MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM56)

(Lecce - Università degli Studi)

Teaching COMPOSITE AND NANOCOMPOSITE MATERIALS

GenCod A003713

Owner professor Antonio GRECO

Teaching in italian COMPOSITE AND NANOCOMPOSITE MATERIALS

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SSD code ING-IND/22

Reference course MATERIALS ENGINEERING AND

Course type Laurea Magistrale

Credits 6.0

Teaching hours Front activity hours: 54.0

For enrolled in 2019/2020

Taught in 2020/2021

Course year 2

Language ENGLISH

Curriculum PERCORSO COMUNE

Location Lecce

Semester First Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

This course is aimed at providing the basics of composites and nanocomposites materials in view of their application in different engineering fields, using a strong interdisciplinary approach. Competences on polymer matrices and reinforcements, mechanics of anisotropic materials, fabrication technologies of thermoplastic and thermosetting matrix composites are provided.

REQUIREMENTS

knowledge of solid mechanics and materials science and technology

COURSE AIMS

Knowledge and understanding:

The course provides the basis of knowledge to understand and solve complex new problems in design and processing of composite materials accounting for anisotropy and reactive processing

Applying knowledge and understanding

The student will be able to apply the basic knowledge on mechanics of anisotropic materials to the design of simple structural elements. A multidisciplinary approach is presented accounting for chemical, materials and mechanical engineering aspects.

Making judgements

Simplification and synthesis of complex problems is presented in order to promote the judgement and evaluation capabilities of the students

Communication

The course promotes the development of the following skills of the student: ability to expose in precise and formal terms an abstract model of concrete problems, identifying the salient characteristics of them and discarding the inessential characteristics; ability to describe and analyze an efficient solution for the problem under consideration. A seminar on composite properties is assigned to students

Learning skills

Autonomous learning is promoted thanks to the use of: different books and slides, numerical methods, homework exercise to be solved in groups of two.

TEACHING METHODOLOGY	The course is made up of frontal lessons for about 45 hours, and about 10 hours practice with a software implementing micro and macromechanic of composite materials. 10 more hours of laboratory are foreseen, in order to highlight the relevance of anisotropy in mechanical testing, and provide a practical demonstration of the main technologies for composite processing
ASSESSMENT TYPE	Oral exam after a seminar on composite properties and a homework .
FULL SYLLABUS	***Introduction:*** matrix and reinforcements. Reinforcement materials: Physical, chemical, mechanical properties of carbon, glass, aramide, basalt, polymeric and natural fibers. Surface treatment of fibers for improved adhesion ***Sandwich structures:*** Core materials: foams and honeycombs. Mechanical properties of sandwich structures. ***Micromechanics*** Fiber-matrix interface. Characterization of fiber-matrix adhesion. Calculation of the elastic and ultimate properties of unidirectional laminae from the properties of matrix and fibers ***Macromechanics*** Elastic properties of a lamina of arbitrary orientation. Failure criteria ***Macromechanical behavior of a laminate*** Lamination theory. Special cases of laminate stiffness. Mechanical behaviour of anisotropic laminates (Helius Composite Design) ***Nanocomposites*** Nanofillers, geometries and materials. Preparation of nanocomposites. Characterization of nanocomposites: improvement of properties and analytical prediction of properties.

REFERENCE TEXT BOOKS

- P.K. Mallick, "***Fiber reinforced composites***'", Marcel Dekker
- R.M. Jones, "***Mechanics of composite materials***", McGraw Hill
- Didactic aids (lecture slides) provided by the teacher