PHYSICS 4363010
QUANTUM MECHANICS

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Office Hours: By email appointment

Course Information

Course Description

A study of the fundamental principles of quantum theory with emphasis on both the Schrodinger and matrix formulations.

Prerequisite and Co-requisite Courses

Physics 3301, and credit for or parallel registration in Physics 3461.

Prerequisite Skills

Ability to use Blackboard, use ASU Library resources, attend class, and meet deadlines.

Student Learning Outcomes

Upon completion of this course, students will be able to:

- Gaining a basic understanding of the subject (e.g., factual knowledge, methods, principles, generalizations, theories),
- Learning to *apply* course material (to improve thinking, problem solving, and decisions), and
- Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to this course.

Course Delivery

This course is a face-to-face course with learning resources and supplemental materials posted in Blackboard.

Required Texts and Materials

Quantum Mechanics by Richard Fitzpatrick, Open Source text book available in Blackboard. A student of this institution is not under any obligation to purchase a textbook from a university-affiliated bookstore. The same textbook may also be available from an independent retailer, including an online retailer.

Technology Requirements

To successfully complete this course, students need to be proficient with Blackboard and using open source text books.

Communication

Faculty will respond to university email and/or telephone messages within 24 hours during working hours Monday through Friday. Weekend messages may not be returned until Monday.

Grading

Evaluation and Grades

Course grades will be determined as indicated in the table below.

Assessment	Percent of Total Grade
Concept Survey	10%
Exams (One, Two, and Final)	35% (10%, 10%, 15%)
Problem Sets	35%
Class Presentation	20%
Total	100%

Honors program requirement will be an additional 20% of the course grade (A >= 108%, B 96% to 107.94%, C 84% to 95.4%, D 72% to 83.4%, and F < 72%).

Grading System

Course grades will be dependent upon completing course requirements and meeting the student learning outcomes.

The following grading scale is in use for this course:

A = 90.00-100 points
B = 80.00-89.99 points
C = 70.00-79.99 points
D = 60.00-69.99 points
F = 0-59.99 points (Grades are not rounded up)

Assignment and Activity Descriptions

Homework is due at the next class meeting. Late homework assignments will receive zero credit. Makeup exams must be prearranged with the instructor prior to exam dates. Presentation of a peer-reviewed article on quantum mechanics is required. See Blackboard for the presentation requirements.

Students taking Physics 4363 for Honor Program requirements must complete one of the following:

- Read 3 peer reviewed papers by scientists cited in the text. Write a paper discussing how these scientists reached their published conclusions about quantum mechanics. This paper

may include physics formulas and graphics, but the primary focus should be on cause and effect; i.e., the historical perspective.

- Read a peer reviewed paper on an effect in quantum mechanics. Write a paper using your own words on how you would explain this effect to another student. Word or pdf format is acceptable.

- Read a peer reviewed paper on an effect in quantum mechanics. Write a 5 to 6-page summary and an abstract no more than 450 words for this paper. Convert your summary and abstract to poster format. Presentation of this poster at the April University Undergraduate Symposium is required.

General Policies Related to This Course

All students are required to follow the policies and procedures presented in these documents:

- Angelo State University Student Handbook[1]
- Angelo State University Catalog[2]

Academic Integrity

Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU.

The College of Science and Engineering adheres to the university's Statement of Academic Integrity.[3]

Accommodations for Students with Disabilities

ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA) and subsequent legislation.

Student Disability Services is located in the Office of Student Affairs, and is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability. It is the student's responsibility to initiate such a request by contacting an employee of the Office of Student Affairs, in the Houston Harte University Center, Room 112, or contacting the department via email at ADA@angelo.edu. For more information about the application process and requirements, visit the Student Disability Services website.[4] The employee charged with the responsibility of reviewing and authorizing accommodation requests is:

Dallas Swafford
Director of Student Disability Services
Office of Student Affairs
325-942-2047

dallas.swafford@angelo.edu
Houston Harte University Center, Room 112

Incomplete Grade Policy

It is policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required. See ASU Operating Policy 10.11 Grading Procedures[5] for more information.

Plagiarism

Plagiarism is a serious topic covered in ASU's Academic Integrity policy[6] in the Student Handbook. Plagiarism is the action or practice of taking someone else's work, idea, etc., and passing it off as one's own. Plagiarism is literary theft.

In your discussions and/or your papers, it is unacceptable to copy word-for-word without quotation marks and the source of the quotation. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list.

