PHY 341 - Quantum Mechanics I, Spring 2022 UMass Dartmouth

Lectures: MWF 12:00-12:50pm, Room SEng-108
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, Dion 103 (temp), 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 18, F	80≤ B <90
Test 2	15%	Mar 25, F	70≤ C <80
Final	20%	May 3, 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.

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-108).

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. Covid-19 and other information.

- This will be an in-person class, and everyone is expected to follow the covid safety protocols, including vaccination and mask-wearing requirements:
  https://www.umassd.edu/covid/

  However, despite best effort, there is always the possibility of being exposed to or even infected with covid. As a matter of public health with infectious diseases, please follow the MA isolation and quarantine protocol (IQP):
  https://www.mass.gov/info-details/covid-19-isolation-and-quarantine-information

  According to the protocol, you must isolate if you are symptomatic or have tested positive for Covid-19, and you must quarantine if you are not sick but are a close contact to someone diagnosed with Covid-19, for a nominal of 5 days. Every effort will be made to accommodate your learning needs. For instance, if you are in IQP, you can attend the class on zoom if you are able, and reasonable extension of due dates will be considered. By the same token, should the instructor be in IQP, zoom will be used for class delivery for the duration of IQP (pending quantum teleportation technology being invented; someone hurry). Office hours will be conducted in-person and on zoom simultaneously whenever possible.

  Should you feel sick with flu-like symptoms, please consider the remote option.

- From previous feedback and effectiveness, an asynchronous part with video-recorded course material will be posted on the course website, roughly once every 1.5 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.

- You are expected to be familiar with and follow the policies of academic integrity in the student handbook: https://www.umassd.edu/studentaffairs/studenthandbook/

Syllabus

Tentative Schedule, PHY 341, Spring 2022, UMass Dartmouth			
Date	Chap	Sections to read	Topics
Jan 19, 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 18, F			
Mar 2, 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 25, F			
Mar 30, W	4	Sec 1-4	Schrödinger equation in 3D radial and angular wave functions structure of the hydrogen atom angular momentum and spin
Apr 27, W		Last class	
May 3, T		Final Exam 11:30-2:30pm, Comprehensive	