

## Faculty of Applied Sciences



### MECA2640 Mechanics of composite materials.

[30h+15h exercises] 4 credits

This two-yearly course is taught in 2006-2007, 2008-2009,...

This course is taught in the 2nd semester

**Teacher(s):** Issam Doghri  
**Language:** French  
**Level:** Second cycle

#### Aims

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.

#### 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.

#### Content and teaching methods

- Chap. 1 Composite materials: types, properties, applications, fibers, matrices, forming processes.
- Chap. 2 Micro-mechanics approaches (homogenization theories).
- Chap. 3 Anisotropic elasticity.
- Chap. 4 Behavior of a single layer (micro- and macro-mechanics).
- Chap. 5 Classical laminate theory: constitutive equations, strength criteria, simple computation methods, inter-laminar stresses and edge effects.
- Chap. 6 Bending, vibration and buckling of anisotropic laminated plates. Basic equations and energy methods (finite elements).
- Chap. 7 Hygro-thermo-elasticity.
- Chap. 8 Experimental methods for material properties measurement.

#### Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

- Pre-requisites : a course on Theory of Elasticity or Continuum Mechanics.
- Mini-project 1 : solving a simple problem with analytical methods.
- Mini-project 2 : design of composite materials or structures using commercial software.
- Mini-project 3 : read and comment a scientific article.
- Examination : written or oral. Final grade: 50% examination and 50% mini-projects.

**Other credits in programs**

<b>ELME23/E</b>	Troisième année du programme conduisant au grade d'ingénieur civil électro-mécanicien (énergie)	(4 credits)
<b>MATR22</b>	Deuxième année du programme conduisant au grade d'ingénieur civil en science des matériaux	(4 credits)
<b>MATR23</b>	Troisième année du programme conduisant au grade d'ingénieur civil en science des matériaux	(4 credits)
<b>MECA22</b>	Deuxième année du programme conduisant au grade d'ingénieur civil mécanicien	(4 credits)
<b>MECA23</b>	Troisième année du programme conduisant au grade d'ingénieur civil mécanicien	(4 credits)