Papers are subject to be evaluated for originality. Resources to help you understand this policy better are available at the ASU Writing Center.[7]

Student Absence for Observance of Religious Holy Days

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. See ASU Operating Policy 10.19 Student Absence for Observance of Religious Holy Day[8] for more information.

Title IX at Angelo State University

The University prohibits discrimination based on sex, which includes pregnancy, sexual orientation, gender identity, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination including: sexual assault, sex-based discrimination, sexual exploitation, sexual harassment, public indecency, interpersonal violence (domestic violence and/or dating violence), and stalking. As a faculty member, I am a Responsible Employee meaning that I am obligated by law and ASU policy to report any allegations I am notified of to the Office of Title IX Compliance.

Students are encouraged to report any incidents of sexual misconduct directly to ASU's Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator at:

Michelle Miller, J.D.
Special Assistant to the President and Title IX Coordinator
Mayer Administration Building, Room 210
325-486-6357
michelle.boone@angelo.edu

You may also file a report online[9] 24/7.

If you are wishing to speak to someone about an incident in confidence you may contact the University Health Clinic and Counseling Center at 325-942-2173 or the ASU Crisis Helpline at 325-486-6345.

For more information, visit the Title IX website.[10]

Modifications to the Syllabus

This syllabus, including grade evaluation and course schedule, is subject to modification.

Course Schedule

Date	Topic	Homework
Jan 19	Probability Theory	2:2
Jan 21	Waves and Complex Numbers	3:2,4,7,8
Jan 24	Photoelectric Effect and Double Slit with Waves	
Jan 26	Double Slit with Electrons and Wave Packets	
Jan 28	Double Slit with Electrons and Wave Packets	
Jan 31	Gaussian Wave Packets	
Feb 2	Schrodinger's Equation	
Feb 4	University Closed	
Feb 7	**Concept Survey over Chapters 2 and 3**	
Feb 9	Normalization	4:1,2,4,7
Feb 11	Probability Current	
Feb 14	Expectation Values	
Feb 16	Erhenfest's Theorem	
Feb 18	Operators	
Feb 21	Momentum Representation	
Feb 23	Heisenberg Uncertainty & Eigen Sachen	
Feb 25	Orthogonality & Stationary States	
Feb 28	One Dimensional Potentials	5:4,6,8
Mar 2	Square Potential Barrier	
Mar 4	Square Well Potential	
Mar 7	WKB Approximation, **Exam 1 Available**	
Mar 9	Harmonic Oscillator	
Mar 11	Raising and Lowering Operators	
Mar 14-18	*Spring Break Holiday*	
Mar 21	Exam 1 Recitation	
Mar 23	Non-interacting Particles, **Exam 1 Due**	6: Handout
Mar 25	Identical Particles	
Mar 28	Three-Dimensional Particle in a Box	7: Handout
Mar 30	Degenerate Electron Gas,	
Apr 1	Angular Momentum (Section 8.2)	8:1
Apr 4	L^2 and L_z Operators, **Exam 2 Available**	
Apr 6	Central Potentials (φ solution)	9:1,3
Apr 8	Central Potentials (θ solution)	
Apr 11	Spherical Harmonics (Orthonormality, etc…)	
Apr 13	Central Potentials (r solution)	
Apr 15	Exam 2 Recitation	

Apr 18	Hydrogen Atom, **Exam 2 Due**	
Apr 20	Hydrogen Atom	
Apr 22	Hydrogen Atom	
Apr 25	Spin Operators	
Apr 27	Eigenstates of S_z and S^2	
Apr 29	Article Presentation Guidelines	
May 2	Article Presentations	
May 4	Article Presentations	
May 6	Article Presentations	
May 11	**Exam 3 on the Hydrogen atom in Blackboard***	

[1] https://www.angelo.edu/current-students/student-handbook/
[2] https://www.angelo.edu/academics/catalog/
[3] https://www.angelo.edu/live/files/27603-student-handbook-2020-21#page=96
[4] https://www.angelo.edu/current-students/disability-services/
[5] https://www.angelo.edu/content/files/14197-op-1011-grading-procedures
[6] https://www.angelo.edu/live/files/27603-student-handbook-2020-21#page=96
[7] https://www.angelo.edu/current-students/writing-center/academic_honesty.php
[8] https://www.angelo.edu/content/files/14206-op-1019-student-absence-for-observance-of
[9] http://www.angelo.edu/incident-form
[10] https://www.angelo.edu/title-ix