Quantum Mechanics (PHY 420)

COURSE MEETING TIME AND PLACE:

Course Section	Meeting Time	Location
420-01	Tu, Th 2:00-3:15 PM	SSN 192

INSTRUCTOR INFORMATION:

Dr. Tianran Chen
e-mail: tchen@wcupa.edu (please include PHY420 in the subject line of any e-mail)
phone: (610) 436-3563
office: Merion Science Center 128

OFFICE HOURS:

My scheduled office hours as of the first day of class are listed below. I reserve the right to adjust this schedule to reflect unforeseen circumstances.

Monday	Tuesday	Wednesday
2:00 PM – 5:00 PM	3:30 – 5:00 PM	5:00 – 6:00 PM

Office hours are available by appointment for students with an ongoing schedule conflict with my scheduled hours.

REQUIRED COURSE MATERIALS:

- *Introduction to Quantum Mechanics,* by David J. Griffiths, 3rd Ed (Cambridge University Press).

COURSE OBJECTIVE:

This is essentially an introductory quantum mechanics course, with a bit of atomic physics mixed in. The goal is for you to acquire a firm grasp of the fundamentals: the Schrodinger Equation, solutions to the time-independent Schrodinger equation (square well, harmonic oscillator, etc.), mathematical formalism (operators, Dirac notation), the Hydrogen atom, spin and angular momentum, and perturbation theory. You will likely find yourself at times, learning about things that seem too strange to possibly be true, and ask yourself where it came from:

"If you are not confused by quantum physics then you haven't really understood it"
- Niels Bohr

"I think I can safely say that nobody understands quantum mechanics"
- Richard Feynman

Unfortunately, the bottom line is: as mind-boggling as it may sometimes seem, no experiment yet has proven quantum mechanics wrong. Therefore, instead of understand what quantum mechanics means, we will simply do quantum mechanics and accept it as is.

This is an extremely challenging course: Not only are the concepts challenging, but there is a lot of math. You will be using things from calculus, linear algebra, differential equations, and even learn some 'new' math. Also, much of the information is cumulative. Translation: Do NOT fall behind in this class! As SOON as you are lost, ask for help – from classmates, from the instructor, or from other professors.

Prerequisite: PHY 240, PHY 300, and MAT 343 (or PHY 370). Linear Algebra, although is not technically a prerequisite, might as well be one. If you have not taken all of these courses, it is not a disaster, but you should see me as soon as possible so that we can get you up to speed.

ASSESSMENT:

I will be using the D2L grade-book feature to post course grades. Please check it periodically.

- **Homework** (15%):
  Weekly homework assignments are typically due at the beginning of Tuesday and Thursday class. **No late assignments will be accepted. No exceptions.** All problem sets will be graded (**to varying degrees**) and returned within a week. **The problem sets will be graded only roughly.** It is your responsibility to check your work with the solution set. If you fail to turn in an assignment because of absences (excused or unexcused) then you will receive a zero for that assignment grade. Your lowest assignment grade will be dropped.
  - **Academic integrity: cite collaborators and outside resources used.** Explicitly cite any ideas, hints, derivations, or problem-solving steps that you got from other people, books, or other resources in your homework. If you worked with classmates on a particular problem, mention them explicitly. If you do a problem completely out of your own head, state so explicitly. **Using internet problem solutions such as Cheg is forbidden and considered plagiarism.**

    Although you might often work together to solve assigned problems, **the work you turn in MUST be your own**. (See the Academic & Personal Integrity statement on page 6 of this syllabus.) It is likely that your work will look *similar* to that of classmates with whom you worked, but if you prepare your own answers for submission there will be differences in how you express your results.

- **Regular Exams** (55%): Exam 1 (in-class): 25%; Exam 2 (in-class) 25%; Exam 3 (take-home): 5%. There are no make-up exams.
  - **If you miss a regular exam:** If you miss an exam for a **University Sanctioned Event** you must notify me in advance so that we can arrange for you to take the exam in a manner consistent with its integrity. You must also provide some form of documentation (performing arts program, competition schedule etc.) **In all other cases a missed exam will receive zero score.**
  - **If you have an OSSD letter pertaining to exams:** You are responsible for making the appropriate arrangements at least one week prior to the exam date and time.
  - Regular exam dates are subject to changes (snow days, Mastering maintenance, schedule adjustments, etc.). Be available for class days before & after.

- **Final Exam** (30%): The final is cumulative and will require synthesis of concepts from different parts of the course.
  The dates and times of the final exams for this course (as set by the registrar) are listed below. **You should plan to be available for the entire finals week.** We have in past semesters had to reschedule finals due to weather related events.

Course Number	Date and Location of Final	Time of Final
PHY 420-01	Tuesday 5/5, SSN 192	1:00 PM – 3:00 PM

I will be using the official WCU scale for grades, see p.48 in the undergraduate catalog. However, I reserve the right to adjust the weights of individual components, or the scale to account for unforeseen circumstances.

ATTENDANCE POLICY:

If you can pass this class without attending it, I'll be very impressed. Attendance is not mandatory, but if you miss class, I'm not going to go out of my way to help you if you're lost.

