UCLouvain

lgbio2040

2017

Biomechanics

5 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Kerckhofs Greet ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	- Fundamentals of fluid and solid biomechanics, - Biomechanics of tissues, - Biomechanics of the cardiovascular system, - Biomechanics of the lung system, - Numerical and analytical modeling of biomechanical systems.
Aims	With respect to the AA referring system defined for the Master in Biomedical Engineering, the course contributes to the development, mastery and assessment of the following skills : • 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 1 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	• closed-book written examination (60 % of final mark) • project by groups of 3-5 students, with written report and oral debate (40 % of final mark)
Teaching methods	• Theoretical lectures • Exercise session to get acquainted with analysis of experimental data and analytical solutions for (bio)mechanical questions • Q&A sessions about the project
Content	This course provides a link between the structure, function and biological performance of the main biomechanical systems: the musculoskeletal, cardiovascular and respiratory system. A brief introduction on the structure and function of these systems is provided, and the added value of both experimental characterization as well as computational modelling for a better understanding of the (mis)function of the main biomechanical systems devices is discussed, and example of both are described in detail. The course aims at showing that engineering solutions, such as experimental characterization and computational modelling, have their place in (bio)medical practice to solve biomechanical problems. The first part of the course deals with the musculoskeletal system, and the second part with the cardiovascular system. The third part introduces the main biomechanical aspects of the respiratory system. During the exercise sessions, an introduction will be provided into some experimental characterization techniques of the biological systems, as well in analytical solutionsfor (bio)mechanical questions. For the project work, several biomechanical topics will be introduced, for which a dedicated journal paper will be provided focusing on an experimental (Group A) and a computational (Group B) solution. Per topic, Groups A and B will need to defend the strengths of their methodology in an orchestrated debate. Based on these debates, the groups will need to propose future research solutions (independent of their methodology of focus in the debate) to improve the current state-of-the-art, as summarized in a short written report.
Inline resources	Moodle https://moodleucl.uclouvain.be/course/view.php?id=9104

Bibliography	• "Biomechanics", F. Henrotte, E. Marchandise, 2017 • "Fundamentals of Biomechanics : Second Edition", D. Knudson, 2007; Publisher: Springer • "Snapshots of Hemodynamics : An Aid for Clinical Research and Graduate Education", N. Westerhof, N. Stergiopulos, M.I.M. Noble, 2010; Publisher: Springer
Faculty or entity in charge	GBIO

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Biomedical Engineering	GBIO2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		
Master [120] in Computer Science and Engineering	INFO2M	5		
Master [120] in Mechanical Engineering	MECA2M	5		