



Course Information

- PHYS 36000
- CRN 25807
- Course credit hours: 3
- Instructional Modality: Face-to-Face
- Lectures: Mon and Wed 9:00 – 10:15 AM, Room PHYS 203
- Prerequisites: (PHYS 33000 or PHYS 43000 or PHYS 31000 or PHYS 41000) and (PHYS 34200 or PHYS 34400)

Instructor Contact Information

- **Instructor:** Prof. Norbert Neumeister
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 - **Office Phone Number:** 765-494-5198
 - **Email:** neumeist@purdue.edu
 - **Office/Consultation hours:** Tuesday 10:00 – 11:00 am or
by appointment using WebEx: <https://purdue.webex.com/join/nneumeis>
- **Grader:** Bowen Yan
 - **Office Location:** PHYS 305
 - **Office Phone Number:** 571 376 3697
 - **Email:** yan312@purdue.edu
 - **Office/Consultation hours:** Monday 2:00 pm – 4:00 pm or
Wednesday 11 am – 1:00 pm or
by appointment using WebEx: <https://purdue-student.webex.com/meet/yan312>

Course Description

This is an introductory course to Quantum Mechanics. The goals of this course are to teach you the basic concepts of Quantum Mechanics and to make you adept in solving relevant problems. The first five chapters of the textbook will be covered. This provides a thorough introduction to the foundations of quantum mechanics: wave functions, the time-dependent Schrödinger equation, one-dimensional potentials, the harmonic oscillator, Hilbert-space formalism, 3-dimensional potentials, the hydrogen atom, angular momentum, spin, atoms, etc. Entangled states will be noted, plus the statistical interpretation of quantum mechanics, and the conflicts between realist, orthodox, and agnostic positions with regard to the nature of physical “reality.”

Learning Resources, Technology & Texts

- **Required textbook:**
 - *Introduction to Quantum Mechanics*, D.J. Griffiths, 3rd edition

- You can access the course via [Brightspace](https://purdue.brightspace.com/d2l/home/219004) (https://purdue.brightspace.com/d2l/home/219004). It is strongly suggested that you explore and become familiar not only with the site navigation, but with content and resources available for this course. See the Help tab for resources.
- **Supplemental texts:**
Besides our textbook, the following books (not required) will be on reserve in the Physics Library. Most of them contain many solved problems:
 1. C. Cohen-Tannoudji, B. Diu, F. Laloe, *Quantum Mechanics*
 2. P.A.M. Dirac, *Quantum Mechanics*
 3. S. Gasiorowicz, *Quantum Physics*
 4. R. Shankar, *Principles of Quantum Mechanics*
 5. J.J. Sakurai, *Modern Quantum Mechanics*
 6. R.P. Feynman, *Lectures on Physics*, Vol. 3
 7. E. Merzbacher, *Quantum Mechanics*
 8. A. Messiah, *Quantum Mechanics*, Vol. 1 and 2

Learning Outcomes

The purpose of the course is to gain understanding of quantum mechanical concepts and phenomena as well as through practical exercises being able to solve simple quantum mechanical problems. By the end of this course, students should be able to:

- pinpoint the historical aspects of development of quantum mechanics
- understand and explain the differences between classical and quantum mechanics
- understand the idea of wave function
- spot, identify and relate the eigenvalue problems for energy, momentum, angular momentum and central potentials explain the idea of spin
- understand the quantum mechanical description of the measurement process and concepts such as complementarity and the uncertainty relation
- solve the Schrödinger equation for the continuous case for simple potentials such as the quantum well and the harmonic oscillator
- understand and use the rules for additions of spin and angular momenta
- solve the Schrödinger equation for hydrogen like atoms

Lectures

Considerable material will be covered so it is important to not fall behind. The lecture will be used to introduce new concepts and to provide examples that help you understand how Quantum Mechanics works. Read the assigned text in advance of the lecture and then again afterwards for optimal comprehension. Your active participation during lectures with questions and comments is strongly encouraged. Please do not hesitate to, or be shy about, asking questions. We will follow the textbook quite closely, and you are strongly encouraged to get a copy. If you use the 2nd edition instead, be aware that the numbering of problems has changed. We will not spend very much time (but more than Griffiths) on the experimental issues that led to the development of Quantum Mechanics.

