PHY 431 – Quantum Mechanics 3 Units Fall 2018

PLNU Mission Statement

To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Professor: Dr. Heide Doss
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E-mail: plnuPhysicsDoss@gmail.com or hdoss@pointloma.edu (response time faster for first email)
Office Hours: MWF 11:00 AM – 12:00 AM (office), Th 12:30 PM-2:30 PM (LA2) or by appointment. NOTE if you really need to see me I will also be around MF from about 10:00AM to 11:00AM but this is also around Chapel time – so you'll have to make up Chapel one evening.

Regular meeting times Aug 28, 2017 – December 7, 2017 (NOTE: T 8/28 is a M schedule**)**
Lecture: MWF 12:15 PM – 1:10 PM (LA 102)
Final Exam: Wed Dec 12, 2018, 10:30 AM to 1:00 PM

Textbook: Introduction to Quantum Mechanics 2nd Ed., by David J. Griffith, Pearson/Prentice Hall 2005

Course Description: A rigorous introduction to quantum physics including Schrödinger's equation, matrix mechanics, perturbation theory, and applications in atomic and molecular physics.

Prerequisite(s): PHY 304 and MTH 274.
Recommended: MTH 333

Student Learning Outcomes: In this course there are a number of specific goals for you to meet from each chapter. These smaller goals fit into the following overall learning outcomes of the physics and engineering programs to: develop an understanding of the fundamental principles of physics and of engineering; apply physical principles, mathematical reasoning, and computational techniques to solve real-world problems; analyze and interpret data; and effectively communicate complicated technical information. Once you complete this course, you should be able to:

1. apply quantum mechanical principles to several situations;
2. explain the physical meaning of the mathematical formulation;
3. articulate the big ideas from each section of each chapter such as the wave function, stationary states, potential energy wells, observables, the uncertainty principle, the three-dimensional Schrödinger equation, the hydrogen atom, systems of identical particles;
4. justify and explain your thinking and approach to a problem or physical situation; and
5. sketch and interpret relevant diagrams (such as energy level diagrams or sketches of wave functions and their probabilities.)

Pre-class Assignments: Preclasses are assigned for each class day and are due before class (9:00 AM). Your responses to the pre-class questions are graded as follows: 2 = demonstrates reading of material and thinking about material;1 = room for improvement; 0 = unsatisfactory. Pre-class comprises 5% of your grade.

Homework/Classwork: Problems assigned throughout the course are essential to your learning the material. Problems in this course are largely analytic but may be complemented by computational methods. Problems should be worked neatly in clear logical steps. Solutions should be clear enough that one of your peers could easily follow what you did if they had not worked the problem before. Homework/Classwork comprises 20% of your grade. HW sets are due at the beginning of class and will not be accepted late. Classwork cannot be made up.

Collaboration: Scientists and engineers collaborate, and I expect and encourage you to collaborate with your peers while working on homework and labs, **however** your work should be your own. The guideline is that you should have no trouble explaining or repeating the work you turn in. No homework solutions should look identical.

Late Work: Late work will not be accepted unless there is a documented emergency. Assignments are due as noted on the syllabus, in class, and on Canvas. Incompletes are only assigned in extremely unusual circumstances.

You must take ALL the exams and the final in order to pass the class.

Exams: There will be five Exams during the semester, each worth 11% of your grade. Exams make a total of 55% of your grade. You must take all exams to pass the course.

Final Exam: Wed Dec 12, 2018, 10:30 AM to 1:00 PM The final exam date and time is set by the university at the beginning of the semester and may not be changed by the instructor. This schedule can be found on the university website and in the course calendar. No requests for early examinations will be approved. Only in the case that a student is required to take three exams during the same day of finals week, is an instructor authorized to consider changing the exam date and time for that particular student.

Final Exam: Wed Dec 12, 2018, 10:30 AM to 1:00 PM
Successful completion of this class requires taking the final examination **on its scheduled day**. The final examination schedule is posted on the Class Schedules site. **No requests for early examinations or alternative days will be approved**. The final exam is worth 20% of your grade.

Missed Exam Policy: No make-up exams are allowed except for warranted circumstances. Arrangements must be made with me as soon as possible.

Final Course Grade: The points you receive during the course are weighted accordingly:

Component	**Weight**
Pre-Class	5%
Homework/Classwork	20%
Exams (5)	55% (equally weighted)
Final Exam	20%

The grade you earn in this course is based on the following scale:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-
S≥ 91.5	91.5 >S≥ 89.5	89.5 >S≥ 86.5	86.5 >S ≥ 81.5	81.5 >S≥ 79.5	79.5 >S≥ 76.5	76.5 >S≥ 71.5	71.5 >S≥ 69.5	69.5 >S≥ 66.5	66.5 >S≥ 61.5	61.5 >S≥ 59.5

Department Mission:
The Physics and Engineering Department at PLNU provides strong programs of study in the fields of Physics and Engineering. Our students are well prepared for graduate studies and careers in scientific and engineering fields. We emphasize a collaborative learning environment, which allows students to thrive academically, build personal confidence, and develop interpersonal skills. We provide a Christian environment for students to learn values and judgment, and pursue integration of modern scientific knowledge and Christian faith.

