Solid state physics

list of topics 2025/2026 I. semester

1. **Heat capacity of solids** Bose-Einstein statistics, Einstein's model and Debye's model
2. **Electrons in metals**: Drude theory - conductivity, Hall effect
3. **Sommerfeld model:** free electron theory, susceptibility, electron heat capacity, density of states
4. **Lattice vibrations**: vibrations in mono- and diatomic chains (1D), dispersion relation, eigen modes and Brillouin zone, vibrations in higher dimensions
5. **Geometry of crystalline solids**: crystal structure, lattice, reciprocal lattice, Brillouin-zone, symmetry of crystalline solids, Neumann's principle.
6. **Structure determination**: Bragg's law, scattering amplitude and intensity, structure factor, atomic form factor, X-ray and neutron diffraction
7. **Electrons in solids**: Fermi-Dirac statistics, nearly free electron model, Bloch's theorem, electronic bands of a chain, metals and insulators
8. **Electrons in solids II.**: tight binding approximation, effective mass, metals and insulators
9. **Semiconductors**: band structure, simple semiconducting devices