**Solid State Physics**

**Content of the material:**

**Chapter 1: Introduction**

* matter, the solid state.

**Chapter 2: Fundamental notion of crystallography and crystal bonding**

* Concept of patterns, lattice, meshes, reticular planes.
* Concept of symmetries.
* Bravais lattices.
* Reciprocal lattices.
* Crystal structures.
* X-ray diffraction and experimental methods.
* Reminder of chemical bonding.
* Various types of bonding in crystals.

**Chapter 3: Thermal Properties**

* Heat capacity.
* Thermal expansion.
* Thermal conduction.
* Specific heat: Law of Dulong and Petit.
* Einstein’s theory.
* Debye’s theory.
* Modes of vibration: one dimension: infinite chain, finite chain. Three dimensions: first Brillouin zone, normal modes of vibration.

**Chapter 4: Electrical properties**

**Free electron model**

* Introduction
* Ohm’s law and electron relaxation time.
* Relaxation time, collision time and mean free path.
* Energy levels, Fermi-Dirac distribution function and electric density at the light of Fermi-Dirac statistics.
* Electron diffusion and resistivity of metals.
* Measurement of the concentration and mobility of electrons in metals: Hall effect.
* Specific heat due to electrons.
* Thermal conductivity due to electrons.
* Electronic emission.
* Some electrical phenomena occurring in contact between metals: Difference contact potential. Thermoelectricity: Seebeck effect. Peltier effect.

**Periodic potential model**

* Crystalline potential.
* Qualitative point of view on the origin of energy bands.
* Energy-wave vector relationship, concept of effective mass.
* Hall effect in a semiconductor.