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 zniszczenia
Name of the course in English	Failure mechanics
Number of the ECTS points	1
Language of instruction	Polish
Category of the course	Choosable
Field of education	Engineering and technology
Discipline of education	Mechanical engineering
Person responsible for the course Contact	Prof. Halina Egner, *doctor habilitatus* halina.egner@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	0	0	0

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

Course objectives

Code	Objective description
Objective 1	Introduction to the basics of the failure mechanics of engineering materials.
Objective 2	Acquiring the ability to take into account degradation processes in engineering modelling.

Learning outcomes

Code	Description of the learning outcome adjusted to the specific characteristics of the discipline	Learning outcome symbol in the CUD DS	Methods of verification
OUTCOMES RELATED TO KNOWLEDGE			
EUW1	The doctoral student knows the physical basics and mathematical methods of describing the current state of material degradation	E_W01, E_W02	Involvement in class activities, a presentation.
EUW2	The doctoral student knows the thermodynamic formalism of constitutive modelling of the material undergoing degradation	E_W01, E_W02	Involvement in class activities, a presentation.
OUTCOMES RELATED TO SKILLS			

EUU1	The doctoral student is able to identify the phenomena related to the degradation of the material that occur or may occur in the issue related to the implementation of the doctoral dissertation. The doctoral student is able to propose a method of their modelling.	E_U01	A presentation, discussion.
EUU2	The doctoral student is able to present and assess the effects of phenomena related to the degradation of the material that occur or may occur in an issue related to the implementation of the doctoral dissertation.	E_U01	A presentation, discussion.
OUTCOMES RELATED TO SOCIAL COMPETENCES			
EUK1	The doctoral student can refer to the methods of modelling material degradation known in the literature on the issue related to the implementation of the doctoral thesis and justify the models they use or the lack of the need to use them.	E_K01, E_K03	Discussion.

Course outline

No.	Contents	Learning outcomes for the course	No. of hours
LECTURE			
W1	Physical foundations of failure mechanics. Brittle and ductile failure.	EUW1, EUU1	2
W2	Mathematical description of failure. Thermodynamic models of failure mechanics.	EUW1, EUU1, EUU2, EUK1	2
W3	Formalism of thermodynamics of irreversible processes with internal state variables.	EUW2, EUU1	2
W4	Constitutive modelling of brittle and ductile failures.	EUW1, EUW2, EUU1, EUU2, EUK1	2
W5	Modelling of damage healing in bituminous materials and living tissues.	EUW1, EUW2, EUU1, EUU2, EUK1	2
W6	Fatigue failures. Modelling of damage using the thermodynamic state indicator.	EUW1, EUW2, EUU1, EUU2, EUK1	3
W7	Constitutive modelling of multiphase engineering materials with failures.	EUW1, EUW2, EUU1, EUU2, EUK1	2

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	15
Consultations	1
Examination / course credit assignment	2
HOURS WITHOUT THE PARTICIPATION OF AN ACADEMIC TEACHER	
Independent study of the course contents	8
Preparation of a paper, a report, a project, a presentation, a discussion	4
ECTS POINTS STATEMENT	
Total number of hours	30

The ECTS points number	1

Preliminary requirements

No.	Requirements
1	Basic knowledge of the mechanics of materials.
2	Knowledge of the English language.

Course credit assignment conditions / method of the final grade calculation

No.	Description
COURSE CREDIT ASSIGNMENT CONDITIONS	
1	75% attendance in class.
2	Presentation of a paper.
METHOD OF THE FINAL GRADE CALCULATION	
Grade for the presentation	

Additional information

The thematic scope of the lecture, including the level of advancement of the presented theories and modelling examples, takes into account the scope of knowledge in the subject matter acquired by the doctoral students at earlier stages of education.

The course reading list

1	Skrzypek J., 2006, Podstawy mechaniki uszkodzeń, Wydawnictwo PK.
2	Lemaitre, J., 1996. A Course on Damage Mechanics, Springer Berlin Heidelberg
3	Ottosen, N.S., Ristinmaa, M., 2005, The Mechanics of Constitutive Modeling, Elsevier