Unit information

Program	Mechanical Science (53001010053P0)
Course unit	MECHANICS OF COMPOSITE MATERIALS
Unit code	PPCMEC
Unit number	2150
Credit points	4
Period	01/01/2012 -
Professor	Éder Lima de Albuquerque
Prerequisites	No

Unit outline

Objective:

This unit aims to present composite materials as a material option for engineering projects, discussing their strengths and weaknesses and comparing them with other materials. The focus is on the mechanics of composite materials, although manufacturing processes and the chemical composition of composite materials are superficially covered.

Purpose:

The purpose of the unit is to meet the growing demand of the high technology industry, in which the use of composite materials is inserted. Due to their low density and high rigidity and mechanical resistance, composite materials are always the first choice when you want a structure or machine that is rigid and resistant, but at the same time, light. Although the most relevant applications are found in the aerospace and aeronautics industry, the use of composite materials has expanded to the most diverse areas of mechanical sciences.

Contents:

1. Introduction to Composite Materials: Definition. Characteristics. Classification. **2. Fibers, matrices and composite fabrication:** Advanced Fibers, Matrix Materials, Composite Fabrication. **3. Behavior of unidirectional composite materials:** Behavior of unidirectional composites under longitudinal and transverse loads. Elastic and failure properties for unidirectional composites. **4. Short fiber composites:** Theories of charge transfer between fibers and matrix. Average tension in the fiber. Elastic properties and mechanical strength of short fiber composites. **5. Analysis of an orthotropic lamina: Stress-strain relationships** and engineering constants. Relationships between deformation and stress for a lamina. **6. Analysis of laminated composites:** Deformations in laminated composite materials. Determination of stresses and deformations in the sheets of a laminated composite. **7. Failure criteria and experimental tests:** Tsai-Hill failure criterion. Tsai-Wu failure criterion. Tensile, compression, shear and fatigue tests for composite materials.

Assessment

A final exam (50% of the grade); Exercise lists (50% of the grade).

Obs:

Reference:	1. B. D. Agarwal, L. J. Broutman e K. Chandrashekhara, *Analysis and performance of fiber composites*, 4th ed., John Wiley and Sons, 2017, 449 p. 2. R.F. Gibson. *Principles of composite material mechanics.* 4th ed. McGraw-Hill, 2016, 700 p. 3. V. V. Vasiliev, E. V. Morozov. *Advanced Mechanics of Composite Materials and Structures.* 4th ed. Elsevier, 2018. 882 p. 4. L. A. Carlsson, D. F. Adams, R. B. Pipes. Experimental Characterization of Advanced Composite Materials. 4th ed. CRC Press, 2014, 379 p.