

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 konstrukcji nawierzchni drogowych
Name of the course in English	Mechanics of Pavement Structures
Number of the ECTS points	1
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	Jarosław Górszczyk PhD Eng. jaroslaw.gorszczyk@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	Extension of knowledge in the field of fracture mechanics, rheology of asphalt mixtures and high-cycle fatigue calculations using the finite element method.
Objective 2	Extension of knowledge in the field of fracture mechanics, rheology of asphalt mixtures and high-cycle fatigue calculations using the finite element method.
Objective 3	Acquiring the ability to use appropriate calculation procedures when designing new pavement structures and reinforcing existing road pavements.

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 understands and is able to discuss selected issues of fracture mechanics, fatigue calculations and rheology used in analyses and design of road surfaces	E_W01, E_W02	Involvement in class activities, a written assignment assessment

EUW2	A PhD student understands and is able to discuss the models, assumptions and calculation procedures used in the design and analysis of road surfaces and in the determination of material parameters in laboratory tests.	E_W01, E_W02	Involvement in class activities, a written assignment assessment
OUTCOMES RELATED TO SKILLS			
EUU1	A PhD student is able to use the appropriate calculation procedure with the use of computer programs in the design of new pavement structures and reinforcement structures of the existing road surfaces.	E_U01	Involvement in class activities, a written assignment assessment
EUU2	A PhD student is able to prepare design documentation for the reconstruction or renovation of the road surface as part of the mechanistic-empirical method.	E_U01	Involvement in class activities, a written assignment assessment
EUU3	A PhD student is able to plan and carry out the necessary laboratory tests in order to determine the material parameters necessary in the process of designing the pavement structure.	E_U01	Involvement in class activities, a written assignment assessment
OUTCOMES RELATED TO SOCIAL COMPETENCES			
EUK1	A PhD student is ready to critically evaluate the calculation procedures used in the analysis and design of road pavement structures (Cartesian scepticism).	E_K01	Involvement in class activities, a written assignment assessment
EUK2	A PhD student is ready to recognize the importance of knowledge about conducting laboratory tests in order to correctly obtain material parameters necessary in the design and analysis of road surfaces.	E_K03	Involvement in class activities, a written assignment assessment

Course outline

No.	Contents	Learning outcomes for the course	No. of hours
LECTURE			
W1	Introduction to the design of road surfaces - basic concepts and definitions, a historical outline of the development of design methods and analysis of road structures	EUW1, EUW2, EUK1	1
W2	Structural fatigue analysis: criteria for multi-axis high-cycle fatigue, static strength versus fatigue strength - Wöhler-Basquin curves of asphalt mixtures and their determination in laboratory tests, crack propagation under variable loads	EUW1, EUU3, EUK1, EUK2	3
W3	The rheology of asphalt mixtures (MMA): MMA rheological models of Maxwell, Voigt-Kelvin, Burgers, Krass, Huschek, Huet, Weiland, Hou. MMA relaxation and creep, laboratory tests of MMA rheological properties, MMA stiffness modules for force impulse and harmonic load, temperature influence on MMA material parameters.	EUW1, EUU3, EUK1, EUK2	3
W4	Methods of designing and analysing road surfaces: empirical, mechanistic-empirical method, mechanistic method, load models, material models, contact issues in multilayer systems, required laboratory and field tests.	EUW1, EUW2, EUU1, EUU2, EUU3, EUK1, EUK2	3

W5	Computer method in the design and analysis of road surfaces. Comparison of computer programs dedicated to the design of road surfaces. The use of the finite element method in the analysis and design of road surfaces.	EUW1, EUW2, EEU1, EUK1	3
W6	Mechanistic-empirical method of designing the reinforcement of the existing pavement with an example.	EUW2, EEU2, EEU3, EUK1, EUK2	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	1
HOURS WITHOUT THE PARTICIPATION OF AN ACADEMIC TEACHER	
Independent study of the course contents	8
Preparation of a paper, report, project, presentation, discussion	5
ECTS POINTS STATEMENT	
Total number of hours	30
The ECTS points number	1

Preliminary requirements

No.	Requirements
1	Not specified

Course credit assignment conditions / method of the final grade calculation

No.	Description
COURSE CREDIT ASSIGNMENT CONDITIONS	
1	80% attendance in class.
2	Oral credit for a written dissertation prepared by a PhD student related to the subject of the subject.
METHOD OF THE FINAL GRADE CALCULATION	
Assessment of the completion of the presented work, taking into account the attendance	

Additional information

Not specified

The course reading list

1	Judycki J., <i>Analizy i projektowanie konstrukcji nawierzchni podatnych i półsztywnych</i> , Warszawa, 2014, Wydawnictwo WKŁ.
2	Nagórski R., <i>Mechanika nawierzchni drogowych w zarysie</i> , Warszawa 2021, Wydawnictwo Naukowe PWN.
3	FGSV-Nr.: AP 65, <i>Mechanisches Verhalten von Asphalt in Befestigungen für Verkehrsflächen - Eingangsgrößen in die Bemessung (Materialkennwerte)</i> , Ausgabe 2006.

4	Czasopisma: <i>Road Materials and Pavement Design; Materials and Structures; Roads and Bridges, etc.</i>
5	Design catalogues, GDDKiA and FGSV technical documents