Phys 2566 Syllabus (Spring, 2017), Prof. Tao Han Quantum Mechanics II

1 Identical Particles (≈ 3 lectures)

1.1 Multiple-Particle System

1.2 Permutation Symmetry

1.3 Symmetrization Postulate

1.4 Two-Electron System

2 Approximation Methods ($\approx 15 - 16$ lectures)

2.1 Time-independent Perturbation Theory: Non-degeneracy

2.2 Time-independent Perturbation Theory: Degeneracy

2.3 Variational methods

2.4 Interaction Picture and Time-Dependent Potential

2.5 Time-Dependent Perturbation Theory

2.6 Application: Interaction with Classical Radiation Field

2.7 Application: Energy Shift and Decay Width

3 Scattering Theory ($\approx 12 - 13$ lectures)

3.1 Lippmann-Schwinger Equation

3.2 The Born Approximation

3.3 Optical Theorem

3.4 Plane Waves versus Spherical Waves

3.5 Methods of Partial Waves

3.6 Resonance Scattering

3.7 Coulomb Scattering

4 Quantum Theory of Radiation ($\approx 3 - 4$ lectures)

4.1 Classical Radiation

4.2 Quantization of Radiation Field

4.3 The Casimir Effect and Vacuum Energy

4.4 Interaction of the E&M Field with Matter (tentative)

5 Relativistic Quantum Mechanics ($\approx 8 - 9$ lectures)

5.1 Relativistic Transformation: Galilean and Einstein's

5.2 Klein-Gordon Equation: Spin-0 Particles

5.3 The Dirac Equation: Spin-$\frac{1}{2}$ Particles

5.4 Plane-Wave Solutions

5.5 The Non-Relativistic Limit

5.6 Negative Energy Solution; Hole Theory

5.7 The Two-Components System (tentative)