

## Quantum Mechanics (Physics 430) Spring 2017

### Professor:

Dr. Ananda Shastri

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Hagen 307E, phone 477-2448

### Link to course web page:

<http://physics.mnstate.edu/courses.cfm>

### Texts or materials:

- *Quantum Mechanics: Concepts and Applications*, N. Zettili, 2<sup>nd</sup> Edition.

### Office hours:

Shastri Spring 2017 Schedule					
Time	M	T	W	Th	F
8					
9			Dept meeting 9-10	Office	
10	Phys161 10-10:50	Phys306 9:30-10:20	Phys161 10-10:50		Phys161 10-10:50
11		Office	Office	Office	
12	Phys430 12-12:50	Phys161L 12-1:15	Phys430 12-12:50	Phys161L 12-1:15	Phys430 12-12:50
1	Office	Office	Office	Research	Research
2					
3	Phys306 3-4:50	Astro102 3-4:10	Phys306 3-4:50		
4					
5					

### Meeting:

- **Lecture:** MWF 12-12:50 pm Hagen 305

**Final exam time:** Wednesday, May 10, 2-3:50pm. You must plan to take the final exam on this day. Travel plans, etc. will not be grounds for a makeup exam.

**Description:** This course involves the application of quantum physics to atoms and molecules. Students will learn the wave-particle duality, the mathematics necessary for doing quantum physics (basic linear algebra and bra-ket notation), the postulates of quantum mechanics. Various systems will be studied analytically and with computer simulations, such as the infinite square well, the harmonic oscillator, and the hydrogen atom. Emphasis will be placed on mastering mathematical techniques and solving problems.

**Grading:** Course grades will be assigned on an absolute scale according to

A-/A+	B-/B+	C-/C+
90-100%	80-90%	70-80%
D-/D+	F	
60-70%	Below 60%	

Typically, the minus grades are from 0-3.5, and the plus grades from 6.5 and up. The components of your grade and their relative weights are:

**On-time points/review (5%):** Arriving on time and reviewing are part of your grade. Arrive a little early, and review your cards or notes. When you finish, you may sign in to receive your points.

**5 new note cards/week (5%):** To encourage mastery of concepts, notation, and important theorems, you will make note cards. You are encouraged to use these as flashcards and review material every day for 10-15 minutes. A minimum of 5 cards per week is expected. On Fridays you should verify you have at least this amount.

**Quizzes (15%):** There will be occasional in-class quizzes. See syllabus for dates.

**Homework (35%):** There will be weekly homework due. On exam weeks, homework is replaced by a take-home exam problem.

**Exams (40%):** There will be four exams. See syllabus for exam schedule. Note that there are in-class and take-home parts.

**Policies:**

1. *No late assignments:* In order for me to grade and return assignments to you by the next class, late assignments will not be accepted. This allows me to collect and evaluate all work at one time. Assignments submitted by email will not be accepted. Exceptions will be made for excused absences (see below).
2. *Excused absences:* Absences are excused in cases of illness, emergencies, military service, and participation in a university-related event. (see student handbook online at <http://www.mnstate.edu/sthandbook/>).
3. *Exams:* You may only make up exams for excused absences. Alarm clocks not going off, Pracs studies, vacations, etc., are not excused, and you will not be allowed to make up the exam. Exams will involve an in-class part and a take-home part. You may not discuss the take-home part with anyone but me.
4. *Cheating:* Copying someone else's homework with or without their consent and submitting as your own, copying problem solutions from another person's exam are all forms of cheating. Cheating on an exam will result in an F for the course. Cheating on homework will result in a zero for the homework, and a second offense will result in an F for the course. Using a solutions manual on homework assignments is considered cheating. Using the textbook or other textbooks, journal articles is appropriate and encouraged.
5. *Student collaboration on homework:* Working with other students on homework is encouraged. However, this extends only to the discussion of the approach, not the writing of the solution. Identical homework solutions will be given zero credit. If there is a question about your level of understanding, you will come to my office and present it on the board.
6. *Professionalism:* This class is run like a research group. You are expected to have read and made notes on the reading by the time you come in to class. Everything you turn in should reflect professionalism. Homework assignments can easily take 4 hours or more to complete, and should be planned for accordingly. Written work must be legible, and assumptions and logic must be explained.

Students with disabilities who believe they may need an accommodation in this class are encouraged to contact Greg Toutges, Director of Disability Services at 477-4318 (Voice) or 1-800-627-3529 (MRS/TTY), Flora Frick 154 as soon as possible to ensure that accommodations are implemented in a timely fashion. Information regarding Disability Services is available at <http://web.mnstate.edu/disability/>.

## Schedule

Week	Mon	Wed	Fri	Lecture	Reading
<b>1</b> (Jan. 9-13)				<ul style="list-style-type: none"> <li>Wave particle duality</li> <li>Postulates of QM</li> <li>Mathematics of QM</li> </ul>	Ch1, Ch2, Ch3
<b>2</b> (Jan. 16-20)	No class	HW1		<ul style="list-style-type: none"> <li>Mathematics of QM</li> </ul>	Ch2
<b>3</b> (Jan. 23-27)		HW2	Quiz1	<ul style="list-style-type: none"> <li>Mathematics of QM</li> <li>Time independent Schrodinger eqn</li> </ul>	Ch2, Ch3
<b>4</b> (Jan.30-Feb.3)		HW3		<ul style="list-style-type: none"> <li>Commuting observables and measurement</li> </ul>	Ch3
<b>5</b> (Feb.6-10)	Exam1	Exam1 take-home due		<ul style="list-style-type: none"> <li>1D Schrodinger eqn: free particle, wave packets</li> </ul>	Ch4
<b>6</b> (Feb. 13-17)		HW4		<ul style="list-style-type: none"> <li>1D Schrodinger eqn: potential step, potential well</li> </ul>	Ch4
<b>7</b> (Feb.20-24)	No class	HW5	Quiz2	<ul style="list-style-type: none"> <li>1D Schrodinger eqn: harmonic oscillator</li> </ul>	Ch4
<b>8</b> (Feb.27-Mar.3)		HW6		<ul style="list-style-type: none"> <li>1D Schrodinger eqn:</li> </ul>	Ch5
<b>9</b> (Mar.6-10)	No class	No class	No class	Spring Break	
<b>10</b> (Mar.13-17)	Exam2	Exam2 take-home due		<ul style="list-style-type: none"> <li>Angular momentum</li> </ul>	Ch5
<b>11</b> (Mar.20-24)		HW7		<ul style="list-style-type: none"> <li>Angular momentum</li> </ul>	Ch5
<b>12</b> (Mar.27-31)		HW8	Quiz3	<ul style="list-style-type: none"> <li>3D problems: free particle, box potential</li> </ul>	Ch6
<b>13</b> (Apr.3-7)		HW9		<ul style="list-style-type: none"> <li>3D problems: hydrogen atom</li> </ul>	Ch6
<b>14</b> (Apr.10-14)	Exam3	Exam3 take-home due	No class	<ul style="list-style-type: none"> <li>3D problems: free particle, box potential</li> </ul>	Ch6
<b>15</b> (Apr.17-21)	No class	HW10		<ul style="list-style-type: none"> <li>Perturbation theory</li> </ul>	Ch9
<b>16</b> (Apr.24-28)		HW11	Quiz4	<ul style="list-style-type: none"> <li>Perturbation theory</li> </ul>	Ch9
<b>17</b> (May1-5)		Study day			
(May8-12)		Final 2-3:50pm	Final exam Wednesday, May 10. You must plan to take the exam at this time, or you must have an excused absence.		