Solid state physics

Topics of the complex exam

1. X-ray diffraction and symmetry properties of crystals
2. Consequences of the translational symmetry, Bloch theorem
3. Adiabatic approximation, Born-Oppenheimer approximation
4. Vibrations in 3D crystals: harmonic approximation, eigenmodes, branches
5. Quantization of the lattice vibrations, phonons
6. Density of states, approximations of Einstein and Debye
7. Specific heat of crystals, the law of Doulong and Petit
8. Basic properties of single-electron eigenstates, effective mass tensor
9. Fermi level, band structures, metals, dielectrics and semiconductors
10. Quasi-free and tight binding approximations
11. Permutation symmetry, Slater determinants
12. Hartree-Fock approximation
13. Foundations of the density functional theory, Hohenberg-Kohn theorems

Reading:

Neil W. Ashcroft, N. David Mermin: Solid state Physics (Thomson Press)

Charles Kittel: Introduction to Solid State Physics (Whiley)

Jenő Sólyom: Fundamentals of Physics of Solids (Springer)