MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM56)

(Lecce - Università degli Studi)

Teaching HEAT AND MASS TRANSFER PHENOMENA IN COMPOSITES AND POLYMERS

GenCod A003120

Owner professor Alfonso MAFFEZZOLI

Teaching in italian HEAT AND MASS TRANSFER PHENOMENA IN

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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 2020/2021

Taught in 2021/2022

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 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 polymrs is analyzed as an application of the basic knowledge of transport phenomena

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

TEACHING METHODOLOGY	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
ASSESSMENT TYPE	Interview 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 interview is started with questions regarding the main topics of the course
ASSESSMENT SESSIONS	Assessments dates available at ing.unisalento.it. The assessment includes the discussion of an assignment followed by an interview
OTHER USEFUL INFORMATION	Write an email to the teacher (alfonso.maffezzoli@unisalento.it) for an appointment or questions The link to participate to on-line interviews is: https://teams.microsoft.com/l/team/19%3aacd7a95cfc284755a9abd13166db8c77%40thread.tacv2/conversations?groupId=27704f5f-8082-4ce8-85dc-fc7678e9f8bc&tenantId=8d49eb30-429e-4944-8349-dee009bdd7da
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, pulrusion, RTM and other processes (16 hours). Processing of thermoplastic composites (8 hours). Visit to industrial plants (3 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 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”