

**SYLLABUS** (Subject to Modification)

**PHYS. 4310**

**Quantum Mechanics**

Dr. Sandra Quintanilla

Spring 2019

Lecture: MWF 9:00 – 9:50 a.m.

Recitation: M 2:00 – 2:50 p.m. (3:20 p.m.)

Physics 116

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Office hours: M 1:00 p.m. – 1:30 p.m.

Office hours: WF 10:00 a.m. – 10:30 a.m.

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**Prerequisite(s):** PHYS. 3010/PHYS.3030 and MATH. 3410

PHYS. 3010: Modern Physics

PHYS. 3030: Laboratory in Modern Physics

**Recommended Prerequisites:**

MATH. 2700: Linear Algebra and Vector Geometry

MATH. 3410: Differential Equations I

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, 3<sup>rd</sup> Edition.

Cambridge University Press.

ISBN: 978-1-107-18963-8 Hardback

DOI: 10.1017/9781316995433

<https://www.reed.edu/physics/faculty/griffiths/Errata1QM3.pdf>

**Useful Resources:**

- *Basic Quantum Mechanics*, J. M. Cassels, 2<sup>nd</sup> Edition, (McGraw-Hill Ltd, 1982) ISBN: 0 333 18599.
- *Quantum Mechanics*, Eugen Merzbacher, 3<sup>rd</sup> Edition, (John Wiley & Sons, Inc. 1961, 1970, 1988, 1998) ISBN: 0-471-88702-1.
- *Principles of Quantum Mechanics*, R. Shankar, 2<sup>nd</sup> 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, 2<sup>nd</sup> 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](http://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](http://www.demonstrations.wolfram.com/search.html?query=Quantum+Mechanics)
- *Physics of Atoms and Molecules*, B. H. Bransden and C. J. Joachain, 2<sup>nd</sup> 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:** There are three term exams and one final exam. Exams will be based on the text reading, any other assigned readings, class lectures, homework and any additional material given. Closed book exams. Calculators can not be used. No make-up exams given in general. Terms exams are scheduled on Mondays from 2:00 p.m. to 3:20 p.m.

**Homework:** Weekly homework that is due at beginning of the Wednesday class and to be given in class. No-late homework accepted unless permission given by instructor. The plan is for homework assignments to be placed on *Canvas*.

**Canvas:** Please check blackboard daily Monday-Saturday for possible announcements, Mathematica files and references.

**Reading:** Read appropriate sections of the book before class. Read from additional material if suggested. Read class notes and book after class.

**Attendance:** Required attendance for both class and recitation.

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

**Quizzes:** The plan is to give quizzes during some of the recitations. Quizzes may also be passed out during recitation to do outside of recitation. The quizzes do not help directly towards your grade, but take them seriously.

**Grading:**

Three unit exam average	60%	A: 90-100
Homework	15%	B: 80-89
Comprehensive final	<u>25%</u>	C: 70-79
	100%	D 60 -69
		F: < 60

**Additional Policies and Procedures:**

Cell phones, iPads, tablets, etc, are to be turned off during class during to class and recitation, other than when taking SPOT evaluations if done in class or recitation.

Extra Help: If you are having trouble with this class, please come by my office during office hours or make an appointment to see me. I am also available by email at squintanilla@unt.edu.

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

Office of the Registrar: <https://registrar.unt.edu/>

Student Evaluation System: <http://vpaa.unt.edu/spot>

Office of Disability Access

<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.*

1-1	M	Jan. 14	Chp. 1	Wave Equation	
1-2	W	Jan. 16	Chp. 1	Wave Equation	
1-3	F	Jan. 18	Chp. 1	Wave Equation	
2-4	W	Jan. 23	Chp. 2	Time-Independent Schrödinger Equation	1 <sup>st</sup> Hwk due
2-5	F	Jan. 25	Chp. 2	Time-Independent Schrödinger Equation	
3-6	M	Jan. 28	Chp. 2	Time-Independent Schrödinger Equation	
3-7	W	Jan. 30	Chp. 2	Time-Independent Schrödinger Equation	Hwk due
3-8	F	Feb. 1	Chp. 2	Time-Independent Schrödinger Equation	
4-9	M	Feb. 4	Chp. 2	Time-Independent Schrödinger Equation	
4-10	W	Feb. 6	Chp. 2	Time-Independent Schrödinger Equation	Hwk due
4-11	F	Feb. 8	Chp. 2	Time-Independent Schrödinger Equation	
5-12	M	Feb. 11	Chp. 2	Time-Independent Schrödinger Equation	
5-13	W	Feb. 13	Chp. 2	Time-Independent Schrödinger Equation	Hwk due
5-14	F	Feb. 15	Chp. 2	Time-Independent Schrödinger Equation	
6-15	M	Feb. 18	Chp. 2	Time-Independent Schrödinger Equation	
6-15	MR	Feb. 18	Exam 1.	Chapters 1 & 2	
6-17	W	Feb. 20	Chp. 2	Time-Independent Schrödinger Equation	Hwk maybe due
6-19	F	Feb. 22	Chp. 2	Time-Independent Schrödinger Equation	
7-20	M	Feb. 25	Chp. 2	Time-Independent Schrödinger Equation	
7-21	W	Feb. 27	Chp. 2	Time-Independent Schrödinger Equation	Hwk due
7-22	F	Mar. 1	Chp. 3	Formalism	
8-21	M	Mar. 4	Chp. 3	Formalism	
8-22	W	Mar. 6	Chp. 3	Formalism	Hwk due
8-23	F	Mar. 8	Chp. 3	Formalism	

Spring Break, March 11<sup>th</sup> -15<sup>th</sup>

9-24	M	Mar. 18	Chp. 4	QM in 3D	
9-25	W	Mar. 20	Chp. 4	QM in 3D	Hwk due
9-26	F	Mar. 22	Chp. 4	QM in 3D	
10-27	M	Mar. 25	Chp. 4	QM in 3D	
10-27	MR	Mar. 25	Exam 2	Chapters 2 & 3	
10-28	W	Mar. 27	Exam 2	QM in 3D	
10-29	F	Mar. 29	Chp. 4	QM in 3D	
11-30	M	Apr. 1	Chp. 4	QM in 3D	
11-31	W	Apr. 3	Chp. 4	QM in 3D	Hwk due
11-32	F	Apr. 5	Chp. 4	QM in 3D	
12-33	M	Apr. 8	Chp. 4	QM in 3D	
12-34	W	Apr. 10	Chp. 4	QM in 3D	Hwk due
12-35	F	Apr. 12	Chp. 4	QM in 3D	
13-36	M	Apr. 15	Chp. 4	QM in 3D	
13-37	W	Apr. 17	Chp. 4	QM in 3D	Hwk due
13-38	F	Apr. 19	Chp. 4	QM in 3D	
14-39	M	Apr. 22	Chp. 4.	QM in 3D	
14-39	M	Apr. 24	Exam 3.	Chapters 3 & 4	Hwk maybe due
14-40	W	Apr. 24	Chp. 4.	QM in 3D	
14-41	F	Apr. 26	Chp. 5	Identical Particles	
15-42	M	Apr. 29	Chp. 5	Identical Particles	
15-43	W	May 1	Review		

Final Exam: Wednesday, May 8, 2019, 8:00 - 10:00 a.m.