SYLLABUS (Tentative Syllabus, Subject to Modification)
PHYS. 4310
Quantum Mechanics

Dr. Sandra Quintanilla   Office: Physics 309
Spring 2021   email: squintanilla@unt.edu
Lecture: MWF 10:00 – 10:50 a.m.   Phone: 565-4739
Recitation: W 11:00 – 11:50 a.m.   Office hours: M 11:15 a.m. – 12:15 p.m.
Partial Remote   Office hours: F 11:15 a.m. – 12:15 p.m.

Exam Schedule:
First Term Exam: 10:00 a.m. – 11:50 a.m. Wednesday, 02/17/2021, Phys. 102
Second Term Exam: 10:00 a.m. – 11:50 a.m. Wednesday, 03/17/2021, Phys. 102
Third Term Exam: 10:00 a.m. – 11:50 a.m. Wednesday, 04/14/2021, Phys. 102
Final Exam: 8:00 a.m. – 10:50 a.m. Saturday, 04/24/2021, Phys. 102

COVID rules:
See University COVID rules regarding coming to campus.
https://healthalerts.unt.edu/
https://healthalerts.unt.edu/return/safety?unttoday=070620
Learn Anywhere Fall 2020 https://online.unt.edu/learn?unttoday=081920
Return to Learn https://vpaa.unt.edu/return
From "https://clear.unt.edu/teaching-resources/dsi-clear-syllabus-template" with modification: "Face coverings are required at UNT. Students are expected to wear face coverings in class, in recitation and when we meet in person. If you are unable to wear a face covering due to a disability, please contact the Office of Disability Access to request an accommodation. UNT face covering requirements are subject to change due to community health guidelines. Any changes may be communicated via the instructor."
Face coverings are required in the classroom and in the building on the way to and from the classroom. Please see: https://www.untsystem.edu/covid-19-response-guidelines#toc-3
"If you are experiencing any symptoms of COVID-19 please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Hotline at 844-366-5892 or COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure. While attendance is an important part of succeeding in this class, your own health, and those of others in the community, is more important."
https://studentaffairs.unt.edu/student-health-and-wellness-center/services/laboratory/covid-testing

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Prerequisite(s): PHYS. 3010/PHYS.3030 and MATH. 3410
PHYS. 3010: Modern Physics
PHYS. 3030: Laboratory in Modern Physics
MATH 3410: Differential Equations I

Recommended Prerequisites:
MATH. 2700: Linear Algebra and Vector Geometry
MATH. 3420: Differential Equations II
PHYS. 3310: Mathematical Methods in the Physical Sciences

Text: *Introduction to Quantum Mechanics*, David J. Griffiths and Darrell F. Schroeter, 3rd Edition.
Cambridge University Press.
ISBN: 978-1-107-18963-8 Hardback
DOI: 10.1017/9781316995433
https://www.reed.edu/physics/faculty/griffiths/QM3a.pdf
https://www.reed.edu/physics/faculty/griffiths/QM3ErrataCurrent.pdf

Useful Resources:
- *Basic Quantum Mechanics*, J. M. Cassels, 2nd Edition, (McGraw-Hill Ltd, 1982) ISBN: 0 333 18599.
- *Quantum Mechanics*, Eugen Merzbacher, 3rd Edition, (John Wiley & Sons, Inc. 1961, 1970, 1988, 1998) ISBN: 0-471-88702-1.
- *Principles of Quantum Mechanics*, R. Shankar, 2nd Edition, (Springer Science+Business Media, Inc. 1994) ISBN; 0-306-44790-8.
- *Quantum Mechanics*, Leonard I. Schiff, (International Student Edition, McGraw-Hill International Book Company, 1968) ISBN 9-07-085643-5.
- *Introductory Quantum Mechanics*, R. L. Liboff, 2nd Edition, (Addison-Wesley Publishing Company, Inc., 1992) ISBN 0-201-54715-5.
- *Quantum Physics*, Stephen Gasiorowicz, (John Wiley, 1974).
- *Mathematical Methods for Science Students*, G. Stephenson.
- *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*, R. Eisberg and R. Resnick, (John Wiley & Sons 1974, 1985), ISBN: 0-471.12.E34.
- *Mathematical Methods for Physicists, A Comprehensive Guide*, 7th Edition, George B. Arfken, Hans J. Weber, and Frank E. Harris, Academic Press, An imprint of Elsevier elsevierdirect.com, ISBN-13: 978-0123846549, ISBN-10: 0123846544.
- *NIST Digital Library of Mathematical Functions,* http://dlmf.nist.gov/
- http://www.demonstrations.wolfram.com/search.html?query=Quantum Mechanics
- *Physics of Atoms and Molecules*, B. H. Bransden and C. J. Joachain, 2nd Edition, 2003 Prentice Hall, An imprint of Pearson Education, Harlow, England, London, New York, ISBN 0582 35692 X.

