wholly repeated in the class.

Syllabus

Tentative Schedule, PHY 341, Spring 2023, UMass Dartmouth			
Date	Chap	Sections to read	Topics
Jan 18, W	1	Sec 1-6	The Schrödinger equation wave function and probability interpretation operators and expectation values uncertainty principle
	2	Sec 1-6	Time-independent Schrödinger equation 1D systems: particle in a box harmonic oscillator, potential wells bound and unbound (continuum) states
Sectional conclusion. Test 1, Ch 1, 2, Feb 17, F			
Mar 1, W	3	Sec 1-6	Formal principles of quantum mechanics Hilbert (function) space, eigenvalues and eigenfunctions, Hermitian operators, Dirac notation, basis set
Sectional conclusion. Test 2, Ch 2, 3, Mar 24, F			
Mar 29, W	4	Sec 1-4	Schrödinger equation in 3D radial and angular wave functions structure of the hydrogen atom angular momentum and spin
Apr 26, W		Last class	
May 2, T		Final Exam 11:30-2:30pm, Comprehensive	