

MECHANICAL METALLURGY

1.1. Identification

University:	Alma Mater Studiorum – Università di Bologna										
School:	School of Engineering										
Course:	Mechanical Metallurgy										
ECTS:	6										
Semester:	<i>Winter</i>			X	<i>Summer</i>						
Category	<i>Fundamental course</i>					<i>Specialisation course</i>				X	
Module	<i>MFI</i>		<i>MFII</i>		<i>MFIII</i>		<i>MSI</i>		<i>MSII</i>	X	<i>MSIII</i>
Teachers:	Lorella Ceschini										
Language:	<i>English</i>	X	<i>Italian</i>	X	<i>Swedish</i>		<i>Spanish</i>				

1.2. Learning-outcomes

- Knowledge of the mechanical behaviour of metallic materials, under different service conditions.
- Knowledge of the main metallurgical aspects influencing the static and fatigue resistance, the low and high temperature behaviour, as well as the wear resistance.
- Study of the effects of production technique and the characteristics of the main engineering metallic materials (iron-based alloys, aluminium and titanium alloys, metal matrix composites).

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 metallic materials in technical design
- to understand the relation between technology and properties product
- to develop better choice criteria as function of severe operative conditions

1.4. Contents

Elastic deformation and Young Modulus in metals. Plastic strain and strain hardening. Strengthening mechanism: alloying, grain size control, thermal treatment, etc. Main

laboratory techniques for microstructural characterization and failure analysis. Failure analysis: effects of temperature, strain rate and environment. Fatigue and fatigue strength analysis. Thermo-chemical and surface treatments to improve fatigue behavior.

High temperature behavior of metals: creep and superplasticity. Laboratory test. Metals for high temperature (steels and superalloys). Superplastic forming techniques. Tribological phenomena and laboratory test. Steel and high strength steel, aluminum and titanium alloys, metal matrix composites materials.

1.5. Teaching Methodology

- Lecture sessions
- Practical sessions

1.6. Evaluation

- oral evaluation

1.7. Bibliography

- D. Askeland "The Science and Engineering of Materials", Chapman & Hall
- G.E. Dieter "Mechanical Metallurgy", Mc Graw Hill