Course Content: 3 hours. (3;0;1) Origins of the modern theory of atomic structure; Schrödinger's formulation of non-relativistic, single-particle quantum mechanics and application to simple systems; the one-electron atom.

Course Objectives:
- To learn basis quantum mechanics and its mathematical formulation.
- To be ready to take the graduate Quantum Mechanics courses.

Exams:

For pre-test exam (held Wednesday, January 13th, in recitation via Zoom) a webcam is required. Download the pre-test from *Canvas*. Submit your pre-test answers in pdf format on *Canvas*.

There are three term exams and one final exam. Exams may be based on the text reading, any other assigned readings, class lectures, homework and any additional material given. Pay attention to *Canvas*. Closed book exams. Calculators may not be used.

In general, I do not give make-up exams. If you are sick, provide an official medical note. Terms exams are scheduled in class and recitation on Wednesdays. I plan to provide a Seat Assignments for all exams held on campus. If you have COVID-19, COVID-19 symptoms or need to self-isolate, please contact the COVID UNT hotline. (See https://healthalerts.unt.edu/, Email: COVID@unt.edu, Phone: 844-366-5892) Also, please contact myself by email.

For any exams held remotely via Zoom, a webcam is required. A LockDown Browser may be required.

Homework: Weekly homework is due typically by 9:00 a.m. on Fridays. Submit in pdf format on *Canvas*. No-late homework is accepted unless I give permission. If you are sick, please email me an official medical note. I plan to drop the lowest homework score.

Canvas: Please check *Canvas* daily Monday-Saturday for possible announcements, Mathematica files, references, quizzes, homework assignments, etc.

Reading and Preparation:
- Read appropriate sections of the book before class *Canvas*.
- Read from additional material if suggested.
- Please look at Mathematica files and/or pdf files that are referenced or given on *Canvas*.
- Read class notes and book after class.
- I plan to post class notes and recordings on *Canvas*. Please read the class notes. Recordings that are posted on *Canvas* are for this course and must not be used elsewhere.

Message from the Provost: "Class recordings are reserved for use only by students in this class for educational purposes. The recordings should not be shared outside the class in any form. Failing to follow this restriction is a violation of the UNT Code of Student Conduct and could lead to disciplinary action."
https://vpaa.unt.edu/office-provost/covid-19-update-32720

Attendance:
- Required attendance for both class and recitation via Zoom. Exams are currently scheduled to be on campus. If you are unable to attend class and/or recitation at the scheduled times, please let me know by email. Webcams are strongly encouraged.
- I plan to record class when given via Zoom.
- Please look for Zoom links for class and office hours on *Canvas*.
- You are required to take exams on campus unless there is a justifiable reason not to do so that is approved by the myself or if the university closes.
- https://policy.unt.edu/policy/06-039
- Webcams are strongly recommended for class and for recitation.

- When on Zoom for class and recitation, send message in Chat on Zoom to say that you are here. You are required to do this. This gives me a record for attendance.

Recitation: The plan for recitation includes discussing homework, doing extra problems and reviewing the material.

Quizzes: The plan is for weekly quizzes which we are to be posted on *Canvas*. Submit your quiz in pdf format on *Canvas*. I plan to drop the lowest quiz score.
Grading scheme for quizzes:
- 10 points for giving in a quiz and doing all or most of the questions reasonably well.
- 5 points for giving in a quiz and only doing some of the questions reasonably well, or doing all/most the problems but all/most of them are wrong.
- 0 points for not giving in the quiz or for giving in a quiz where none of the questions are correct.

Study Group: I plan to assign study group to meet via Zoom weekly to discuss homework and/or to study for an exam. I expect you to attend a study group, in general, each week.

Grading:

Homework	15%	A: 90-100
Quizzes	5%	B: 80-89
Three unit exam average	60%	C: 70-79
Comprehensive final	20%	D: 60-69
	100%	F: < 60

Policies and Procedures:
https://teachingcommons.unt.edu/teaching-handbook/definitions-and-policies/
Emergency Notifications & Procedures
unt-teaching-policies/emergency-notifications-procedures
"Emergency Notification & Procedures. UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Blackboard for contingency plans for covering course materials." [Blackwood → Canvas ?] https://emergency.unt.edu/
https://emergency.unt.edu/emergency-floor-plans
physics_building_emergency_floorplan_2019.pdf
If there is a tornado or hurricane, please proceed to the physics basement.

