UCLouvain

lmapr2020

2023

Materials Selection

5.00 credits	30.0 h + 22.5 h	Q2

Teacher(s)	Nysten Bernard ;Pardoen Thomas ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	1. The design process 2. Material properties charts 3. The basics of materials selection 4. Over constrained and multiple objectives problems 5. Influence of shape on material selection 6. Design of hybrid materials 7. Process selection 8. Ecoselection
Learning outcomes	**At the end of this learning unit, the student is able to :** **Contribution of the course to the program objectives** Having regard to the LO of the programme KIMA, this activity contributes to the development and acquisition of the following LO: • LO 1.1, 1.2 • LO 2.1, 2.2, 2.3, 2.4, 2.5 • LO 4.1, 4.2, 4.4 • LO 5.1, 5.2, 5.3, 5.4, 5.6 **Specific learning outcomes of the course** At the end of this course, the student will be able to 1 • LO1.1. Explain the basic concepts of the materials selection procedure established by Prof M.F. Ashby: property charts, the formulation of selection problems in terms of - function, objectives, constraints, free variable - using performance indices, multiple and/or conflicting objectives, shape and hybrid solutions, eco-design; • LO1.1. Describe modern material solutions which more and more consist of multimaterials systems, comprising composites, multilayers, coatings, assemblies, functionalized surfaces. • LO1.2 Use the material selector software EDUPACK edited by Granta design; • LO2.1 to 2.5. Apply the material selection procedure to real problems (case studies) which involve the analysis of the problem (i.e. define the list of requirement by decomposition into the elementary functions in order to define the working conditions and function, main solicitations, objectives and constraints), the derivation of performance indices, the selection of the best solution, the justification of the simplification, the critical assessment of the solution and the formulation of better solution compared to existing solution ' all these steps will require mobilizing all their scientific and technical knowledge gained in earlier training regarding physical phenomena and all the classes of materials. • LO4. Organize the analysis of the last case study as a team project effort • LO5. Communicate and defend the results of the case study analysis
Evaluation methods	The students will be individually graded based on the objectives indicated above. More precisely, the evaluation involves the grading of • the homeworks on the topics covered by the flipped classes; • the presentation of a case study already solved in the supporting book by group of two (or three); • the presentation of a new material selection problem by group of two (or three); • a written exam based on a short list of synthetic questions prepared by the teachers and given during the year. Details of assessment methods and the weighting of each are given at the beginning of each term.
Teaching methods	This course is very much based on self-study. The method proposed by M.F. Ashby in his book "Materials selection in mechanical design" is followed with some additional or more in-depth topics such as hybrid materials. The course is divided into 9 topics. Some topics are covered in the form of flipped classes using self-study, assignment handouts and restructuring sessions. Other topics are presented in the traditional way (lectures followed by exercise sessions). In groups of two (or three), students are also required to prepare two presentations on materials selection case studies.

Content	1. The design process 2. Material properties charts 3. The basics of materials selection 4. Overconstrained and multiple objectives problems 5. Influence of shape on material selection 6. Design of hybrid materials 7. Process selection 8. Ecoselection
Inline resources	Moodle site : https://moodle.uclouvain.be/course/view.php?id=3085
Other infos	This course requires only basic knowledge of materials science in particular regarding the mechanical properties (elasticity, plasticity, fracture, basic structural mechanics) and functional properties (electrical, thermal, optical, magnetic).
Faculty or entity in charge	FYKI

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 Biomedical Engineering	GBIO2M	5		
Master [120] in Mechanical Engineering	MECA2M	5		
Master [120] in Electrical Engineering	ELEC2M	5		
Master [120] in Physical Engineering	FYAP2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		