Theory of Solids 2014 Prof. M. Cini- Program

Group representations. Great Orthogonality Theorem. Orthogonality of CharactersApplications to orbitals and vibrations. Space-time symmetries of Bloch states. Space Groups . Young diagrams. Tensors. Direct product. Double Groups-. Jahn-Teller effects. Vibronic Coupling.

Second Quantization 'True Hamiltonian ' and Hubbard Model. Role of phase in Quantum phenomena. Interaction Picture. Applications: -Fano-Anderson-model, Fano self-energy, Newns model . Kondo effect

Green's functions. Lippmann-Schwinger equation. Embedding. Retarded,advanced, time-ordered functions. Examples: tight-binding solids, bipartite lattices, density of states, Kubo formulas. Lehmann representation . Fluctuation-dissipation theorem.

Applications to ESCA, Auger Spectroscopy (Cini-Sawatzky theory).

Recurrence techniques (Lanczos –Haydock , etc). Equations of Motion. Ground State Energy.

Magnons- Ferrimagnetism- Quantum transport-Landauer formula. Partition-free time dependent formulation.

Graphene, carbon nanotubes.

Adiabatic theorem- Berry Phase, polarization of insulators. Quantum pumping – Quantum Hall effect- Topological insulators