PLNU Attendance and Participation Policy:
Attendance is expected at each class session. In the event of an absence you are responsible for the material covered in class and the assignments given that day.

Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member can file a written report, which may result in de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university drop date or, after that date, receive the appropriate grade for their work and participation. See http://catalog.pointloma.edu/content.php?catoid=24&navoid=1581#Class_Attendance in the Undergraduate Academic Catalog.

Class Enrollment:
It is the student's responsibility to maintain his/her class schedule. Should the need arise to drop this course (personal emergencies, poor performance, etc.), the student has the responsibility to follow through (provided the drop date meets the stated calendar deadline established by the university), not the instructor. Simply ceasing to attend this course or failing to follow through to arrange for a change of registration (drop/add) may easily result in a grade of F on the official transcript.

Academic Accommodations:
While all students are expected to meet the minimum standards for completion of this course as established by the instructor, students with disabilities may require academic adjustments, modifications or auxiliary aids/services. At Point Loma Nazarene University (PLNU), these students are requested to register with the Disability Resource Center (DRC), located in the Bond Academic Center. (DRC@pointloma.edu or 619-849-2486). The DRC's policies and procedures for assisting such students in the development of an appropriate academic adjustment plan (AP) allows PLNU to comply with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Section 504 (a) prohibits discrimination against students with special needs and guarantees all qualified students equal access to and benefits of PLNU programs and activities. After the student files the required documentation, the DRC, in conjunction with the student, will develop an AP to meet that student's specific learning needs. The DRC will thereafter email the student's AP to all faculty who teach courses in which the student is enrolled each semester. The AP must be implemented in all such courses.

If students do not wish to avail themselves of some or all of the elements of their AP in a particular course, it is the responsibility of those students to notify their professor in that course. PLNU highly recommends that DRC students speak with their professors during the first two weeks of each semester about the applicability of their AP in that particular course and/or if they do not desire to take advantage of some or all of the elements of their AP in that course.

Credit Hour:
In the interest of providing sufficient time to accomplish the stated course learning outcomes, this class meets the PLNU credit hour policy for any 4 unit class delivered over 15 weeks. Specific details about how the class meets the credit hour requirements can be provided upon request.

Copyright Protected Materials:
Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

PLNU Academic Honesty Policy:
Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See http://catalog.pointloma.edu/content.php?catoid=24&navoid=1581#Academic_Honesty for definitions of kinds of academic dishonesty and for further policy information.

FERPA Policy: In compliance with federal law, neither PLNU student ID nor social security number should be used in publicly posted grades or returned sets of assignments without student written permission. This class will meet the federal requirements by distributing grades and papers individually. Also, in compliance with FERPA, you will be the only person given information about your progress in this class unless you have designated others to receive it in the "Information Release" section of the student portal. See Policy Statements in the undergrad academic catalog.

TENTATIVE SCHEDULE – subject to updates
Time spent outside of class should be between 2 and 3 hours per credit hour per week
Pre-class assignments on Canvas are due by 9:00 AM, unless otherwise noted

