Instructor: Zhen Wu (zwu@rutgers.edu) Office: 361 Smith Hall

Quantum Mechanics I

Course No. 26:755:631

Textbook

J.J. Sakurai, Modern Quantum Mechanics, revised edition, Addison-Wesley.

With the prerequisite of undergraduate quantum mechanics, students are expected to learn more advanced topics in quantum mechanics. Emphasis will be placed on a good physical understanding of the topics. The course aims to help students learn how to use the more advanced concepts and techniques to solve the physical problems they will encounter in their future research. The course will be assessed by exams and homework.

Chapter 1 FUNDAMENTAL CONCEPTS
Sections 1.1 − 1.7

(Topics covered: ket space, bra space, operators, matrix representations of kets, bras, and operators, position space and momentum space, translation)

Homework problems: # 2, 7, 8, 9, 10, 12, 13, 19, 23, 28

Chapter 2 QUANTUM DYNAMICS
Sections 2.1 − 2.4

(Topics covered: time evolution operator, Schrodinger picture, Heisenberg picture and interaction picture, simple harmonic oscillator (Dirac method), density operator (density matrix), pure and mixed ensembles)

Homework problems: # 3, 4, 5, 8, 9, 11, 16, 20, 22, 23

Midterm exam (chapters 1 ,2)

Chapter 3 THEORY OF ANGULAR MOMENTUM
Sections 3.1 − 3.7, 3.9

(Topics covered: rotation operator, rotation matrix (Wigner D-matrix), angular momentum addition and Clebsch-Gordon coefficients, irreducible spherical tensors, Wigner-Eckart theorem, projection theorem, selection rules, application to the quadrupolar wall interaction of spin polarized ^{131}Xe nuclei)

Homework problems: # 1, 3, 9, 10, 12, 16, 18, 21, 22, 27, 29

Chapter 4 SYMMETRY IN QUANTUM MECHANICS
Sections 4.1, 4.2, 4.4

(Topics covered: symmetries, conservation laws, and degeneracies, space reflection (parity), parity selection rule, parity conservation and parity nonconservation, time reversal symmetry)

Homework problems: # 2, 3, 4, 8, 9

Chapter 5 APPROXIMATION METHODS

Sections 5.1 − 5.3 (Topics covered: time independent perturbation theory, Stark effect, spin-orbit interaction, low field Zeeman effect, high field Zeeman effect (Paschen-Back effect), and Zeeman effect for intermediate field)

Homework problems: # 1, 3, 4, 8, 9, 11, 17

Final exam (chapters 1, 2, 3, 4, 5)

Office Hours: T 10:00 − 11:00 am and Th 2:00 − 3:00 pm and by appointment

Homework 20%
Midterm 35%
Final 45%