TENTATIVE COURSE SCHEDULE: I reserve the right to modify it as needed over the course of the semester.

Week	Date	Lecture	Reading
1	T Jan 21	Shrödinger Equation, Statistical interpretation, Probability	1.1 – 1.3
	R Jan 23	Probability cont'd, Normalization, Momentum	1.4 – 1.6
2	T Jan 28	Uncertainty Principle, Stationary States	2.1 – 2.2
	R Jan 30	Infinite Square Well	2.2
3	T Feb 4	Infinite Square Well cont'd	2.4
	R Feb 6	Harmonic Oscillator	2.5
4	T Feb 11	The Free Particle	2.6
	R Feb 13	Delta-Function Potential	2.3
5	T Feb 18	Finite Square Well	2.3
	R Feb 20	Square Potential Barrier	3.1
6	T Feb 25	Hilbert Space, Inner Space, Orthonormality	3.2
	R Feb 27	Observables, Hermitian Operators, Eigenfunctions	3.3
7	T Mar 3	**EXAM 1: Chapters 1 – 2**	
	R Mar 5	Generalized Statistical Interpretation; Uncertainty Principle	3.4 – 3.5
8	T Mar 10 R Mar 12 F Mar 13	**SPRING BREAK**	
9	T Mar 17	Dirac Notation	3.6
	R Mar 19	Shrödinger Equation in Spherical Coordinates	4.1
10	T Mar 24	Shrödinger Equation in Spherical Coordinates cont'd	4.1
	R Mar 26	Hydrogen Atom	4.2
11	T Mar 31	Hydrogen Atom con'd	4.2
	R Apr 2	Angular Momentum: eigenvalues	4.3
12	T Apr 7	Angular Momentum: eigenfunctions	4.3
	R Apr 9	Spin	4.4
13	T Apr 14	**EXAM 2: Chapters 3, 4.1 – 4.3**	
	R Apr 16	Spin cont'd	4.4
14	T Apr 21	Nondegenerate Perturbation Theory I	6.1
	R Apr 23	Nondegenerate Perturbation Theory II	6.2
		EXAM 3 (take-home)	
15	T Apr 28	Degenerate Perturbation Theory I	6.3
	R Apr 30	Degenerate Perturbation Theory II	6.4
16	T May 5	**FINAL EXAM**	ALL

ELECTRONIC DEVICE POLICY:

The pace of the course is such that your undivided attention will be required for the entire lecture and lab period. Please set all electronics to silent or "vibrate mode" and put them away, so that both you and your neighbors will be able to concentrate on the material at hand. No texting or making phone calls is allowed in the classroom.

DISABILITY STATEMENT:

If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities(OSSD), please contact the OSSD which is located at 223 Lawrence Center. The OSSD hours of Operation are Monday – Friday 8:30 a.m.–4:30 p.m. Their phone number is 610-436-2564,

their fax number is 610-436-2600, their email address is ossd@wcupa.edu, and their website is at www.wcupa.edu/ussss/ossd.

ELECTRONIC COMMUNICATIONS STATEMENT:

It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.

UNIVERSITY SANCTIONED EVENTS:

If you will be participating in a University sanctioned event during class or an exam **you must notify me in advance.** Please see the discussion of University Sanctioned Events in the general catalog.

INTELLECTUAL PROPERTY STATEMENT:

I, the instructor, utilize copyrighted materials under the "Freedom and Innovation Revitalizing the United States Entrepreneurship Act of 2007" (Fair Use Act). Apart from such copyrighted materials, all other intellectual property associated with this course is owned and copyrighted by the instructor, including, but not limited to, lectures, course discussions, course notes, slides, assessment instruments such as exams, and supplementary materials posted or provided to students authored by the instructor. No recording, copying, storage in a retrieval system, or dissemination in any form by any means of the intellectual property of the instructor, in whole or in part, is permitted without prior written permission of the instructor. When such permission is granted, it must specify the utilization of the intellectual property and all such permissions and waivers shall terminate on the last day of finals of the semester in which this course is held.

ACADEMIC INTEGRITY & CONDUCT

I have a zero tolerance policy for breaches of academic integrity. Breaches of academic integrity will be investigated and sanctions imposed to the full extent available under University policy. For questions regarding the university Academic Dishonesty, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to their major department's handbook, the Undergraduate Course Catalogue, the Rams Eye View, or the University Web Site. Please understand that improper conduct in any of these areas will not be tolerated and may result in immediate ejection from the class.

TITLE IX STATEMENT

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator, Ms. Lynn Klingensmith. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University protection of minors policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at the webpage for the Office of Social Equity at http://www.wcupa.edu/_admin/social.equity/.

ALL OTHER ACADEMIC POLICIES

For any university wide academic policy not explicitly covered in this document, such as No Grade policies. Please consult your major advising handbook, the Undergraduate Catalog, the Ram's Eye View, or the University Website.

PUBLIC SAFETY

The Emergency Communications Committee recommends that the number of WCU's Department of public safety be available on every course syllabi. WCU Department of Public Safety: (610) 436-3311.