UNIVERSITÀ DI PAVIA

Anno Accademico 2018/2019

BIOMECHANICS AND SIMULATION OF BIOMEDICAL DEVICES

Enrollment year	2017/2018
Academic year	2018/2019
Regulations	DM270
Academic discipline	ING-IND/34 (INDUSTRIAL BIOENGINEERING)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	BIOENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	2°
Period	2nd semester (06/03/2019 - 14/06/2019)
ECTS	6
Lesson hours	60 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	AURICCHIO FERDINANDO (titolare) - 3 ECTS CONTI MICHELE - 3 ECTS
Prerequisites	Basic knowledge of physics and algebra
Learning outcomes	The course aims at providing the basic knowledge of biomechanics and an introduction to the use of computer codes for the study of situations characterized by complex geometrical/loading conditions (e.g., cardiovascular implants such as stents or other area of ??interest for the student) .
Course contents	COURSE INTRODUCTION: the main techniques to formulate and solve (bio)mechanical problems will be introduced with particular attention to model complex and solution methods, ranging from analytical to numerical ones (e.g., finite element analysis) PRELIMINARY NOTES

	• Introduction to engineering, indicial notation • tensorial calculus • planar sections (inertia, centroid, etc.) • material point RIGID BODY • definition • Study of balance of two-dimensional systems of rigid bodies (beams) • Stress resultants • simple examples of application of Statics to Biomechanics their application in biomechanics. DEFORMABLE BODY • 1D deformable body. • Tensile test • Definition of internal deformation and internal tension • Response characteristic of a material with identification of the regions of elastic and inelastic behavior. • 3D deformable body • Analysis of deformation and definition of tensor of deformation with its physical meaning of its components • Balance and analysis of the stress; definition of tensor of tension with its physical meaning of its components. CONSTITUTIVE MODELING • Introduction to the concept of costitutive modeling and in particular to the case of linear elastic material. • Application of the concepts introduced in the case of biological tissues (hard and soft tissues). COMPLEX 3D CASES • Analytical solutions (e.g., Saint-Venant model) • Numerical solutions: use of finite element analysis for the solution of problems of three-dimensional deformable body • Analysis of application such as cardiovascular stents or other area of specific interest to the student.
Teaching methods	Lectures (hours/year in lecture theatre): 45 Practical class (hours/year in lecture theatre): 0 Practicals / Workshops (hours/year in lecture theatre): 0
Reccomended or required readings	Course notes. Further suggested books: C.Comi, L. Corradi Dell'Acqua. Introduzione alla meccanica strutturale. McGraw Hill, 2/ed, 2007 . N.Ozkaya and M.Nordin. Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation. Springer, 2010. D.Gross, W. H. Schröder, W. A. Wall, J. Bonet. Engineering Mechanics 1-2. Springer
Assessment methods	The examination consists of three tests: written, computer-based, and oral examination. The access to the oral examination is open to whom have already

	performed the other two examinations. The written test is based on the resolution of problems, which mostly focused on the application of the principles of statics to biomechanics. It is also possible the test includes theoretical questions. The computer exam deals with the solution a simple problem (bio) mechanical by use of commercial software finite element, illustrated during the course. The oral examination starts from the discussion of what was done in the other two tests and it addresses the theoretical aspects presented during the course. The written test is usually performed following the official schedule given by the Presidency and requires the student registration online.
Further information	Useful links: http://www.unipv.it/compmech/teaching_av.html http://www.unipv.it/compmech/lab_ind_prj.html
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile