UCLouvain

lmeca2801

2024

Machine design

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Havelange Yorick (compensates Raucent Benoît) ;Raucent Benoît ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	This course is taught in the first year of the master MECA and ELME mechatronics. It assumes that students already have basic skills in technical drawing. The aim of the course is to introduce the elementary knowledge necessary for the mechanical design of the elements that compose a machine. It is thus the basic course before a specialization 'design and manufacturing' and will contribute to prepare students to a future job as R&D engineer in the technical department of a company.
Main themes	Functional analysis of machines and their components Properties of component Elements of calculus of machine components.
Learning outcomes	**At the end of this learning unit, the student is able to :** **Specific learning outcomes of the course** · Write functional specifications for a machine · Identify the functionalities of a machine (actuation, bearing systems, transmission, sealing, ') · Estimate the installed and maximum power, the energetic consumption and the efficiency of a machine · Design a simple machine following an adapted methodology · Identify the basic hypotheses of elements dimensioning · Dimensioning following various criteria (yield strength, elastic compliance, fatigue) of usual elements (e.g. shafts) · Dimensioning while taking into account the effect of dynamic loading, stress concentration and residual stresses · Choose machine components (bearing, gasket, transmission) Read and interpret the drawing of an existing machine 1 · Hand drawing of machine components and overall drawings · Placing tolerances for a mechanical system · Machine component design : threaded fastener and power screws, rivet and welding rolling bearing, sliding bearings, clutches and brakes, power transmssion components (gears, belt, chains, etc..), shaft and assocated part (key, pin, coupling, ') In consideration of the reference table AA of the program " Master's degree civil engineer mechanics ", this course contributes to the development, to the acquisition and to the evaluation of the following experiences of learning: AA1.1, AA1.2 AA2.1, AA2.2, AA2.3, AA2.4, AA2.5, AA2.6, AA2.7, AA2.8 AA4.3, AA4.4 AA5.1
Evaluation methods	Students will be evaluated on the basis of the two projects and a written exercise exam. Project 1 and 2 will be assessed on 3 points each in the final grade . The note for the two projects are acquired once and for all (there is no second chance in September). The written examination in session will be worth 14 points in the final grade. Students must score at least 7 out of 14 on the exam to receive credit for the entire course.The written exam will contain exercises, theoretical questions and at least one drawing, the book Juvinall and the bearing catalogue are authorized, **the book on technical drawing is not authorized.**
Teaching methods	Part of the course is taught as lectures and by problem and project based learning (PBL) within groups of 6 students. Two projects are proposed: • Project 1 : design of a machine • Project 2: Digital manufacturing of the solution

Content	At the end of the course the students will be able to : 1. Describe the functionalities of a machine (actuation, bearing systems, transmission, sealing, …). Write functional specifications for a machine and conduct a risk analysis. 1. Design a simple machine following an adapted methodology. Take into account of digital manufacturing technologies, environmental, social, and economic impacts from the initial phase of design through to the end of life (sustainable design) 1. Use the propose vocabulary for the various machine items. 1. Identify the basic hypothesis of elements dimensioning. Estimate the installed and maximum power, the energetic consumption and the efficiency of a machine. 1. Dimensioning following various criteria (static strength, elastic deformation, fatigue, …) of usual elements (e.g. shafts) 1. Choose machine components (bearing, gasket, transmission, brake, clutch, hydraulic, spring) 1. Read and interpret the drawing of an existing machine. Hand drawing machine elements and overall drawings. Placing tolerances for a mechanical system
Bibliography	Suggested books (available at the BST library) : ***Engineering Design Methods*** N. Cross, ed. J. Wiley and Sons, 1991. *Materials Selection in Mechanical Design*, M.F. Ashby, Butterworth-Heinemann. This book is available on the web site of the BST library when connected to the UCL network, see: http://www.sciencedirect.com/science/book/9781856176637 *Aide Mémoire de l'ELEVE Dessinateur et du Dessinateur Industriel* M. Norbert et R. Philippe, La Capitelle, Casteilla, 1987. *Roulements FAG, roulements à billes, roulements à rouleaux, paliers, accessoires*, catalogues WL 41 520 FA. *Mémotech, productique, conception et dessin*, C. Barbier et R. Bourgeois, collection A. Capliez, Educative, ed. Casteilla, 1988. *Méthode Active de Dessin Technique*, A Ricordeau, C. Corbet, C. Hazard, ed Casteilla (Ce livre est également obligatoire pour le cours LMECA_1210 et le cours de LFSA_1501). *Materials - Engineering, Science, Processing and Design*, M. Ashby, H. Shercliff, D. Cebon, Butterworth-Heinemann.
Other infos	All the information are given on Moodle
Faculty or entity in charge	MECA

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Mechanical Engineering	MECA2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Energy Engineering	NRGY2M	5		