QUANTUM MECHANICS

Physics 4/56101

SPRING 2014

INSTRUCTOR:

Dr. Mark Manley
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330-672-2407

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CLASS HOURS: 11:00 - 12:15 M T R, 202 Smith Hall

OFFICE HOURS: 3:10 - 4:00 M T W
11:10 - 12:00 F
(or by appointment)

TEXT: *Introduction to Quantum Mechanics*, second edition, by David J. Griffiths (Pearson/Prentice Hall).

PREREQUISITES: For PHY 46101 - PHY 36001 and pre/corequisite MATH 32052. For PHY 56101 - Special approval and graduate standing.

STUDENT LEARNING OUTCOMES: Upon successful completion of this course, students will be able to:

- Demonstrate a satisfactory level of familiarity with the basic concepts and mathematical structure of Quantum Mechanics, with emphasis upon the Schrödinger wave function.
- Apply these to one-dimensional potentials including the harmonic oscillator, realistic three-dimensional systems including the quantum description of angular momentum. Use time-independent perturbation theory and identical two-particle systems are also treated.
- Derive explicit solutions of the Schrödinger equation as a differential equation, and in the case of the harmonic oscillator derive the solution by the algebraic method of raising and lowering operators. Obtain the

solution of first- and second-order perturbation problems. Apply and derive the fundamental commutation relations of the uncertainty principle and angular momentum.

GRADE DETERMINATION:

Homework	20%
Exam 1	25%
Exam 2	25%
Final Exam	30%

HOMEWORK: Problems will be assigned in class. Homework assignments *must* be handed in on time.

EXAMS: Each of the two midterm exams will cover only those chapters of the text that were covered in class since the previous exam. The final exam will be comprehensive.

COVERAGE: As indicated on the tentative course outline.

MAKEUP CLASSES: I anticipate being away occasionally because of research commitments. Make-up classes will be scheduled as needed.

CHEATING AND PLAGIARISM:

University policy 3342-3-01.8 deals with the problem of academic dishonesty, cheating, and plagiarism. None of these will be tolerated in this class. The sanctions provided in this policy will be used to deal with any violations. If you have any questions, please read the policy at http://www.kent.edu/policyreg/-policydetails.cfm?customel_datapageid_1976529=2037779 and/or ask.

STUDENTS WITH DISABILITIES:

University policy 3342-3-01.3 requires that students with disabilities be provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact the instructor at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through Student Accessibility Services (contact 330-672-3391 or visit www.kent.edu/sas for more information on registration procedures).

REGISTRATION REQUIREMENT:

The official registration deadline for this course is January 26, 2014. The course withdrawal deadline is March 23, 2014. University policy requires all students to be officially registered in each class they are attending. Students who are not officially registered for a course by published deadlines should not be attending classes and will not receive credit or a grade for the course. Each student must confirm enrollment by checking his/her class schedule (using Student Tools in FlashFast) prior to the deadline indicated. Registration errors must be corrected prior to the deadline.

TENTATIVE COURSE OUTLINE:

Week	Date	Day	Tentative Schedule
1	Jan 13	M	Ch. 1—Introduction
	Jan 14	T	Ch. 1—Wave Packets
	Jan 16	R	Ch. 1—The Schrödinger Equation
2	Jan 20	M	MLK Jr. Day—No Class
	Jan 21	T	Ch. 1—Expectation Values
	Jan 23	R	Ch. 1—Position and Momentum Operators
3	Jan 27	M	Ch. 2—Infinite Square Well
	Jan 28	T	Ch. 2—Harmonic Oscillator (Analytic Method)
	Jan 30	R	Ch. 2—Harmonic Oscillator (Algebraic Method)
4	Feb 3	M	Ch. 2—Free Particle
	Feb 4	T	Ch. 2—Delta Function Potential
	Feb 6	R	Ch. 2—Finite Square Well

TENTATIVE COURSE OUTLINE (Continued):

Week	Date	Day	Tentative Schedule
5	Feb 10	M	Ch. 2—Continued
	Feb 11	T	Ch. 2—Continued
	Feb 13	R	Ch. 2—Continued
6	Feb 17	M	Ch. 3—Vector Space Formalism
	Feb 19	T	Ch. 3—Hilbert Spaces, Observables
	Feb 20	R	Ch. 3—Eigenfunctions and Operators
7	Feb 24	M	Ch. 3—Uncertainty Principle
	Feb 25	T	Ch. 3—Dirac Notation
	Feb 27	R	Exam 1 (Chapters 1 and 2)
8	Mar 3	M	Ch. 3—Continued
	Mar 4	T	Ch. 3—Continued
	Mar 6	R	Ch. 4—Quantum Mechanics in Three Dimensions
9	Mar 10	M	Ch. 4—Schrödinger Equation in Spherical Coordinates
	Mar 11	T	Ch. 4—The Hydrogen Atom
	Mar 13	R	Ch. 4—Continued
10	Mar 17	M	Ch. 4—Continued
	Mar 18	T	Ch. 4—Continued
	Mar 20	R	Ch. 4—Continued
11	Mar 24	M	Spring Break—No Class
	Mar 25	T	Spring Break—No Class
	Mar 27	R	Spring Break—No Class

TENTATIVE COURSE OUTLINE (Continued):

Week	Date	Day	Tentative Schedule
12	Mar 31	M	Ch. 4—Continued
	Apr 1	T	Ch. 4—Continued
	Apr 3	R	Exam 2 (Chapters 3 and 4)
13	Apr 7	M	Ch. 5—Identical Particles
	Apr 8	T	Ch. 5—Systems of Two Identical Particles
	Apr 10	R	Ch. 5—Continued
14	Apr 14	M	Ch. 6—Time-Independent Perturbation Theory
	Apr 15	T	Ch. 6—Nondegenerate Perturbation Theory
	Apr 17	R	Ch. 6—Degenerate Perturbation Theory
15	Apr 21	M	Ch. 6—Fine Structure of Hydrogen
	Apr 22	T	Ch. 6—Zeeman Effect and Hyperfine Splitting
	Apr 24	R	Selected Topics from Ch. 7, 9, 11
16	Apr 28	M	Continued
	Apr 29	T	Continued
	May 1	R	Continued
17	May 5	M	Final Exam (10:15–12:30 p.m.)