Course Title	Nonlinear Mechanics of Solids and Structures				
Course Code	**MMK 551**				
Course Type	COMPULSORY				
Level	MASTER/PHD				
Year / Semester	SPRING SEMESTER				
Teacher's Name	VASILEIOS VAVOURAKIS				
ECTS	8	Lectures / week	3 hours weekly	Laboratories / week	NO
Course Purpose and Objectives	The purpose of this course is to cover a particular area in applied solid mechanics and biomechanics: nonlinear mechanics of solid matter using a continuum-based approach.				
Learning Outcomes	Successful completion of the course will enable students • to consolidate theoretical background in continuum solid mechanics, • to use and evaluate the most common stress, strain and deformation measures, • to model rubber-like materials, biological tissues, elastomers, poroelastic and viscoelastic materials, and (small/large) plastic deformations in metallic materials, • to calibrate constitutive models using experimental data, • to apply analytical methods for the calculation of stresses and strains in simple geometries of structures and loading conditions, • to build nonlinear finite element models and analyze the mechanics of simple structural problems using the commercial software ABAQUS®, • to read and understand scientific publications of nonlinear material models in applied mechanics and biomechanics.				
Prerequisites	MMK 531	Required	NO		
Course Content	The course briefly presents the fundamentals in continuum solid mechanics, i.e. stress/strain measures, equations of motion and equilibrium for deformable solids, while it also gives an outline to variational principles. Subsequently, the constitutive equations that describe the mechanical behavior on a wide range of elastic solids is presented: spanning from linear elastic (isotropic and anisotropic) materials to hypo- and hyperelastic, viscoelastic, and elastoplastic solids. Finally, analytical solutions to axially and spherically symmetric solutions for linear elastic and elastoplastic solids under quasi-static loading is outlined. Students will also receive specialized hands-on training on ABAQUS® to simulate and analyze nonlinear elasticity problems in applied mechanics or/and biomechanics.				
Teaching Methodology	• Communicative, Collaborative • Class lectures (PowerPoint, Socrative, Screencast-o-matic), and computer-lab sessions at the School computing center				

	• During the first week of the semester, the Syllabus of the course is given by the course tutor, which includes information on the course content, expected learning outcomes, assessment and office hours.
Bibliography	Lawrence E. Malvern. Introduction to the Mechanics of a Continuous Medium. ISBN-13: 978-0134876030 G.A. Holzapfel. Nonlinear Solid Mechanics: A Continuum Approach for Engineering. ISBN-13: 978-0471823193 Ray W. Ogden. Non-linear Elastic Deformations. ISBN-13: 978-0486696485 Yuen-Cheng Fung. Classical and Computational Solid Mechanics. ISBN-13: 978-9810241247 G.T. Mase, G.E. Mase. Continuum mechanics for engineers. ISBN-13: 978-0849388309 A.J.M. Spencer. Continuum Mechanics. ISBN-13: 978-0486435947 Vlado A. Lubarda. Elastoplasticity Theory. ISBN-13: 978-1420040784 Aleksey D. Drozdov. Finite Elasticity and Viscoelasticity: A Course in the Nonlinear Mechanics of Solids. ISBN-13: 978-9810224332
Assessment	Bi-weekly homework assignments (40% total) Course project assignment (30%) One (1) final exam (30%)
Language	GREEK OR ENGLISH