UCLouvain

lmeca2410

2020

Mechanics of Materials

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Delannay Laurent ;Simar Aude ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	The course presents different mathematical models used by engineers in order to describe the mechanical reponse of deformable materials as well as their ability to sustain crack extensions. Each model is motivated from the physics and adaptations are suggested in order to account for non-linearity under finite strains, anisotropy of composite materials as well as the influence of temperature, environment and strain rate on the mechanical response. A systematic procedure is presented in order to select materials with optimized mechanical properties.
Aims	At the end of the course, students will be able : · to solve basic problems using models allowing to predict mechanical responses of materials involving (hyper)elasticity and (visco)plasticity under finite strains as well as crack propagations, · to explain the physics underlying each model and the link between microstructure and macroscopic mechanical properties, · to explain the origin of various phenomena including anisotropy of composite materials, elastic spring back and necking of plastically deformed samples, residual stresses and creep. · to select a material with the best combination of mechanical properties based on the definition of performance indices, 1 According to the classification of LO in the EPL programme, this activity contributes to the development and acquisition of the following LO: **LO1.1, LO1.2, LO1.3, LO2.1, LO2.2, LO2.4, LO5.3, 5.4, 5.6** • LO1 Foundations of scientific and technical knowledge (LO1.1, LO1.2, LO1.3) • LO2 Engineering skills (LO2.1, LO2.2, LO2.5) • LO3 R & D skills (LO3.2) • LO5 Efficient communication (LO5.3) • LO6 Ethics and professionalism (LO6.1, LO6.3) - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The final exam will asssess both the level of understanding of theoretical concepts and the student's skills to solve practical exercices. Students will be graded while accounting also for the outcome of the daily work (several projects and homeworks graded individually or per group). The relative weight of the final exam in the total grade will depend on the number of projects organized. However, if the mark obtain at the exam is less than 8/20, only this mark will be accounted for in the total grade. If the exam is organized in distant mode, the professors may complete the evaluation by an individual oral exam.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The course will involve lectures, practical exercises, mechanical testing in the laboratories and as well as PBL in small groups. Face-to-face teaching will be priviledged but some activities may also be organized in distant mode.
Content	The course will cover the following topics : · Materials selection procedure to achieve desired mechanical properties (material classes, performance indices) · Complements of linear thermo(visco)elasticity : phase partitioning of strain and stress in composite materials (incl. eigenstrains and anisotropy) · Plasticity and viscoplasticity (yield surface, J2 theory, elastic springback, dynamic loading, creep) · Finite strains (hyperelasticity, plastic spin) · Linear elastic fracture mechanics + influence of microstructure on toughness

	- Fatigue
Bibliography	• Lecture notes written by the teachers
Faculty or entity in charge	MECA

Force majeure

Evaluation methods	Your daily work will be graded and it should represent 40% of the total grade: - the part of the course taught by Prof Simar includes four projects and each one represents 5% of the total grade. - the part of the course taught by Prof Delannay includes three tests (moodle or gradescope) as well as a miniproject (surfboard). Each item represents 5% of the total grade. The final examination will be a written exam. In case of a very low performance (<40%) at this exam for one part of the course, the grading of that part will not account for the daily work. There will be no exercises in the Delannay part of the final exam. Students who failed at one or two of the preliminary tests will be given a second chance during the test organized on May 12 2021.

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Civil Engineering	GCE2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Mechanical Engineering	MECA2M	5		