MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM56)
(Lecce - Università degli Studi)

Teaching HEAT AND MASS TRANSFER PHENOMENA IN COMPOSITES AND POLYMERS

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<td>Owner professor Alfonso MAFFEZOLI</td>
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Teaching in italian HEAT AND MASS TRANSFER PHENOMENA IN COMPOSITES AND POLYMERS

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SSD code ING-IND/24

Reference course MATERIALS ENGINEERING AND

Course type Laurea Magistrale

Credits 9.0

Teaching hours Ore-Attivita-frontale: 81.0

For enrolled in 2017/2018

Taught in 2018/2019

Course year 2

Language INGLESE

Curriculum PERCORSO COMUNE

Location Lecce

Semester Primo-Semestre

Exam type Orale

Assessment Voto-Finale

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

BRIEF COURSE DESCRIPTION

This course provides a strong interdisciplinary approach to composite materials in view of their application in aeronautic structure. Competences on polymer matrices and reinforcements, mechanics of anisotropic materials, fabrication technologies of thermoplastic and thermosetting matrix composites are provided. Also ceramic matrix materials are presented with special attention to their processing and properties.

REQUIREMENTS

Knowledge of transport phenomena and polymer physics and chemistry.

COURSE AIMS

Knowledge and understanding:
The course provides the basis of knowledge to understand and solve complex new problems in materials processing and in mass and heat diffusion, applying ideas often in a research context.

Applying knowledge and understanding:
The student will be able to solve heat and mass balances, applied to materials processing, using approximate solution or numerical methods. A multidisciplinary approach is presented accounting for chemical, materials and mechanical engineering aspects.

Making judgements:
Dimensionless and approximate methods are 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.

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.
ASSESSMENT TYPE
Oral after a homework. A homework regarding modeling topics, and an associated finite element solution of the related differential equations, is assigned to students. During the exams the homework is discussed and if the results are satisfactory an oral stage is started with questions regarding the main topics of the course.

FULL SYLLABUS
Introduction, thermosetting composite matrices (12 hours).
Basic principles of the processing of thermosetting matrix composites: autoclave lamination as case study (20 hours).
Process modeling through numerical solution of differential equations (10 hours).
Modeling approach to filament winding, pultrusion, RTM and other processes (16 hours).
Processing of thermoplastic composites (10 hours).
Visit to industrial plants (8 hours).
Mass transport in polymers: technological and modeling issues (12 hours).
Industrial plant visits are programmed. A full day to the Journée européenne de composites (JEC) in Paris (France), the most relevant world fair on materials and processes for composites, is organized if adequate financial support is provided by University to students.

REFERENCE TEXT BOOKS
Slides in *.ppt format available at the intranet of dipartimento di ingegneria dell’innovazione
Crank “Mathematics of diffusion”
D. S. Burnett “Finite Element Analysis: From Concepts to Applications”
P.K. Mallick “Fiber-Reinforced Composites: Materials, Manufacturing, and Design”