Time-dependent perturbation theory: interaction representation; static and harmonic perturbations; first order transitions, transition rates, the golden rule; second order transitions; forward scattering; Born approximation; sudden and adiabatic changes;

Intrinsic angular momentum, or spin: Pauli matrices; rotations of spinors; spin dynamics; magnetic dipole moments; Zeeman effect;

Interaction of atoms with classical radiation: classical theory of electromagnetic fields and charged particles; gauge invariance, charge conservation and the Schrödinger equation; absorption of light, stimulated emission;

Identical particles: permutations and symmetry; fermions and bosons; conservation of (anti)symmetry; states of many non-interacting identical particles; Slater determinants; permanents; scattering of identical particles; isospin; Heisenberg's interaction; distant particles; self-consistent Hartree-Fock method;

Second quantisation of bosons and fermions: N-particle Hilbert space; creation and annihilation operators; review of harmonic oscillator; second quantised operators; correlations;

Further aspects of angular momentum: addition of two angular momenta; Clebsch-Gordan coefficients; rotations and spherical tensor operators; Wigner-Eckart theorem; multipole radiation;

Further aspects of scattering theory: partial wave analysis; scattering of particles with spin; polarisation effects;

Quantisation of the electromagnetic field: the free scalar field; phonons; the electromagnetic field; spontaneous and stimulated emission; dipole transitions; scattering of light by charged particles; Raman scattering;

Relativistic quantum mechanics: review of special relativity; Klein-Gordon equation and its interpretation; the Dirac equation; spin, the gyromagnetic ratio, and the non-relativistic limit.