MATERIALS SCIENCE

1.1. Identification

University:	Alma Mater Studiorum – Università di Bologna													
School:	School of Engineering													
Course:	Materials Science													
ECTS:	6													
Semester:	*Winter*							*Summer*						X
Category	*Fundamental course*					X		*Specialisation course*						
Module	*MFI*		*MFII*	X	*MFIII*			*MSI*		*MSII*		*MSIII*		
Teachers:	Franco Sandrolini													
Language:	*English*	X	*Italian*	X	*Swedish*			*Spanish*						

1.2. Learning-outcomes

Fundamental knowledge of all the instruments necessary to deal with engineering materials properties and performances, main technologies of their production, their use and selection criteria.

1.3. Competencies

- **General**
  - to have critical understanding of technical and scientific tools
  - communication skills
  - to work in an international context

- **Specific**
  - to understand the importance of materials in technical design
  - to understand the relationship between technology and properties product
  - to perform materials choice criteria

1.4. Contents

Materials classification: metals, ceramics, polymers and composites. Properties and main forming techniques. Mono-crystalline, poly-crystalline and amorphous materials. Equilibrium (solid phase-diagrams) and non-equilibrium microstructures. Physical-mechanical behavior. Elastic, anelastic and plastic deformation. Defects and physical-mechanical properties. Metals plastic deformation and thermal treatments. Cold and hot working processes. Microstructure and physical-mechanical behavior of polymers, ceramics and composites. Mass transport in solid materials: Fick laws and Hartley-

Kirkendall effect. Diffusion processes in poly-crystalline materials, sintering and powders technology. Temperature and mechanical properties: viscoleasticity, creep, Larson-Miller parameter and engineering design. Fracture mechanics and resilience. Brittle fracture in ductile materials. Fatigue behavior.

1.5. Teaching Methodology

- Lecture sessions
- Practical sessions: a short text on a specific topic concerning materials must be elaborated before oral test.
- laboratory sessions

1.6. Evaluation

- oral evaluation
- discussion of the text elaborated in practical session

1.7. Bibliography

- J. Wulff (et. al.), Structure and Properties of Materials. John Wiley & Sons Inc.
- A. G. Guy, Introduction to Materials Science. McGraw-Hill, 1975.