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COURSE: Manufacturing Technology

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ACADEMIC YEAR: 2017-2018

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TYPE OF EDUCATIONAL ACTIVITY: Characterizing

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TEACHERS: Sorgente Donato (6 ECTS), Renna Paolo (3 ECTS)

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phone: +39 971205114 - 5143

mobile (optional):

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Language: Italian

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ECTS: 9

n. of hours: 90  
54 for lessons  
46 for tutorials

Campus: Potenza  
Dept./School: School of  
Engineering  
Program: Mechanical  
Engineering

Semester: I

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#### EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course provides students with fundamentals of manufacturing in the mechanical field, spanning the most widespread and traditional manufacturing processes and addressing the statistical process control.

On completion of the module students should be able to:

- Know the most common mechanical testing procedure (tensile test, hardness test, impact test, creep test)
- Know the traditional casting techniques (expandable and permanent mould) and understand the factors affecting the design of the mould
- Know the traditional forming and shaping processes (both bulk and sheet metal forming processes)
- Know the traditional machining processes
- Understand the principles of traditional welding techniques
- Appreciate the factors that affect the quality of a product and how the statistical control of a process can be carried out

Students get to apply these fundamentals on specific fields to which each process is suitable basing on technical, cost and quality criteria. In the course students develop the following skills:

- Choose the most suitable process to manufacture a specific component
  - Design or choose the right tools and equipment for different manufacturing processes
  - Choose the optimal process parameters to meet functional, cost and quality requirements of a product
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#### PRE-REQUIREMENTS

Students should be able to understand technical drawings and to interpret both dimensional and geometrical tolerances. They also should know the principal properties of metallic materials and the fundamentals of heat transfer. This knowledge is fundamental to understand the physical phenomena that are involved in material processing technology.

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#### SYLLABUS

##### Section I. Metallic materials and mechanical testing

##### 1.1 Fundamentals of metallic material properties

##### 1.2 Mechanical test procedures

##### 1.2.1 Tensile test

##### 1.2.2 Hardness test

##### 1.2.3 Impact test

##### 1.2.4 Creep test

##### 1.3 Fundamentals of steel classification and designation

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## Section II. Foundry

- 2.1 Fundamentals of solidification of metals
- 2.2 Cooling of the casting, shrinkage and residual stresses
- 2.3 Main design criteria for casting moulds (risers and gating system)
- 2.4 Metal-casting processes with expandable and permanent moulds

## Section III. Forming and Shaping

- 3.1. Fundamentals of plasticity and strain hardening
- 3.2. Constitutive relationships for plastic flow
- 3.3. Design of metal forming processes
- 3.4. Forging
- 3.5. Rolling
- 3.6. Drawing
- 3.7. Extrusion
- 3.8. Sheet metal working: Shearing, Bending, Deep Drawing and Stamping

## Section IV. Material-Removal Processes

- 4.1. Dimensional and shape variation engineering tolerances
- 4.2. Mechanics of chip formation
- 4.3. Main features of machining processes: turning, drilling, boring, end and face milling, grinding
- 4.4. Cutting tools, terminology and characteristics
- 4.5. Cutting parameters and tool life
- 4.6. Economics of machining
- 4.7. Finishing operations

## Section V. Welding

- 5.1. Overview on fusion and on solid-state welding processes
- 5.2. Shielded metal-arc welding
- 5.3. Gas metal-arc and gas tungsten-arc welding
- 5.4. Resistance welding
- 5.5. Welding metallurgy

## Section VI. Assurance quality management

- 6.1. Elements of Statistical Estimation, Hypothesis Testing and Analysis of Variance.
- 6.2. Statistical techniques for the acceptance check: General, Sampling plans for attributes and variables.
- 6.3. Process control: General concepts of control charting, control charts for variable data; Control charts for attributes: p, np,c and u charts, analysis of process capability
- 6.4. Robust design: basic concepts and Design of Experiment.
- 6.5. Quality Assurance systems . ISO 9000:2015 quality management, ISO9000 normative reference and process management approach.

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## TEACHING METHODS

The course consists both in theoretical lessons (54 hours) and in classroom tutorials (46 hours). Totally, 60 hours are focused on the first five sections and 30 hours to the last section (see the list of sections in the syllabus).

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## EVALUATION METHODS

The candidates will attend a written examination and an oral examination. The written exam consists in quantitative problems to be solved in two hours. A minimum mark of 18 allows the candidate to access the oral examination.

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## TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

### Main text and additional resources

- Resources available at <https://sites.google.com/site/tecnologiaunibas>
- F. Giusti e M. Santochi, "Tecnologia Meccanica e Studi di Fabbricazione", Casa Editrice Ambrosiana, Milano
- Douglas C. Montgomery, "Statistical Quality Control", McGraw-Hill.

### Optional and recommended readings

- S. Kalpakjian, S.R. Schmid, "Manufacturing Engineering & Technology" (7<sup>th</sup> Edition), Pearson
- M.P. Groover, "Tecnologia Meccanica", 2014, CittàStudi
- A. Cigada, Tommaso Pastore, "Struttura e proprietà dei materiali metallici", McGraw Hill
- F. Gabrielli, "Appunti di TECNOLOGIA MECCANICA", Pitagora Editrice Bologna
- W.F. Smith, J. Hashemi, "Foundations of Materials Science and Engineering" (5<sup>th</sup> Edition), McGraw Hill
- Bertocco, Callegaro, De Antoni Migliorati "Ingegneria della Qualità", Città Studi Edizioni
- Piero de Risi, Progettare in Qualità, il Sole 24 Ore Libri
- ISO 9000:2000 references.

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## INTERACTION WITH STUDENTS

At the beginning of the course, the teachers will describe the aims, the content and the assessment criteria. The teacher will make the resources at the website <https://sites.google.com/site/tecnologiaunibas> available to the students.

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## EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

*05/02/2018, 21/02/2018, 04/04/2018, 09/05/2018, 29/06/2018, 13/07/2018, 19/09/2018, 14/11/2018, 12/12/2018*

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SEMINARS BY EXTERNAL EXPERTS    YES     NO

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## FURTHER INFORMATION

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<sup>1</sup> Subject to possible changes: check the web site of the Teacher or the Department/School for updates.