Term Information

Effective Term   Spring 2017

General Information

Course Bulletin Listing/Subject Area   Physics
Fiscal Unit/Academic Org   Physics - D0684
College/Academic Group   Arts and Sciences
Level/Career   Graduate, Undergraduate
Course Number/Catalog   5501
Course Title   Quantum Mechanics II
Transcript Abbreviation   QM 2
Course Description   Harmonic oscillator, time-independent and time-dependent perturbation theory, addition of angular
                                       momenta, fine and hyperfine structure of hydrogen, identical particles, periodic systems, modern physics
                                       applications of quantum mechanics.
Semester Credit Hours/Units   Fixed: 4

Offering Information

Length Of Course   14 Week
Flexibly Scheduled Course   Never
Does any section of this course have a distance No
education component?
Grading Basis   Letter Grade
Repeatable   No
Course Components   Lecture
Grade Roster Component   Lecture
Credit Available by Exam   No
Admission Condition Course   No
Off Campus   Never
Campus of Offering   Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites   5500; Math 2174 or 2415 or 2255 or 5520H; or permission of instructor
Exclusions   Not open to students with credit for 5501H or 633

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code   40.0801
Subsidy Level   Baccalaureate Course
Intended Rank   Junior, Senior, Masters, Doctoral

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Harmonic Oscillator: Students will be able to use raising and lowering operators to compute a full range of observable results and their probabilities.

- Perturbation Theory: Students will be able to approximate the effects of time-independent and time-dependent perturbations, understanding the conditions under which interactions can be treated as perturbations.

- Addition of Angular Momentum: Students will understand when and how to employ the addition of angular momenta, being able to convert back and forth between coupled and uncoupled bases with the use of Clebsch-Gordon tables.

- Identical Particles: Students will be able to solve a wide variety of problems involving two identical particles and from this appreciate the drastically different collective behavior of fermions and bosons.

- Periodic Systems: Students will understand how Bloch states emerge from atomic states in simple periodic systems. They will have a qualitative understanding of collective phenomena that emerge from the dispersion relations for Bloch states.

- Modern Applications: Students will gain an appreciation of how quantum mechanics permeates all of modern physics. Specific examples chosen by the instructor from atomic, condensed matter, nuclear, particle physics and quantum information theory.

Content Topic List

- Harmonic oscillator, time-independent and time-dependent perturbation theory, magnetic interactions in hydrogen, addition of angular momenta, identical particles, periodic systems, examples from modern physics.

Attachments

- 5501_syllabus_ASC.docx: Physics 5500 syllabus

  (Syllabus. Owner: Perry,Robert James)

Comments

- We have a second semester of quantum mechanics for honors students and need a non-honors version to meet the needs of many Physics and Engineering Physics majors. *(by Perry,Robert James on 04/28/2016 01:00 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Perry,Robert James	04/28/2016 01:00 PM	Submitted for Approval
Approved	Perry,Robert James	06/21/2016 12:07 PM	Unit Approval
Approved	Haddad,Deborah Moore	06/21/2016 12:21 PM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole	06/21/2016 12:21 PM	ASCCAO Approval

Physics 5501 – Quantum Mechanics II

Credits: 4 undergraduate credit hours

Instructor: <Name, contact information>, <Office Hours>, or set up appointment.

Textbook: *Quantum Mechanics,* David H. McIntyre

Course Description: This course covers multi-particle quantum systems, approximation techniques for a wide variety of simple, time-dependent and time-independent quantum systems, and applications of quantum mechanics in several areas of modern physics.

Prerequisites: Physics 5500 (C+ or better), Math 2174, 2415, 2255; or permission of instructor.

Grading: Weekly homework assignments (35% of grade), two midterm exams (2x20% of grade) and a final exam (25% of grade). It is expected that you will spend about 3 hours outside of class for each lecture hour (12 hours/week) on homework assignments and studying for exams.

Homework assignments: Every week, you will be assigned problems in which you will provide detailed, written solutions. These assignments are to be done on paper and handed in at the beginning of lecture on the due date. The assignments are posted on <website>, and include problems written by the instructor or derived from the text or other sources, and small assignments using simulations and/or using computer applications such as Mathematica.

Many of the assigned problems will be challenging, and you are encouraged to work with classmates to help determine solutions to the homework; however you must write your own solutions—direct copying of solutions from classmates (or other sources) will be submitted to the Committee on Academic Misconduct. Write up you own work to turn in!

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of academic misconduct. The term "academic misconduct" includes all forms of student misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see Code of Student Conduct at http://studentlife.osu.edu/csc/.

Disability Services: Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office of Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 614-292-3307, TDD 614-292-0901; http://www.ods.ohio-state.edu/.

	5501 Class Schedule
Week 1	**Harmonic Oscillator** Chapter 9
Week 2	**Harmonic Oscillator** Chapter 9 HW #1 due
Week 3	**Time Independent Perturbation Theory** Chapter 10 HW #2 due
Week 4	**Time Independent Perturbation Theory** Chapter 10 HW #3 due
Week 5	**Hyperfine Structure and addition of angular momenta** Chapter 11 HW #4 due
Week 6	**Hydrogen perturbations: Fine Structure, Spin Orbit, Zeeman** Chapter 12 HW #5 due **1st midterm**
Week 7	**Identical Particles** Chapter 13 HW #6 due
Week 8	**Time Dependent Perturbation Theory** Chapter 14 HW #7 due
Week 9	**Time Dependent Perturbation Theory: Applications** Chapter 14 HW #8 due
	Spring Break
Week 10	**Periodic Systems** Chapter 15 HW #9 due

Week 11	**Applications: Metals, Insulators, Semiconductors, 2-d systems** Chapter 15 HW #10 due **2nd midterm**
Week 12	**Modern Applications** Chapter 16 No Homework due this week
Week 13	**Modern Applications** Chapter 16 HW #11 due
Week 14	**Modern Applications** Chapter 16 HW #12 due
	Final Exam: Time TBA, Location: TBA

Weeks 11-14: Modern Physics Applications chosen from <varies by instructor>:
- Atomic, Molecular & Optical Physics
- Biophysics
- Condensed Matter Physics
- High Energy Physics
- Nuclear Physics
- Astrophysics/Cosmology
- Quantum Information Processing