Date	Topics and Readings	Assignments
8/28/18 T = **Monday schedule**	*Readings are due before class starts, the first day is an exception.* Read entire preface of Griffith. Chapter 1.1-1.4	Pre-classes are due by 9:00 AM the day of class. The first pre-class is an exception, It is due tomorrow by 9:00AM along with. pre-class 1 due by 8/29 HW 1 due 8/30 Problems 1.1, 1.2, 1.3, 1.5 **See Canvas for full HW assignments**
8/29/18 W	Chapter 1.5-1.6	pre-class 2 due HW 2 due 8/31 P: 1.7, 1.9, 1.10. 1.16, 1.17
8/31/18 F	Chatper 2.1-2.2	pre-class 3 due HW 2 due P: 1.7, 1.9, 1.10. 1.16, 1.17
9/3/18 M	**LABOR DAY – NO CLASSES**	
9/5/18 W	**Exam 1 Chapter 1**	pre-class 4 due
9/7/18 F	Chapter 2.1-2.2 Chapter 2.3.1	pre-class 5 due
9/10/18 M	Chapter 2.3.1	pre-class 6 due HW 3 due Problems 2.1, 2.2, 2.3, 2.4, 2.5, 2.7
9/12/18 W	Chapter 2.3.2	pre-class 7 due HW 4 due Problems 2.10, 2.11, 2.12 See Canvas for full assignment
9/14/18 F	Chapter 2.4	pre-class 8 due HW 5 due Problems 2.17
9/17/18 M	Chapter 2.5	pre-class 9 due HW 6 due Problems 2.22 (graph part c) extra credit 2.20
9/19/18 W	Chapter 2.6	pre-class 10 due HW 7 due P: 2.23, 2.26. 2.27
9/21/18 F	Chapter 6.1-6.2.1 (some Dirac notation used here)	pre-class 11 due HW 8 due Problems 2.29, 2.34, 2.38
9/24/18 M	Chapter 6.2.1	pre-class 12 due HW 9 due Problems 6.1, 6.2, 6.4
9/26/18 W	Chapter 2 review /catch up	pre-class 13 due HW 10 due Problem 6.7
9/28/18 F	**EXAM 2 Chapter 2, 6.1, 6.2.1**	pre-class 14 due Read ch 3
10/1/18 M	Read the Appendix and Chapter 3.1-3.2	pre-class 15 due HW 11 due Problems A.8, A.9, A.11, A18

Date	Topics and Readings	Assignments
10/3/18 W	Chapter 3.3	pre-class 16 due HW 12 due Problems 3.2, 3.3
10/5/18 F	Chapter 3.4 – 3.5	Pre-class 17 due
10/8/18 M	Chapter 3.5	pre-class 18 due HW 13 due Problems 3.11, 3.12
10/10/18 W	Chapter 3.6	pre-class 19 due HW 14 due Problems 3.13, 3.14, 3.17
10/12/18 F	Chapter 6.2.2, Review Chapter 3/ catch up	pre-class 20 due
10/15/18 M	**EXAM 3 Chapter 3**	pre-class 21 due HW 15 due Problems 3.30, 3.31, 3.36, 3.37, 6.9 note: not a hw problem, but 3.38 is great practice for the test
10/17/18 W	Chapter 4.1	pre-class 22 due
10/19/18 F	NO CLASSES Fall Break Day	
10/22/18 M	Chapter 4.1 – 4.2	pre-class 23 due HW 16 due Problems 4.1, 4.2, 4.3, 4.5
10/24/18 W	Chapter 4.2	pre-class 24 due
10/26/18 F	Chapter 4.2 – 4.3	pre-class 25 due HW 17 P:4.10, 4.11, 4.12, 4.13
10/29/18 M	Chapter 4.3	pre-class 26 due HW 18 due P: 4.16
10/31/18 W	Chapter 4.3-4.4	pre-class 27 due
11/2/18 F	Chapter 4.4	pre-class 28 due HW 19 due 4.18, 4.19, 4.21, 4.22
11/5/18 M	Chapter 4.4	pre-class 29 due
11/7/18 W	Chapter 6.3-6.5, Chapter 4 review/ catch up	pre-class 30 due HW 20 due Problems 4.28, 4.29
11/9/18 F	**Exam 4 Chapter 4, chapter 6.3-6.5**	pre-class 31 due HW 21 due Problems 4.34, 4.38, 4.44, 6.12 (ALSO read other single starred problems in 6.3-6.5, and take a look at 6.31 and 6.40 too. Tell me what they are asking – you don't have to do them.)
11/12/18 M	Chapter 5.1	pre-class 32 due
11/14/18 W	Chapter 5.1	pre-class 33 due HW 22 due Problem 5.4

Date	Topics and Readings	Assignments
11/16/18 F	Chapter 5.2	pre-class 34 due HW 23 due Problem 5.6
11/19/18 M	Chapter 5.3	pre-class 35 due HW 24 due Problems 5.9, 5.12, 5.13
11/21-23 W Th F	NO CLASSES Thanksgiving Break	
11/26/18 M	Chapter 5.3-5.4	pre-class 36 due HW 25 due Problems 5.15, 5.16
11/28/18 W	Chapter 5.4	pre-class 37 due HW 26 due Problems 5.22, 5.23, 5.24
11/30/18 F	Chapter 5, Chapter 6.3-6.5	pre-class 38 due
12/3/18 M	Review Chapter 5 / catch up	pre-class 39 due HW 27 due Problems, 5.32, 5.33, 5.34 read 5.30, 5.31, and 5.36 and tell me about them - you don't have to solve them.
12/5/18 W	**Exam 5 Chapter 5, 6.3-6.5**	pre-class 40 due (review)
12/7/18 F	REVIEW	pre-class 41 due (perusing ch 12)
12/12/18 W	**FINAL EXAM 10:30 AM - 1:00 PM**	
	Grades turned in by Dec23	