Cell phones, iPads, tablets, etc, are to be turned off during class and recitation, other than when taking SPOT evaluations if done in class and/or in recitation.
Extra Help: If you are having trouble with this course, please come to "see" me via Zoom during office hours or please make an appointment to "see" me via Zoom. I am also available by email at squintanilla@unt.edu.
I have been assigned a TA for this course.

Student Academic Integrity: https://policy.unt.edu/policy/06-003

Office of the Registrar: https://registrar.unt.edu/
Spring 2021 Registration Guide:
https://registrar.unt.edu/registration/spring-registration-guide

Student Evaluation System: http://vpaa.unt.edu/spot
https://vpaa.unt.edu/spot/fa20/spring21calendars

https://www.unt.edu/catalogs/2020-21/calendar
Office of Disability Access
https://policy.unt.edu/policy/16-001
https://disability.unt.edu/parents-faculty-staff/taglines
"The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking reasonable accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with a reasonable accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request reasonable accommodations at any time, however, ODA notices of reasonable accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of reasonable accommodation for every semester and must meet with each faculty member prior to implementation in each class. Students are strongly encouraged to deliver letters of reasonable accommodation during faculty office hours or by appointment. Faculty members have the authority to ask students to discuss such letters during their designated office hours to protect the privacy of the student. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323."

In attachment of an email by the Physics Dept. Main Office.
The University of North Texas is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 92-112 The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act (ADA), pursuant to section 504 of the Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

https://cos.unt.edu/
https://physics.unt.edu/

1-1	M	Jan. 11	Chp. 1	Wave Equation
1-2	W	Jan. 13	Chp. 1	Wave Equation
1-3	F	Jan. 15	Chp. 1	Wave Equation
2-4	W	Jan. 20	Chp. 2	Time-Independent Schrödinger Equation
2-5	F	Jan. 22	Chp. 2	Time-Independent Schrödinger Equation
3-6	M	Jan. 25	Chp. 2	Time-Independent Schrödinger Equation
3-7	W	Jan. 27	Chp. 2	Time-Independent Schrödinger Equation
3-8	F	Jan. 29	Chp. 2	Time-Independent Schrödinger Equation
4-9	M	Feb. 1	Chp. 2	Time-Independent Schrödinger Equation
4-10	W	Feb. 3	Chp. 2	Time-Independent Schrödinger Equation
4-11	F	Feb. 5	Chp. 2	Time-Independent Schrödinger Equation
5-12	M	Feb. 8	Chp. 2	Time-Independent Schrödinger Equation
5-13	W	Feb. 10	Chp. 2	Time-Independent Schrödinger Equation
5-14	F	Feb. 12	Chp. 2	Time-Independent Schrödinger Equation
6-15	M	Feb. 15	Chp. 2	Time-Independent Schrödinger Equation
6-16	W	Feb. 17	Exam 1.	Chapters 1 & 2
6-17	F	Feb. 19	Chp. 3	Formalism
7-18	M	Feb. 22	Chp. 3	Formalism
7-19	W	Feb. 24	Chp. 3	Formalism
7-20	F	Feb. 26	Chp. 3	Formalism
8-21	M	Mar. 1	Chp. 3	Formalism
8-22	W	Mar. 3	Chp. 4	QM in 3D
8-23	F	Mar. 5	Chp. 4	QM in 3D	Hwk due

9-24	M	Mar. 8	Chp. 4	QM in 3D
9-25	W	Mar. 10	Chp. 4	QM in 3D
9-26	F	Mar. 12	Chp. 4	QM in 3D
10-27	M	Mar. 15	Chp. 4	QM in 3D
10-28	W	Mar. 17	Exam 2	Chapters 2 & 3
10-29	F	Mar. 19	Chp. 4	QM in 3D
11-30	M	Mar. 22	Chp. 4	QM in 3D
11-31	W	Mar. 24	Chp. 4	QM in 3D
11-32	F	Mar. 26	Chp. 4	QM in 3D
12-33	M	Mar. 29	Chp. 4	QM in 3D
12-34	W	Mar. 31	Chp. 4	QM in 3D
13-35	M	Apr. 5	Chp. 4	QM in 3D
13-36	W	Apr. 7	Chp. 4	QM in 3D
13-37	F	Apr. 9	Chp. 4	QM in 3D
14-38	M	Apr. 12	Chp. 4.	QM in 3D
14-39	W	Apr. 14	Exam 3.	Chapters 3 & 4
14-40	F	Apr. 16	Chp. 5	Identical Particles
15-41	M	Apr. 19	Chp. 5	Identical Particles
15-42	W	Apr. 21	Review	