UCLouvain

lmeca2640

2024

Mechanics of composite materials

5.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Doghri Issam ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	Composite materials, especially fiber-reinforced ones, are increasingly used in numerous industrial sectors (e.g., aerospace, automotive, sporting equipment) where the technological advances require combined properties that no classical homogeneous material has. The objective of this course is to introduce the students to the methods of analysis and computation which enable the design of structures or products made of composite materials. This is why the course will develop micro-mechanically based approaches, anisotropic elasticity, the theory of laminates, etc.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 In consideration of the reference table AA of the program "Masters degree in Mechanical Engineering", this course contributes to the development, to the acquisition and to the evaluation of the following experiences of learning: • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2, AA2.3 • AA3.2, AA3.3 • AA5.1, AA5.2, AA5.5 • AA6.1, AA6.2 Introduce the students to the basic concepts of the mechanics of composite materials in order to enable them to design structures and products made of those advanced materials.
Evaluation methods	Written exam: 50%. Project: 50%.
Teaching methods	-Project (e.g., heterogeneous microstructure composite laminate) using (semi)analytical models and a finite element numerical simulation software, in order to master various models and methods and compare their predictions. A report will be written. -In the classroom or at home: solve several relatively simple problems enabling to learn the theoretical concepts.
Content	1. Composite materials: types, properties, applications, fibers, matrices, forming processes. 2. Anisotropic elasticity. Différent classes of material symmetries. 3. Behaviour of an orthotropic ply. Engineering and apparent properties. Simple rules of mixture 4. Multiscale approach and homogenization. General results. Eshelby's solution. Mean-field models (Mori-Tanaka, self-consistent, etc.). Applications to various types of composites. 5. Classical laminate theory: constitutive equations, simple calculation methods. 6. Damage models and failure criteria. At the ply level. At the laminate level. Interlaminar stresses and edge effects.
Inline resources	http://icampus.uclouvain.be/claroline/course/index.php?cid=LMECA2640
Faculty or entity in charge	MECA

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Chemical and Materials Engineering	KIMA2M	5		
Master [120] in Civil Engineering	GCE2M	5		
Master [120] in Mechanical Engineering	MECA2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		