



COURSE SPECIFICATION

Course code	full-time studies	Z-ZB-E-510a
	part-time studies	-
Course title in English	Application of simulation methods in risk quantification	
Course title in Polish	Zastosowanie metod symulacyjnych w kwantyfikacji ryzyka	
Valid from academic year	2025/2026	

PLACEMENT IN THE TEACHING PROGRAM

Programme of study	BUSINESS MANAGMENT
Level of education	1st degree
Studies profile	academic
Form and mode of study	full-time programme
Scope	risk management
Academic unit responsible for the course	Department of Production Engineering
Course coordinator	dr inż. Maria Krechowicz
Approved by	dr hab. inż. Dariusz Bojczuk, prof. uczelni

GENERAL CHARACTERISTIC OF THE COURSE

Teaching block	Specialist subject	
Course status	Obligatory	
Language of instruction	English	
Semester of delivery	full-time studies	Semester V
	part-time-studies	-
Prerequisites	Mathematics, Fundamentals of statistics and econometrics, Financial mathematics, Introduction to risk management	
Exam (YES/NO)	NO	
ECTS	2	

Method of conducting classes		lecture	classes	laboratory	project	other
Number of hours per semester	full-time	15			15	
	part-time					



LEARNING OUTCOMES

Category	Outcome code	Course learning outcomes	Reference to the directional learning effect
Knowledge	W01	The student has knowledge of mathematical analysis and statistics useful for risk quantification.	ZB1_W06
	W02	The student has advanced knowledge of the principles and risks of operating enterprises in the global economy.	ZB1_W03
	W03	The student has knowledge of systems, techniques, tools and methods for quantitative risk assessment in an enterprise and is able to quantitatively determine the impact of implementing various risk management strategies on the risk level of the project.	ZB1_W07
	W04	The student has knowledge of methods and techniques of learning and the principles and rules of logical thinking and reasoning. Knows the methodology of creating research studies that address the problems of risk management in an organization.	ZB1_W11
Skills	U01	The student is able to use the acquired knowledge to quantify risks emerging in the organization.	ZB1_U01
	U02	The student has the skills to independently plan and conduct empirical research in the field of risk quantification. He is able to develop and present the obtained results using multimedia tools.	ZB1_U13
	U03	The student is able to act creatively, identify, assess and control risk and select appropriate risk reduction methods along with determining the degree of risk reduction.	ZB1_U11
Social competences	K01	The student is able to think and act in an entrepreneurial manner using knowledge of risk management.	ZB1_K04
	K02	The student is able to critically evaluate the knowledge he/she possesses and the content he/she receives, as well as supplement and improve the acquired knowledge and skills in the field of risk management in order to improve professional qualifications in connection with the changing socio-economic and technological conditions on a national and international scale.	ZB1_K02
	K03	The student is ready to adhere to the principles of professional ethics, disseminate and defend his/her own views on the quantification of risk in the enterprise with respect for different positions and cultures, and requires the same from others.	ZB1_K07
	K04	The student is ready to cooperate and work in a group in the preparation of projects in the field of risk quantification and to communicate effectively within the roles performed, with respect for professional ethics, taking into account the public interest and applicable legal and economic restrictions.	ZB1_K03



COURSE CONTENT

Method of conducting classes	Course content
lecture	The essence of risk measurement and estimation. Theoretical concepts in risk measurement. Methods for measuring basic types of risks in an enterprise. Value at Risk (VaR) estimation methods: variance-covariance approach, historical simulation, Monte Carlo simulation, determining the quantile of any distribution, extreme value theory, values from the tail of the distribution. Advantages and disadvantages of VaR. Quantitative risk assessment using matrix methods (two-parameter, three-parameter, five-parameter). Quantitative risk assessment using fault tree analysis. Quantitative risk assessment using fuzzy set theory. Quantitative risk assessment using FMEA spreadsheets. Risk simulation using artificial intelligence models.
project	The project consists of quantifying the risk of a selected undertaking (risk identification, risk quantification using selected methods, sensitivity analysis, risk reduction, assessment of the degree of risk reduction). The project is prepared in teams of 2 or 3 people. The results of the project will be presented by groups of students using multimedia presentations.

METHODS FOR VERIFYING LEARNING OUTCOMES

Outcome code	Learning outcomes verification methods					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			
W02			X			
W03			X			
W04			X			
U01				X		
U02				X		
U03				X		
K01				X		
K02				X		
K03				X		
K04				X		

FORM AND CONDITIONS OF ASSESSMENT

Form of classes	Assessment type	Assessment Criteria
lecture	Credit with grade	Obtaining at least 50% of points in the final colloquium.
project	Credit with grade	Obtaining at least a passing grade for the project and its defense.



STUDENT WORKLOAD

ECTS Balance							
No.	Activity type	Student workload					Unit
		full-time					
1.	Scheduled contact hours	W	C	L	P	S	h
		15			15		
2.	Other (consultations, exams)	2			2		h
3.	Total number of contact hours	34					h
4.	Number of ECTS credits for contact hours	1,4					ECTS
5.	Number of hours of independent student work	16					h
6.	Number of ECTS points that a student obtains through independent work	0,6					ECTS
7.	Workload related to practical classes	25					h
8.	Number of ECTS credit points which a student receives for practical classes	1,0					ECTS
9.	Total number of hours of a student's work	50					
10.	ECTS credits for the course <i>1 1 ECTS credit =25 student learning hours</i>	2					ECTS

W - LECTURE C - CLASSES L - LABORATORY P- PROJECT S - SEMINAR

READING LIST

1. Smith N., Merna T., Jobling P., (2011), Managing risk in construction projects, Blackwell Publishing, Oxford
2. Krechowicz, M., Gierulski, W., Loneragan, S., & Kruse, H. (2022). External risk factors evaluation in horizontal directional drilling technology using failure mode and effect analysis. Management and Production Engineering Review, 13(1).
3. Krechowicz, M. (2021). The hybrid Fuzzy Fault and Event Tree analysis in the geotechnical risk management in HDD projects. Georisk: Assessment and Management of Risk for Engineered Systems and Geohazards, 15(1), 12-26.
4. Krechowicz, Maria. "Effective risk management in innovative projects: A case study of the construction of energy-efficient, sustainable building of the laboratory of intelligent building in Cracow." IOP Conference Series: Materials Science and Engineering. Vol. 245. No. 6. IOP Publishing, 2017.
5. Krechowicz, M., & Krechowicz, A. (2021). Risk assessment in energy infrastructure installations by horizontal directional drilling using machine learning. Energies, 14(2), 289.