UCL Université catholique de Louvain

LGBIO2040

2013-2014

Biomechanics

5.0 credits	30.0 h + 30.0 h	2q

Teacher(s) :	Marchandise Emilie ; Henrotte François (compensates Marchandise Emilie) ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	> http://icampus.uclouvain.be/claroline/course/index.php?cid=GBIO2040
Prerequisites :	Basic knowledge of numerical methods and fluid/solid mechanics (e.g. MECA 2321 course or similar, course on mechanics of continuous media)
Main themes :	- Fundamentals of fluid and solid biomechanics - Biomechanics of the cardiovascular system, - Biomechanics of the lung system - Biomechanics of cells and bones - Numerical and analytical modeling of biomechanical systems
Aims :	Eu égard au référentiel AA du programme « Master ingénieur civil des constructions », ce cours contribue au développement, à l'acquisition et à l'évaluation des acquis d'apprentissage suivants : - AA1.1, AA1.2, AA1.3, - AA.2.2, AA2.3, AA2.4 - AA3.2, AA3.3, - AA4.2, AA4.4, - AA5.3, AA5.5, AA5.6 After this course, the student will be able - to understand and model the main biomechanical systems, - to use simulation tools (finite elements) to study the biomechanical models problems introduced in the course, - to make a documented choice between different model types according to the application. Transversal learning outcomes: - Finite element simulations - Use of open-source scientific software and of the Linux OS - Collaborative reporting and oral presentation *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 :	- open-book written examination (55 % of final mark) - project by groups of 2 or 3 with written report and oral presentation (45 % of final mark)
Teaching methods :	- Theoretical lectures - Practical works devoted to getting acquainted with the simulation tools used for the project - Q& mp;A sessions about the project
Content :	This course covers applications of biomechanics on living organisms and in medicine. The usefulness of mathematical modeling in better understanding physiological systems (cardiovascular system, blood system, ') and in developing measurement/diagnostic apparatus and dedicated therapeutic devices is discussed. The course aims at showing that mathematical modeling has become a central issue in medical practice and gives access to information that could not be obtained with traditional methods. The first part of the course deals with biological transfer and flow problems. The second part introduces the mechanical aspects of the cardiovascular system and the cell structure. The third part deals with the biomechanics of solids and bones. During the practical works, clinical problems will be approached from the numerical and mathematical modeling point of view. A number of sessions will be dedicated to getting acquainted with finite element simulation tools to solve real-life biomechanical problems.
Bibliography :	Ethier and Simmons, Introductory Biomechanics"
Other infos :	The needed simulation tools are provided to the students in the form of a platform independent virtual machine (VirtualBox), with the Gmsh and Elmer software pre-installed. This virtual machine is run the students personal computers.

Cycle and year of study :	> Master [120] in Mechanical Engineering > Master [120] in Electro-mechanical Engineering > Master [120] in Biomedical Engineering > Master [120] in Computer Science and Engineering > Master [120] in Mathematical Engineering > Master [120] in Electrical Engineering
Faculty or entity in charge:	GBIO