

Course Syllabus

Course Information

Course Number/Section	MSEN 6319 (MSEN6319.001.17F)
Course Title	Quantum Mechanics for Materials Scientists
Term	Fall 2018
Days & Times	Fridays 13:00 – 15:45
Location	GR 4.208

Professor Contact Information

Professors	Robert Wallace
Office Phones	972 883 6638
Email Addresses	rmwallace@utdallas.edu
Office Location	NSERL
Office Hours	By Appointment
Other Information	

Course Pre-requisites, Co-requisites, and/or Other Restrictions

Students are expected to have mastered the following topics at the undergraduate level prior to this course:

Math: Geometrical Vectors, Exponential/Trigonometric Notation and Identities, Complex number notation and manipulation, Differential Calculus and Equations, Partial Differential Equations, Vector Calculus, Laplacian and Gradient operators, Summation/Product/Factorial Notation, Integral Calculus, Matrix Algebra and Determinants

Physics: Elementary Classical Mechanics, Electrostatics and Electromagnetism (Maxwell's Equations), Waves (Free space/Plane waves) and Diffraction, Polarization, Energy Density and Flow

Chemistry: Molecular Orbital Theory

Course Description

Quantum-mechanical foundation for study of nanometer-scale materials. Principles of quantum physics, operators and Dirac notation, stationary-states for one-dimensional potentials, symmetry considerations. Introduction to: perturbation theory, interaction with the electromagnetic radiation, angular momentum and spin, chemical bonding and molecular orbital theory, crystalline solids and band theory.

Student Learning Objectives/Outcomes

You will be expected to achieve the following:

- Understand and explain the application of Quantum Mechanics to describe the nature atoms, molecules and solids.
- Understand and apply methods to obtain approximate solutions of problems of interest to materials science
- Understand and apply the mathematical formulation of Quantum Mechanics
- Understand and explain the nature and physical principles of Quantum Mechanics

You will be expected to demonstrate these objectives by problem solving in homework and exams.

Required Textbooks and Materials

Required Texts

“Quantum Mechanics for Scientists and Engineers” by David A. B. Miller
ISBN: 978-0-521-89783-9, Cambridge University Press
See also the David Miller YouTube Channel

Suggested Course Materials

Suggested Readings/Texts

On Modern/Quantum Physics

1. Feynman, Leighton and Sands, “*The Feynman Lectures on Physics*,” Vol. 3 (Addison Wesley, New York, 1970), ISBN 0201021153/978-0201021158. The pdf of these lectures is now available on-line from CalTech, <http://www.feynmanlectures.caltech.edu/>.
2. John Gribbin, “*In Search of Schrödinger's Cat: Quantum Physics and Reality*,” ISBN: 978-0553342536 (Bantam Books (1984)).

On College Math

3. Clifford E. Swartz, “*Used Math*,” ISBN-13: 978-0139397448 (Prentice-Hall (1972))

On College Chemistry/Physics

4. See the McDermott Library On-line Resources!

Assignments & Academic Calendar

(Note: This is a tentative schedule and may be changed at the discretion of the faculty.)

Topics, Reading Assignments, Timeline, and Important Dates

Week	Date	Lecture #	Topic – Readings (<i>Homework will be regularly assigned.</i>)
2018	2018		
34	8/24	1	Course Overview/Background Review – Ch. 1 + App. A,B,C,D
35	8/31	2	Time Independent Schrodinger Equation, Particle in a Box, Eigenfunction Properties – Ch. 2.1-2.7
36	9/7	3	Barriers, Finite well, Harmonic Oscillator, Applied Field – Ch. 2.8-2.12
37	9/14	4	Time Dependent Schrodinger Equation, Wave Packets – Ch. 3.1-3.7
38	9/21	5	Measurement, Expectations, Operators, Uncertainty – Ch. 3.8-3.16
39	9/28		Exam 1
40	10/5	6	Functions, State Vectors, Dirac Notation, and Linear Operators – Ch. 4.1-4.6
41	10/12	7	Important Linear Operators, Operators and Quantum Mechanics – Ch. 4.7-4.13 and Ch. 5.1-5.5
42	10/19	8	Quantum Mechanics in Crystalline Materials – Ch. 8.1-8.8, 8.11
43	10/26		Exam 2
44	11/2	9	Angular Momentum – Ch. 9.1-9.6
45	11/9	10	Hydrogen Atom – Ch. 10.1-10.6
46	11/16	11	Spin – Ch. 12.1-8
47	11/23		University Holiday
48	11/30	12	Selected advanced topics
49	12/7		Final Exam (Details TBD)

Grading Policy

Grades will be based on the following weights:

Homework 25 %; Term Exams (2) 25 %; Final Exam 25 %

Homework Assignments

These are **due no later than THE START OF CLASS on the due date. No exceptions.**

Assignments will be posted on the e-learning site for this course.

Homework must be presented in a professional, legible manner to be graded.

Collaboration (NOT copying) is encouraged. See Academic Integrity Statement in

<http://go.utdallas.edu/syllabus-policies>.

Examinations

Examinations will be held in class or at an assigned time and will be written.

Course Policies

Make-up exams

No make up exams will be given except under extreme circumstances.

Extra Credit

Not offered.

Late Work

Not Accepted.

Special Assignments

None.

Class Attendance

Not required but is highly advised. Clear your calendar for all class dates, including FINALS week.

Classroom Citizenship

The Student Conduct and Discipline policy of the University of Texas at Dallas will be followed. See: <http://go.utdallas.edu/syllabus-policies>

Field Trip Policies / Off-Campus Instruction and Course Activities

None

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

“As a Comet, I pledge honesty, integrity, and service in all that I do.”

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University’s policies and procedures segment of the course syllabus.

Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.

These descriptions and timelines are subject to change at the discretion of the Professor. The Instructor may change material, course content, and course pace or item sequence at any time.