Instructor: Eric Foard, SO ENG 318 E, eric.foard@ndsu.edu, 701-231-7045

Office Hours: TuTh 10:45-12:00 AM, open door, and by appointment.

Description: “Quantum Mechanics II” builds on theory and techniques learned in the first semester. By the examination of several applications on quantum mechanics, techniques and approaches are honed to build conceptual understanding. Assessment is based on homework solutions and exams, and a semester project for 686 students.

Goal: To master the foundations of quantum mechanics, including fundamental concepts, key experiments, theoretical methods, and practical applications to a variety of systems.

Textbook: Introduction to Quantum Mechanics, 2nd edition, D. J. Griffiths, Pearson, and additional resources as they are introduced.

Course Outline:
PART I THEORY
Identical Particles: Fermions, Bosons, Two-Particle Systems, Atoms, Solids, Quantum Statistical Mechanics

PART II APPLICATIONS
Time-Independent Perturbation Theory: Nondegenerate and Degenerate Cases, Hydrogen Fine Structure, Zeeman and Hyperfine Splitting
Variational Principle: Helium Ground State, Hydrogen Molecular Ion
WKB Approximation: Tunneling, Wave Function Matching
Time-Dependent Perturbation Theory: Two Level Systems, Emission and Absorption of Radiation
Scattering: Partial Waves, Phase Shifts, Born Approximation
Conceptual Issues: EPR Paradox, Bell’s Theorem, No-clone Theorem, Schrödinger’s Cat, Quantum Zeno Paradox (if time permits)
Adiabatic Approximation (time permitting)

Homework: Group discussion of homework assignments is strongly encouraged, and recommended as a good way to learn how different approaches with varying difficulty can often lead to the same solution. However, each student must provide their own solution, and be prepared to explain their steps if called upon to do so. Late homework will be assessed a 20% penalty per day. Homework problems should be printed or written in ink on one side of 8½” × 11” pages which are stapled together. Show all steps, give all equations before substituting numerical values, always include appropriate units, and box/circle/underline final answers. 686 students will receive additional homework problems.
Exams: Two mid-term exams will be given in class at dates to be determined. The final exam will be given Thursday, May 12, 8:00 AM. Only official exceptions (documented illness, family emergency, official university function, etc.) may be considered for arranging a make-up exam. In addition to written exams, 686 students will complete an oral component of each exam. All exams are cumulative.

Project: Students taking 686 will complete a project and will give an oral presentation of their work to the class during Dead-Week.

Grading: Letter grades are based on the “10-point scale”.

A: 90–100%, B: 80–89.5%, C: 70–79.5%, D: 60–69.5%, F: 0–59.5%
Homework and Quizzes .................................................. 30%
Midterm Exams (2) .................................................. 40% (20 % ea)
Final Exam .................................................. 30% (20 % for 686)
Final Project (686 only) .................................................. 10%

American with Disabilities Act: Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor and contact the Disability Services Office as soon as possible.

Academic Honesty: The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at [www.ndsu.edu/academichonesty](http://www.ndsu.edu/academichonesty)