

MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM56)

(Lecce - Università degli Studi)

Insegnamento HEAT AND MASS TRANSFER PHENOMENA IN COMPOSITES AND POLYMERS

GenCod A003120

Insegnamento HEAT AND MASS TRANSFER PHENOMENA IN

Insegnamento in inglese HEAT AND MASS TRANSFER PHENOMENA IN

Settore disciplinare ING-IND/24

Corso di studi di riferimento MATERIALS ENGINEERING AND

Tipo corso di studi Laurea Magistrale

Crediti 9.0

Ripartizione oraria Ore Attività frontale: 81.0

Per immatricolati nel 2018/2019

Erogato nel 2019/2020

Anno di corso 2

Lingua INGLESE

Percorso PERCORSO COMUNE

Docente Alfonso MAFFEZZOLI

Sede Lecce

Periodo Primo Semestre

Tipo esame Orale

Valutazione Voto Finale

Orario dell'insegnamento

<https://easyroom.unisalento.it/Orario>

BREVE DESCRIZIONE DEL CORSO

This course is aimed to apply the basic knowledge of transport phenomena to the mathematical modeling of processing of composite materials. Competences on thermosetting polymer matrices, their reactivity and the kinetics of curing are also provided. Basic elements of finite element (FE) numerical solution of heat balance equations is provided. The optimization of composite processing is performed adopting a FE tool. In the last part of the course sorption and mass diffusion in polymers is analyzed as an application of the basic knowledge of transport phenomena

PREREQUISITI

Knowledge of transport phenomena and polymer physics and chemistry.

OBIETTIVI FORMATIVI

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

METODI DIDATTICI Lessons, practice with a Finite Element program for the solution of differential equations, visit to an industrial plant. Self evaluation tests with Kahoots after every topic

MODALITA' D'ESAME 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

APPELLI D'ESAME Test dates available at ing.unisalento.it

ALTRE INFORMAZIONI UTILI Write an email to the teacher for an appointment or questions

PROGRAMMA ESTESO

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.

TESTI DI RIFERIMENTO

Slides in *.ppt format available at <https://formazioneonline.unisalento.it/>
Crank "Mathematics of diffusion"
D. S. Burnett "Finite Element Analysis: From Concepts to Applications"
P.K. Mallick "Fiber-Reinforced Composites: Materials, Manufacturing, and Design"