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	Technika Badań Symulacyjnych w Transporcie i Logistyce
Name of the course in English	Simulation Techniques in Transport and Logistics
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 Vitalii Naumov PhD Eng. vitalii.naumov@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	Expanding knowledge in the field of simulation research
Objective 2	Acquiring the ability to use modern computer simulation tools

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 has knowledge of the application of the systemic approach to transport and logistics issues	E_W02, E_W03	A final task
OUTCOMES RELATED TO SKILLS			
EUU1	A PhD student is able to create a simulation model of the transport or logistics process	E_U02	A laboratory exercise
EUU2	A PhD student knows how to develop a simulation experiment plan to solve problems in the field of transport and logistics	E_U02	A laboratory exercise

OUTCOMES RELATED TO SOCIAL COMPETENCES			
EUK1	A PhD student is ready to critically evaluate the results of computer simulations	E_K01	A discussion in class

Course outline

No.	Contents	Learning outcomes for the course	No. of hours
LECTURE			
W1	Systems approach as a basic tool for research on transport and logistics systems	EUW1, EUK1	2
W2	Theoretical principles of generating random variables	EUW1, EUU1, EUU2	3
W3	Program models of transport and logistics systems. Basics of Python modelling. Development of procedures. Create classes	EUW1, EUU1, EUU2, EUK1	6
W4	Basics of planning simulation experiments	EUW1, EUU1, EUU2, EUK1	2
W5	Analysis of simulation results. Repeatability of the simulation experiment	EUW1, EUU1, EUU2, EUK1	2

COMPUTER LAB			
K1	Development of black and white box models	EUU1, EUU2, EUK1	2
K2	Generating random variables in Python	EUU1, EUU2, EUK1	2
K3	Development of the simplest model of the transport process in Python	EUU1, EUU2, EUK1	2
K4	Development of simulation procedures for transport and logistics systems in Python	EUU1, EUU2, EUK1	2
K5	Development of models of elements of transport and logistics systems as classes	EUU1, EUU2, EUK1	2
K6	Automation of the simulation experiment	EUU1, EUU2, EUK1	2
K7	Development of simulation results in Python	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	1
Examination / course credit assignment	2
HOURS WITHOUT THE PARTICIPATION OF AN ACADEMIC TEACHER	
Independent study of the course contents	12
Preparation of a final task	15
ECTS POINTS STATEMENT	
Total number of hours	60

The ECTS points number	2

Preliminary requirements

No.	Requirements
1	Knowledge of the basics of mathematical statistics
2	Knowledge of the basics of programming

Course credit assignment conditions / method of the final grade calculation

No.	Description
COURSE CREDIT ASSIGNMENT CONDITIONS	
1	80% attendance in class. Completion of a final task.
METHOD OF THE FINAL GRADE CALCULATION	
Assessment of the final task, taking into account the attendance	

Additional information

Not specified

The course reading list

1	Sokolowski, J.A., Banks, C.M. *Principles of Modeling and Simulation: a Multidisciplinary Approach*, 2009, John Wiley & Sons, Inc.
2	Brandimarte, P., *Handbook in Monte Carlo Simulation: Applications in Financial Engineering, Risk Management, and Economics*, 2014, John Wiley & Sons, Inc.
3	Cellier, F.E., *Continuous System Simulation*, 2006, Springer Science
4	Banks, J., *Discrete-event System Simulation*, 2001, Prentice-Hall
5	Downey, A.B. *Think Python: How to Think Like a Computer Scientist*, 2015, O'Reilly
6	Lutz, M., *Python: Wprowadzenie*, 2011, Helion