POLITEHNICA University of Bucharest (**UPB**)
Faculty of Engineering and Management of Technological Systems (**IMST**)
Study Programme: Industrial Engineering (**IE**)
Form of study: Licence (Bachelor)

COURSE SPECIFICATION

Course title:	COMPUTER AIDED ENGINEERING	***Semester:***	6
Course code:	UPB.06.C.05.O.001	***Credits (ECTS):***	6

Course structure	Lecture	Seminar	Laboratory	Project	Total hours
Number of hours per week	2		2	2	6
Number of hours per semester	28		28	28	84

Lecturer	Lecture	Seminar / Laboratory / Project
Name, academic degree	Cristina Pupăză Professor PhD. Eng.	Radu Constantin Parpală Lecturer PhD. Eng.
Contact (email, location)	cristinapupaza@yahoo.co.uk CE004	radu.parpala@gmail.com CK008

Course description:

The course deals with structural analysis procedures applied to industrial components and assemblies.This includes simulation, validation, and optimization of products, processes, and manufacturing tools.The course comprises information regarding different solvers and procedures and presents mesh generation techniques, as well as mesh quality criteria. Because engineering problems require the simulation of multiple phenomena in order to represent the underlying physics, fundamentals are provided to address multi-physics solutions, as well. Uni or multi criteria optimization techniques using structural analysis are presented forshape and parameter improvement. Information regarding native and neutral graphical formats is included to perform geometry imports. The main objectives of the courseare to get familiar with static, dynamic (modal and harmonic response simulation), thermal analysis (steady-state and transient) procedures using the Finite Element Method applied to industrial components and assemblies.All types of structural non-linearities are explained and exemplified: geometrical, material and contact non-linearities.The appropriate mathematical formulation is discussed and different solving options are analysed. Fundamentals of kinematics and multibody dynamics tools are explained. An introduction to the Computational Fluid Dynamics, as well as the fluid-structure interaction are also included. For each simulation type different case studies are presented and methods for the verification of the results are provided.

Seminar / Laboratory / Projectdescription:

The laboratory aims to develop the neccesary skills in order to easily use the Computer Aided Engineeringinterface and to perform static, dynamic, thermal analyses of industrial parts or assemblies, involving liniar and non-linear Finite Element procedures. Topology optimization and shape finder alorithms are used to improve the structural behaviour of the industrial components. Computational Fluid Dynamics are applied for basic calculations and fluid-structure interaction is used on simple industrial cases.

The project is a complete Computer Aided Engineering attempt for an industrial assembly or process, involving: geometry generation and parametrization, definition of the physical properties and material laws, mesh generation and improvement of the computational model in order to assure the accuracy of the simulation results, definition of the applied loads and constraints, solving the simulation using the appropriate mathematical formulation, results processing and an optimization attempt. The project ends with the review of the results containing the final verification and conclusion.
Intended learning outcomes:
The course combines general engineering knowledge to support mechanical design attempts, as well as industrial processes. The engineer can take decisions based on their impact on the performance.He can evaluate designs and processes,refinethe solutions using computer simulations, avoidingprototype testing, saving money and time.The course providesto the engineer insights information regarding industrial assemblies and processes, helping him to run „what-if" scenariosand to optimize the desired parameters.

Assessment method:	% of the final grade	Minimal requirements for award of credits
Written exam	20%	
Report / project	30%	
Homework	-	
Laboratory	20%	
Other	30%	

References:

Mandatory:

[1] Pupăză, C.,Parpală, R.C. - Modelare şianalizăstructuralăcu ANSYS Workbench, EdituraPolitehnicaPress, ISBN 978-606-515-189-5, 2011 – English extended summary – e-format

[2]ANSYS Workbench Tutorials Pdf : https://www1.ansys.com/customer/default.asp

[3] CAE User's Manuals: ANSYS Workbench, ANSYS Mechanichal, ANSYS CFD, ANSYS Design Explorer

Optionally:

[1]Saxena, A., Sahay, B., - Computer Aided Engineering, Springer Verlag, 2005, ISBN 1402025556

Prerequisites:	***Co-requisites*** ***(courses to be taken in parallel as a condition for enrolment):***
Technical Mechanics, Mathematics 1, Computer Programming 1, Mechanics of Materials 1, Mathematics 2, General Physics, Materials Science, Mechanics of Materials 2, Computer Aided Design 1, Mechanical Systems Design, Instrumentation and Measurement	Modelling and simulation or Finite Element Analysis of Solids

Additional relevant information:
The course is useful and provides simulation tools to support both process and design engineers, as well as researchers in broad areas.

Date: July, the 7th, 2016
Professional degree, Surname, Name: Professor PhD. Eng. Cristina Pupăză