

**Code: ING-IND/16****Credits: 9****Matter: Special Technology****Main language of instruction: Italian****Other language of instruction: English**

## Teaching Staff

### Head instructor

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### Introduction

The teaching of the course “Special Technology” aims to students to achieve rigorous and practical learning of the different unconventional and special technologies applied to the processing of traditional and innovative materials. Furthermore, the course aims to provide the necessary tools for understanding the technological problems of the different production and processing procedures of the materials of interest to the modern mechanical industry and the ability to propose innovative solutions.

### Objectives

The course is organized in five subjects. The first subject is about the unconventional manufacturing processes, i.e. laser, water-jet and electro-erosion processes. Subject 2 is about the additive manufacturing processes, i.e. binder jetting, fused deposition modelling, stereolithography, direct light processing, selective laser sintering, selective laser melting, material jetting, laser engineered net shaping, laminated object manufacturing techniques and the use of Slic3r software. The third subject concerns the processing methods of metal sheets. Subject 4 deals with the production processes of polymers and polymeric composites. Finally, subject 5 is about finishing treatments and surface coatings.

To influence the rigor of learning the course contains a practical part consisting of the study of two industrial cases. For the resolution of practical cases, the professor through intranet hangs on the cases for reading, analyzing and solving individually.

### Competencies:

- To understand and know the physical and phenomenological fundamentals of the main unconventional and special technologies.
- To acquire problem solving skills based on quantitative and qualitative information.
- To be able to search for, interpret and convey information.

- To propose innovative solutions making decisions using relevant information, applying the appropriate methods and placing the problem within the organisation as a whole.
- To be able to descriptively summarise information.
- To be able to work with academic papers.
- To acquire the ability to relate concepts and carry out analytical exercises and their synthesis.
- To acquire skills for independent learning.
- To be able to create arguments which are conducive to critical and self-critical thinking.
- To acquire the ability to put knowledge into practice.
- To interpret results in terms of physical consistency and engineering feasibility and sustainability.

## **Syllabus**

### **Subject 1. Unconventional manufacturing processes**

- Laser manufacturing
- Water-jet manufacturing
- Electrical discharge machining

### **Subject 2. Additive manufacturing**

- Binder jetting
- Fused deposition modelling
- Stereolithography
- Direct light processing
- Selective laser sintering
- Selective laser melting
- Material jetting
- Laser engineered net shaping
- Laminated Object Manufacturing
- Slic3r

### **Subject 3. Metal sheets processing**

- Metal sheets' properties
- Cutting
- Forming
- Spinning
- Innovative forming techniques

### **Subject 4. Polymers and polymeric composites production**

- Polymers' properties
- Polymers' production processes
- Composites' properties
- Polymeric composites' production processes

### **Subject 5. Finishing treatments and surface coatings**

- Roughness properties of a surface
- Abrasive technologies for finishing
- Non-abrasive technologies for finishing

- Coatings by PVD, CVD, and thermal spray

### **Evaluation system and criteria**

The assessment of the course is based on the following criteria:

#### **I) Final exam (75% of grade):**

This exam is a written test which includes 3 questions; 2 of them are assessed from a minimum of 0 to a maximum of 9 points and one from a minimum of 0 to a maximum of 8 points. In any case, the proposed questions may require both a re-elaboration of the concepts of theory and solving of numerical exercises. The use of handouts and/or notes is not permitted for the written test. Any tables necessary for the resolution of the exercises are provided by the lecturer within the exam text.

#### **II) E-tivity (25% of grade):**

The evaluation of the two E-tivities is carried out during the course duration. These E-tivities present to the students two different industrial cases for which a practical solution must be proposed.

**N.B.** The students who choose Special Technologies as a 6 CFU exam, the development of the E-tivities is still envisaged, while the subjects are reduced to the first 4 (therefore, Subject 5 is excluded).

### **Bibliography and resources**

#### *1. Materials to consult:*

- Handouts and slides of the lecturer.

#### *2. Recommended bibliography:*

“Manufacturing Engineering and technology”, Addison-Wesley.

“Additive Manufacturing Technologies”, Springer-Verlag

“Laser Material Processing”, Springer