Problem Sets

There will be a homework assignment every week. Each assignment will consist of 3-5 problems. Each problem will be graded on a scale of 0 to 10 points. The problem sets will be linked below.

**Problem Set 1**, due Friday January 21
**Problem Set 2**, due Friday January 28
**Problem Set 3**, due Friday February 4
**Problem Set 4**, due Friday February 11
**Problem Set 5**, due Friday February 18
**Problem Set 6**, due Friday February 25
**Problem Set 7**, due Friday March 4

**Wed, March 9: Midterm Exam** (Midterm exam covers chapters 5 and 7-8 in Griffith)
**Problem Set 8**, due Friday March 11
**Problem Set 9**, due Friday March 25
**Problem Set 10**, due Friday April 1
**Problem Set 11**, due Friday April 8
**Problem Set 12**, due Friday April 15

**March 2 - 6: Final Exam Week** (Final Exam covers chapters 5 and 7-12 in Griffith)

Lecture Topics

Lecture notes are linked below.

**Lecture 1 (ppt)** (Mon, Jan 10): Sec 5.1 (two particle systems, identical particles, bosons and fermions)
**Lecture 2 (ppt)** (Wed, Jan 12): Sec 5.1.2 (exchange forces due to symmetrization)
**Lecture 3 (ppt)** (Fri, Jan 14): Sec 5.1.2 (Slater determinant)

**University Holiday** (Mon, Jan 17)
**Lecture 4 (ppt)** (Wed, Jan 19): Sec 5.2 (atoms, He, heavier atoms)
**Lecture 5 (ppt)** (Fri, Jan 21): Sec 5.2 (spectroscopic notation)

**Lecture 6 (ppt)** (Mon, Jan 24): Sec 5.2 (Hund’s rules, overall symmetry of the wave function, parity)
**Lecture 7 (ppt)** (Wed, Jan 26): Sec 5.3 (Solids, free electron gas)
**Lecture 8 (ppt)** (Fri, Jan 28): Sec 5.3.1 (density of states)

**Lecture 9 (ppt)** (Mon, Jan 31): Sec 5.3.2 (band structure, Bloch’s theorem)
**Lecture 10 (ppt)** (Wed, Feb 2): Sec 5.4 (quantum statistical mechanics)
**Lecture 11 (ppt)** (Fri, Feb 4): Sec 5.4 (Lagrange multipliers)

**Lecture 12 (ppt)** (Mon, Feb 7): Sec 5.4 (Boltzmann, Bose and Fermi distributions)
**Lecture 13 (ppt)** (Wed, Feb 9): Sec 5.4 (Blackbody spectrum)
Lecture 14 (ppt) (Fri, Feb 11): finish chapter 5

Lecture 15 (ppt) (Mon, Feb 14): Sec 7 (variational principle)
Lecture 16 (ppt) (Wed, Feb 16): Sec 7.2 (ground state of Helium)
Lecture 17 (ppt) (Fri, Feb 18): Sec 7.3 (Hydrogen molecule ion)

Lecture 18 (ppt) (Mon, Feb 21): Sec 8.1 (WKB approximation; “classical region”)
Lecture 19 (ppt) (Wed, Feb 23): Sec 8.2 (tunneling)
Lecture 20 (ppt) (Fri, Feb 25): Sec 8.3 (connection formulas)

Lecture 21 (ppt) (Mon, Feb 28): time-dependent perturbation theory (TDPT)
Lecture 22 (ppt) (Wed, Mar 2): transition probabilities
Lecture 23 (ppt) (Fri, Mar 4): limits of TDPT, stimulated emission of radiation

Lecture 24 (ppt) (Mon, Mar 7): finish TDPT
Midterm Exam (Wed, Mar 9): covers chapters 5 and 7-8 in Griffith
Lecture 25 (ppt) (Fri, Mar 11): discussion of midterm exam

Spring break (Mar 14 – 18)

Lecture 26 (ppt) (Mon, Mar 21): Sec 9.2 (emission and absorption of EM radiation, selection rules)
Lecture 27 (ppt) (Wed, Mar 23): Sec 9.3 (incoherent perturbations, spontaneous emission, lifetime of an excited state)
Lecture 28 (ppt) (Fri, Mar 25): Sec 10.1 (adiabatic theorem)

Lecture 29 (ppt) (Mon, Mar 28): Sec.11.1 (scattering theory)
Lecture 30 (ppt) (Wed, Mar 30): Sec 11.2 - 11.3 (partial wave analysis and phase shifts)
Lecture 31 (ppt) (Fri, Apr 1): Sec 11.4 (Born approximation)

Lecture 32 (ppt) (Mon, Apr 4): Sec 11.4 (Born approximation [continued])
Lecture 33 (ppt) (Wed, Apr 6): Sec 12.1 – 12.2 EPR paradox and Bell’s theorem
Lecture 34 (ppt) (Fri, Apr 8): Sec 12.3 –12.5 No-clone theorem, Schroedinger’s cat, quantum zeno paradox

Lecture 35 (ppt) (Mon, Apr 11): Intro to relativistic QM
Lecture 36 (ppt) (Wed, Apr 13): Dirac equation
Lecture 37 (ppt) (Fri, Apr 15): Dirac spinors

Lecture 38 (ppt) (Mon, Apr 18): Intro to gauge invariance
Lecture 39 (ppt) (Wed, Apr 20): QED as gauge-invariant theory
Lecture 40 (ppt) (Fri, Apr 22): Student projects presentations I (quantum computing)

Lecture 41 (ppt) (Mon, Apr 25): Student projects presentations II (kaon oscillations)
Lecture 42 (ppt) (Wed, Apr 27): *Student projects presentations III (g-2, laser cooling and atomic clocks)*

Lecture 43 (ppt) (Fri, Apr 29): *Student projects presentations IV (NMR and MRI)*

May 2 - 6: **Final Exam Week** (Final Exam covers chapters 5 and 7-12 in Griffith)