Summary
This course illustrates some selected chapters of materials physics needed to understand the mechanical and structural properties of solids. This course deals in particular with the physics of dislocation. The diffusion and phase transformations are complementary bases.

Content
1. Materials, definitions, structure

2. Diffusion
Diffusion in alloys. Physical and chemical diffusion.

3. Plastic deformation and dislocations

4. Dislocation dynamics
Friction forces due to the lattice, to point defects and to dislocations. Movement equations. Partial dislocations and stacking faults. Dissociation mechanisms: dislocations in face centred cubic metals.

5. Dislocation kinetics
Thermal activation of plastic deformation. Dislocation climb. Deformation tests. Relaxation phenomena and mechanical spectroscopy.

6. Thermodynamics of phase transformations

Keywords
dislocations, deformation, diffusion, elasticity, phase transformations, melting, precipitation crystallography

Learning Prerequisites
Recommended courses
- linear algebra I, II
- analysis III, IV
- physics I, II

Learning Outcomes
By the end of the course, the student must be able to:
- Develop the formalism of dislocation theory
• Model the plastic deformation of materials
• Sketch a phase diagram and its thermodynamic basis

Transversal skills

• Use a work methodology appropriate to the task.
• Assess one’s own level of skill acquisition, and plan their on-going learning goals.

Teaching methods
Ex cathedra with exercises in the classroom

Assessment methods
Oral exam in French or English

Prerequisite for
Physics of new materials