Homework

Problem solving is an essential as well as an integral part of this course; solving problems is how you will learn Quantum Mechanics. There will be 12 homework assignments and problem sets will be assigned each Monday. The homework is due and has to be brought to the **lecture** on Wednesday of the following week. Homework grades will count approximately 30% towards your course grade. Students may discuss the problems with each other in a general way but should **not** do the homework as a group effort. No carbon copy homework sets are acceptable. Further, the problem solutions should be clearly and neatly written on one side only of standard size paper. Your fellow students should be able to read, follow and understand the solutions. The quality of the presentation counts towards the grade. The problem sets will be written

in a format that has your name, PHYS 360, and the due date in the upper right-hand corner of the first page and your name and PHYS 360 on each following page. The question should first be written out (if a long question, re-write it in an outlined form) and then followed by the solution. Assignments will be posted on the course web page. Two homework assignments (with the lowest scores) will be dropped at the end of the semester when calculating final grade.

1. Use 8½ by 11” paper.
2. Write only on one side of the page.
3. Number the pages.
4. Write clearly and neatly.
5. Solutions should be complete, comprehensive and clearly presented.
6. Staple pages together for hand in.
7. Remember to put your name on the front of the first page in hand in.
8. Homework is due in class on the day indicated on the problem set.
9. Please contact your instructor prior to the due date if you need an extension.

Assignments

Specific reading assignments will be given supplementing the lecture material covered in class. A tentative reading and homework assignment schedule is included in the syllabus. You should read the assigned sections before attending lecture. Students who read the assigned material before class will find the lecture far more meaningful. You can always find an up-to-date version on Brightspace.

Your learning will be assessed through a combination of participation, homework and exams spread throughout the academic period. Details on these assignments and exams, including a schedule of due dates, and guidelines on discussion participation and evaluation will be posted on Brightspace.

There will be two midterm exams during the semester (Mar 8, Apr 19) and a comprehensive two-hour final exam final exam at the end of the semester. All exams are closed book and you must remember to bring your ID to the exams. Cheaters will be given an F in the course and will be reported to the Dean of Students. Information regarding the exams will be announced later.

Grading Scale

In this class grades reflect the sum of your achievement throughout the semester. Your course grade will be based on homework and exam scores You will accumulate points with the approximate weights:

Homework	30%
Midterm Exam 1	15%
Midterm Exam 2	15%
Final Exam	40%

At the end of the semester, final grades will be calculated by adding the total points earned and translating those numbers into letter grades (there will be no partial points or rounding). We will use plus-minus letter grades in the final grading of this course. The homework score will be calculated after dropping the two with the lowest scores. Dropping the two lowest scores usually takes care of missed assignments due to minor illness or other problems. **The exact cut- offs for letter grades will not be determined until the end of the semester.**

Absences and Excused Grades

Homework sets are due on the dates indicated on the class calendar. Your work is due on time, with the exception of reasonable documented excuses. If you are going to miss an exam, you must notify the instructor **in advance** (preferably

one week) so alternative arrangements can be made. There will be no makeup midterms. Unexcused absences from any exam will be assigned a zero grade; Excused grades will be given only in one of the following circumstances: (1) illness; (2) personal crisis (e.g., automobile accidents, required court appearance, death of a close relative, weather conditions that make it impossible to get to the university); and (3) required attendance at an official Purdue activity (e.g., athletics). You **must** contact your lecturer as soon as possible but **before** the exam and discuss your problem. Appropriate documents (e.g., a written note from a doctor, with his/her name and phone number included) may be needed to judge the merit of the excuse. **Missing the final exam cannot be excused.**

Attendance Policy during COVID-19

Students are expected to attend all classes in-person unless they are ill or otherwise unable to attend class. If they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus, students should stay home and contact the Protect Purdue Health Center (496-INFO).

In the current context of COVID-19, in-person attendance cannot be a factor in the final grades. However, timely completion of alternative assessments can certainly be part of the final grade. Students need to inform the instructor of any conflict that can be anticipated and will affect the timely submission of an assignment or the ability to take an exam.

Classroom engagement is extremely important and associated with your overall success in the course. The importance and value of course engagement and ways in which you can engage with the course content even if you are in quarantine or isolation, will be discussed at the beginning of the semester. Student survey data from Fall 2020 emphasized students' views of in-person course opportunities as critical to their learning, engagement with faculty/TAs, and ability to interact with peers.

Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflicts, when advance notification to an instructor is not possible, the student should contact the instructor/instructional team as soon as possible by email, through Brightspace, or by phone. In cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via email or phone at 765-494-1747. Our course Brightspace includes a link to the Dean of Students under 'Campus Resources.'

Academic Guidance in the Event a Student is Quarantined/Isolated

If you must quarantine or isolate at any point in time during the semester, please reach out to me via email so that we can communicate about how you can continue to learn remotely. Work with the Protect Purdue Health Center (PPHC) to get documentation and support, including access to an Academic Case Manager who can provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Your Academic Case Manager can be reached at acmg@purdue.edu. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation.

Course Schedule

Week	Date		Lecture Topics/ Reading Assignments	Deadline
Week 1	Jan 18		<i>MLK day (no class)</i>	
	Jan 20	Lecture 1	Introduction, History	
Week 2	Jan 25	Lecture 2	Chapters 1.1 – 1.3	
	Jan 27	Lecture 3	Chapters 1.4 – 1.5	HW 1
Week 3	Feb 1	Lecture 4	Chapters 1.5 – 1.6	
	Feb 3	Lecture 5	Chapter 2.1	HW 2
Week 4	Feb 8	Lecture 6	Chapter 2.2	
	Feb 10	Lecture 7	Chapter 2.3	HW 3
Week 5	Feb 15		<i>no class</i>	
	Feb 17		<i>Reading Day (no class)</i>	
Week 6	Feb 22	Lecture 8	Chapter 2.3	
	Feb 24	Lecture 9	Chapter 2.4	HW 4
Week 7	Mar 1	Lecture 10	Chapter 2.5	
	Mar 3	Lecture 11	Chapter 2.6	HW 5
Week 8	Mar 8		<i>Midterm Exam I</i>	
	Mar 10	Lecture 12	Chapter 3.1	HW 6
Week 9	Mar 15	Lecture 13	Chapters 3.2 – 3.4	
	Mar 17	Lecture 14	Chapters 3.5 – 3.6	HW 7
Week 10	Mar 22	Lecture 15	Chapter 4.1	
	Mar 24	Lecture 16	Chapter 4.2	HW 8
Week 11	Mar 29	Lecture 17	Chapter 4.3	
	Mar 31	Lecture 18	Chapter 4.4	HW 9
Week 12	Apr 5	Lecture 19	Chapter 4.4	
	Apr 7	Lecture 20	Chapter 4.5	HW 10
Week 13	Apr 12	Lecture 21	Chapter 5.1	
	Apr 14	Lecture 22	Chapter 5.2	HW 11
Week 14	Apr 19		<i>Midterm Exam II</i>	
	Apr 21	Lecture 23	Discussion of Exam	
Week 15	Apr 26	Lecture 24	Chapter 5.3	
	Apr 28	Lecture 25	Chapter 5.3, Review	HW 12
Week 16	May 3		<i>Final Exam (7:00 – 9:00 pm PHYS 203)</i>	

* Schedule and assignments subject to change. Any changes will be posted in the learning management system.

Purdue [Academic Calendar](#) and key University dates for the Spring 2021 semester:

Jan. 4 – Academic Year Faculty/Staff First Day

Jan. 19 – Classes Begin

Feb. 17 – Reading Day

March 18 – Reading Day

April 13 – Reading Day

May 1 – Classes End

May 3-8 – Final Exams
May 8 – Semester Ends
May 11 – Grades Due

Classroom Guidance Regarding Protect Purdue

The [Protect Purdue Plan](#), which includes the [Protect Purdue Pledge](#), is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, properly wearing a mask [in classrooms and campus building](#), at all times (e.g., mask covers nose and mouth, no eating/drinking in the classroom), disinfecting desk/workspace before and after use, maintaining appropriate social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not properly wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](#). See also [Purdue University Bill of Student Rights](#).

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace table of contents, under University Policies.

[Purdue's Honor Pledge](#): *"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."*

Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue's full Nondiscrimination Policy Statement is included in our course Brightspace under University Policies.

Accessibility

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Mental Health/Wellness Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#). Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the [Office of the Dean of Students](#). Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a [Purdue Wellness Coach at RecWell](#). Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Disclaimer

Course requirements, deadlines and grading percentages are subject to changes that may be necessitated in the event of major campus emergency or other circumstances. You can get information about changes in this course in Brightspace. Notes are considered to be derivative works of the instructor's presentations and materials, and thus are subject to the instructor's copyright in such presentations and materials.