Cracow University of Technology

Course syllabus

binding for the doctoral students of the CUT Doctoral School commencing their studies in the academic year 2022/2023

Information on the course

Name of the course in Polish	Mechanika ośrodków ciągłych w ujęciu komputerowym
Name of the course in English	Computational Continuum Mechanics
Number of the ECTS points	2
Language of instruction	Polish
Category of the course	Choosable
Field of education	Engineering and Technology
Discipline of education	Civil Engineering and Transport
Person responsible for the course Contact	CUT Prof Dorota Jasińska PhD Eng. dorota.jasinska@pk.edu.pl

Type of course, number of hours in the study programme curriculum

Semester	Credit type (G / NG)*	Lecture	Practical classes	Laboratory	Computer Lab	Project Class	Seminar
2, 3, 4, 5	G	15	0	0	15	0	0

*G – graded credit, NG – non-graded credit

Course objectives

Code	Objective description
Objective 1	Consolidation and broadening of knowledge about the mechanics of continuous media
Objective 2	Expanding knowledge in the field of numerical modelling of materials
Objective 3	Acquiring the ability to model deformable bodies in the MES ABAQUS program

Learning Outcomes

Code	Description of the learning outcome adjusted to the specific characteristics of the discipline	Learning outcome symbol in the CUT SD	Methods of verification
OUTCOMES RELATED TO KNOWLEDGE			
EUW1	A PhD student knows and understands the methods of describing the tasks of the mechanics of a deformable medium in the field of kinematics, dynamics and constitutive equations	E_W01, E_W02	Involvement in the class activities, a project assessment
EUW2	A PhD student knows and understands the principles of computer modelling of continuous medium mechanics tasks, taking into account geometric and physical nonlinearities	E_W02, E_W03	Involvement in the class activities, a project assessment

OUTCOMES RELATED TO SKILLS			
EUU1	A PhD student is able to formulate a problem in a form convenient for solving it with intelligent methods	E_U01, E_U02	Involvement in the class activities, a project assessment
EUU2	A PhD student is able to create and implement his own procedures in the Abaqus software	E_U01	Involvement in the class activities, a project assessment
EUU3	A PhD student is able to create a model of the nonlinear task of continuum mechanics in the Abaqus program and to critically analyse the obtained results	E_U01, E_U02	Involvement in the class activities, a project assessment
OUTCOMES RELATED TO SOCIAL COMPETENCES			
EUK1	A PhD student is ready to critically analyse the computer methods used in describing real phenomena	E_K01	Involvement in the class activities, a project assessment

Course outline

No.	Contents	Learning outcomes for the course	No. of hours
LECTURE			
W1	Description of the kinematics and dynamics of a deformable medium in the material and spatial description of the motion of a continuous medium.	EUW1, EUW2, EUU1	2
W2	Constitutive equations. Hyperselastic, viscoelastic and plastic materials	EUW1, EUW2, EUU1, EUK1	6
W3	Modern materials: with microstructure (cellular), nanomaterials, nanocomposites	EUW1, EUW2, EUU1,EUU2, EUK1	5
W4	Principles of variation and energy methods in the mechanics of a continuous medium	EUW2, EUU2, EUK1, EUK2	2

COMPUTER LAB			
LK1	Introduction to modelling in ABAQUS	EUU1, EUU3,EUK1	4
LK2	Modelling of geometric nonlinearities (large displacements and deformations, buckling)	EUU1, EUU3,EUK1	2
LK3	Material models available in the ABAQUS program - applications	EUU1, EUU3,EUK1	2
LK4	Contact modelling	EUU1, EUU3,EUK1	2
LK5	Dynamics tasks in Abaqus (implicit and explicit approach)	EUU1, EUU3,EUK1	2
LK6	Possibility of introducing your own procedures, including creating your own constitutive relationships (UMAT)	EUU1, EUU2,EUK1	3

The ECTS points statement

WORKING HOURS SETTLEMENT

Type of activity	Average number of hours (45 min.) dedicated to the completion of an activity type
SCHEDULED CONTACT HOURS WITH AN ACADEMIC TEACHER	
Hours allotted in the syllabus	30
Consultations	4
Examination / course credit assignment	2
HOURS WITHOUT THE PARTICIPATION OF AN ACADEMIC TEACHER	
Independent study of the course contents	14
Preparation of a project, a presentation, a discussion	10
ECTS POINTS STATEMENT	
Total number of hours	60
The ECTS points number	2

Preliminary requirements

No.	Requirements
1	Not specified

Course credit assignment conditions / method of the final grade calculation

No.	Description
COURSE CREDIT ASSIGNMENT CONDITIONS	
1	75% attendance in class.
2	Completion of a computer project - tasks prepared in the ABAQUS program
METHOD OF THE FINAL GRADE CALCULATION	
Assessment of a project, taking into account the presence	

Additional information

Not specified

The course reading list

1	P. Szeptynski, „Szczegółówe omówienie podstawowych zagadnień teorii sprężystości”, Wydawnictwo Politechniki Krakowskiej, 2020
2	J.Skrzypek „Plastycznośc i pełzanie”. Teoria, zastosowania, zadania”, PWN, Warszawa 1986.
3	R.M. Christensen, „Theory of Viscoelasticity. An introduction”, Academic Press, 1982
4	J.N.Reddy, “Energy Principles and Variational Methods in Applied Mechanics”, Willey & Sons, 2002
5	J.Mason, “Variational, incremental and energy methods in solid mechanics and shell theory”, Elsevier, 1980
6	S. Burzyński, J. Chrościelewski „Wprowadzenie do modelowania MES w programe Abaqus” Wydawnictwo Politechniki Gdańskiej 2014