



SCHEMA DELL'INSEGNAMENTO (SI)

" ADDITIVE MANUFACTURING "

SSD ING-IND/16

DENOMINAZIONE DEL CORSO DI STUDI: INGEGNERIA MECCANICA PER LA PROGETTAZIONE E LA PRODUZIONE

ANNO ACCADEMICO 2022 - 2023

INFORMAZIONI GENERALI - DOCENTE

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INFORMAZIONI GENERALI - ATTIVITÀ

ANNO DI CORSO: I o II

PERIODO DI SVOLGIMENTO, SEMESTRE: II

CFU: 9

INSEGNAMENTI PROPEDEUTICI (se previsti dal Regolamento del CdS)

"None"

EVENTUALI PREREQUISITI

"None"

OBIETTIVI FORMATIVI

The aim of the course is to provide students with in-depth knowledge on digital manufacturing processes based on additive layer manufacturing for both metals, polymers and composites, in order to allow students to acquire knowledge on the complex thermal, chemical and mechanical mechanisms occurring in the transformation processes and link these to the characteristics and performance of the manufactured products, with a special focus on their anisotropy.

RISULTATI DI APPRENDIMENTO ATTESI (DESCRITTORI DI DUBLINO)

Knowledge and understanding

The student must demonstrate the knowledge of both fundamentals and details of additive manufacturing for different types of materials and different forms of raw materials, such as liquid, powders and wires. They must demonstrate a deep knowledge of materials behavior subjected to different processing conditions such as melting and sintering of powders, polymerization of liquid resins and melting and extrusion of both metal and polymer wires and how this results in properties of additively manufactured parts to choose the suitable technique and material for a specific goal.

Applying knowledge and understanding

The student must first demonstrate to be able to choose, among a range of materials, the one with the most appropriate characteristics for a specific aim.

The course is designed to teach students the methodological tools to select the most appropriate additive manufacturing processes for the realization of a specific product and to evaluate the consequent economic and technical implications. The student will also be able to understand the mechanisms that change the microstructure of the material during the production processes and that govern its properties.

Finally, the student will have to demonstrate that he is able to evaluate the quality of the products made in accordance with the different production processes and consequently choose the tools and techniques to enhance its properties, such as heat treatments and/or finishing processes.

PROGRAMMA-SYLLABUS

Introduction and Basic Principles of Additive Manufacturing.

Development of Additive Manufacturing Technology: Computer-Aided Design Technology; Classification of AM processes; heat sources.

Generalized Additive Manufacturing Process Chain. Vat Photopolymerization. Powder Bed Fusion. Material Extrusion. Material Jetting. Binder Jetting. Sheet Lamination. Directed Energy Deposition. Direct Write Technologies. Hybrid Additive Manufacturing.

Materials for Additive Manufacturing: liquid-based materials, powder-based materials, solid-based materials.

Material issues in additive manufacturing: build orientation, keyholes, chemical degradation, reactive processes, cracks, delamination and distortion, poor surface quality, shelf life of feedstock, support.

Guidelines for process selection. Post-processing. Industrial Drivers for AM Adoption.

Insights of sustainability in Additive Manufacturing: Additive Manufacturing and its effect on sustainable production systems, enhancing sustainability of Additive Manufacturing through functionality integration and part consolidation.

MATERIALE DIDATTICO

- *Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani, Additive Manufacturing Technologies, Springer.*
- *Subramanian Senthilkannan, Muthu Monica, Mahesh Savalani, Handbook of Sustainability in Additive Manufacturing, Springer.*
- *Lecture notes by the teacher*

MODALITÀ DI SVOLGIMENTO DELL'INSEGNAMENTO-MODULO

Lectures, seminars and lab experiences.

Lectures are given in-person and streamed, synchronously.

VERIFICA DI APPRENDIMENTO E CRITERI DI VALUTAZIONE

a) Modalità di esame:

*Nel caso di **insegnamenti integrati** l'esame deve essere unico.*

L'esame si articola in prova	
scritta e orale	
solo scritta	
solo orale	X
discussione di elaborato progettuale	
altro	

b) Modalità di valutazione:

N.A.