PH 406: QUANTUM MECHANICS-II (3-1-0:4)

Symmetries and Conservation Laws
Symmetry operations and unitary transformations, conservation principles, space and time translations, rotation, space inversion and time reversal, symmetry and degeneracy.

Approximation Methods
Time-independent approximation methods, non-degenerate perturbation theory, degenerate case, Stark effect, Zeeman effect and other examples, variational methods, WKB method, tunneling. Time-dependent problems, Schrödinger, Heisenberg and Dirac pictures, time-dependent perturbation theory.

Scattering Theory
Differential cross-section, scattering of a wave packet, integral equation for the scattering amplitude, Born approximation, method of partial waves, low energy scattering and bound states, resonance scattering.

Relativistic Quantum Mechanics
Klein Gordon equation, Dirac equation, negative energy solutions, antiparticles, Dirac hole theory, Feynman interpretation of antiparticles, Gama-matrics and their properties, convariance of Dirac equation, charge conjugation, parity & time reversal invariance, Bilinear covariants, plane wave solution, two component theory of neutrino, spin & helicity, relativistic hydrogen atom problem.

Textbooks and References:
1. C. Cohen-Tannoudji, B. Diu, and F. Laloe, "Quantum Mechanics-Volume II", Wiley VCH.
2. A. Messiah, "Quantum Mechanics -Volume II", North Holland Publications.
3. S. Flügge, "Practical Quantum Mechanics", Springer.
4. J. J. Sakurai, "Modern Quantum Mechanics", Addison Wesley.
5. K. Gottfried, "Quantum Mechanics", Springer.
6. M. L. Bellac "Quantum Physics" Cambridge University Press.