

## UNIVERSITA' DEGLI STUDI MEDITERRANEA DI REGGIO CALABRIA

**Subject Code** -----  
**Subject Name** Science and Technology of Materials  
**Professor** Prof. Pierluigi Antonucci

**Department:** DICEAM  
**Degree course:** Civil and Environmental engineering  
**Class:** L-7  
**Type of educational activity:** Teaching  
**Disciplinary Area:** Materials Engineering  
**Scientific-Disciplinary Sector:** 09/D1 ex ING.IND/22

**Compulsory preliminary exams:** Chemistry  
**Course Year:** II  
**Semester:** I

**ECTS:** 6  
**Hours:** 48

### **Synthetic description:**

The course of Science and Technology of Materials provides to the students the tools for understanding the properties of engineering materials respect to the specific use. The aim of the course is that to introduce the properties of several classes of materials (metals, ceramics and polymers). The course includes supplementary exercises designed to illustrate the quantitative aspects of the theoretical arguments.

### **Acquisition of knowledge on:**

- basic knowledge of the main classes of materials;
- correlations between microstructure, manufacturing technology and properties;
- criteria for the selection and correct use for the materials examined.

### **Evaluation method:**

Written examination and oral test

### **Student's independent work**

The student must have a solid scientific culture: in particular, it is important to have a good knowledge about the fields of Chemistry and Physics.

### **Detailed course program**

Introduction to the science and Technology of Materials. Classification and choice of materials.

Structure and microstructure of materials: crystalline structure, amorphous structure, porosity. Chemical bonds and types of solid. Defects of crystals: point defects, dislocations. The diffusion.

Classes of materials and properties: isotropy and anisotropy. Physical properties: density, electrical conductivity, thermal properties. Mechanical properties: modulus of elasticity and elastic behavior, plastic behavior. Traction curves. Fatigue behavior.

State diagrams. General definitions. Status changes. Phase diagrams of pure substances. Gibbs phase rule. Lever rule. Isomorphous binary alloys. Construction and interpretation of a state diagram of a binary alloy. Eutectic of a binary alloys. Peritectic of a binary alloys. Invariant transformations.

Metals: Metal alloys. Solid solutions. The steels.

State Diagram Iron-carbon. Effect of alloy elements on the iron-carbon diagram. Cooling rate and phase transformations: TTT and CCT diagrams. Heat treatment and surface hardening of steels. Cast irons.

Copper and its alloys. Aluminium and its alloys. Nickel and its alloys. Titanium and its alloys.

Corrosion. Kinetic and thermodynamic aspects

Ceramic materials. Traditional ceramic materials: classification, production cycle. Bricks, ceramic compact paste, tiles, refractories. Aerial and hydraulic binders; setting and hardening.

Glasses: structure and properties, processing cycle. Classification.

Polymeric materials: structure of polymers. Glass transition: transition temperature.

Mechanical, thermal, electrical and optical properties. Main polymeric materials: thermoplastics, thermosets, elastomers.

### **Resources and main references**

W.Smith, Scienza e Tecnologia dei Materiali, Mc Graw Hill

AA. VV., Manuale dei materiali per l'Ingegneria, Mc Graw Hill