GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computer Applications, PG_00043358		
Field of study	Environmental Engineering		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	5	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Hydraulic Engineering -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Zima	
	Teachers	dr hab. inż. Piotr Zima mgr inż. Paweł Wielgat	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	0.0	60
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	60	5.0	45.0	110

Subject objectives	Acquaint the student with the principles of working with engineer support software in the field of environmental engineering. Introduction to basic numerical methods for solving nonlinear equations, systems of linear and nonlinear equations, interpolation and approximation methods, methods for numerical integration and elements of optimization .

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_K01] can think and act in a creative and enterprising way; can set priorities for the implementation of an individual or group task; understands the need for continuous training and professional responsibility for their activities and team	Student is able to work in a group	
	[K6_W05] knows the theoretical basis of hydromechanics and its practical models, necessary to solve technical problems in the field of environmental engineering (sanitary engineering, water melioration, water management and flood protection, pollution spread)	The student is fluent in the field of hydromechanics, knows the practical models necessary to solve problems in the field of environmental engineering	
	[K6_W01] has knowledge in the field of mathematics, including: linear algebra, mathematical analysis and elements of mathematical statistics, probability theory, applications of mathematics, including mathematical methods and numerical methods, necessary for: 1) description and analysis of hydrological phenomena; 2) description and analysis of meteorological phenomena; 3) solving project tasks of the sanitary industry;	The student is fluent in mathematics and statistics	
	[K6_W06] has a structured and theoretically founded knowledge in the field of computer science, numerical methods and the possibilities of their applications for solving tasks, description of phenomena related to the flow of water in the environment, in open pipes and channels, filtration, migration of pollutants	The student uses the software modeling of flow in open channels. He knows the basics of working in the hydroinforamtics system HEC-RAS. He defines the basics of the EPANET. He describes the engineering problem solution with a structural algorithm. He applies basic numerical methods for solving problems of water engineering.	
	[K6_U11] can use selected computer programs to support design, including CAD graphics programs	The student uses the software modeling of flow in open channels. He knows the basics of working in the hydroinforamtics system HEC-RAS. He defines the basics of the EPANET. He describes the engineering problem solution with a structural algorithm. He applies basic numerical methods for solving problems of water engineering.	

Subject contents	LECTURE Application of public-domain programs in environmental engineering. Application of hydroinformatics program in modeling flows in the open channels to the example of HEC-RAS program service. Introduction to HEC-RAS. General assumptions for the description of the fixed longitudinal movement - computational model. Nodal areas of rivers and streams (the connection and branching streams). Numerical description of the channel geometry and river valleys. Determination of drag coefficient in the complex channels. Rules for the calculation of the longitudinal surface of water in rivers and streams with hydrotechnics elements. Different length of flow path on the floodplains and terraces in main riverbed. Suspended sediment and towed transport. Unsteady flow - the flood wave propagation. Modeling of ice flow. Management of water supply network. Support the EPANET program, construction of water supply network model. Models of components and ancillary systems. Solving nonlinear equations: bisection, secant, Newton and a simple iteration method. Methods for solving systems of nonlinear equations: a simple iteration and Newton method. Approximation and interpolation: Lagrange interpolation polynomials. Approximation method of least squares. ADITORIUM EXERCISES Algorithms and flowcharts. Solving nonlinear equations (bisection, secant, simple iteration and Newton method). Systems of linear equations (Gaussian elimination method.) Approximation method of least squares (different types of functions) - exercises. LABORATORY EXERCISES Creating a new project, defining the network of rivers, defining the shapes of the channel in the characteristic cross-sections. Interpolation of intermediate sections. Creating of hydrotechnical elements (bridges, culverts, weirs). The introduction of steady flow data and performance of calculations. Solving nonlinear equations on examples of hydraulic engineering (bisection method, secant, simple iteration, Newton). Systems of linear equations (Gaussian elimination method.) Approximation of least squares method (exponential function, and square
Prerequisites and co-requisites	Acquaint the student with the principles of working with engineer support software in the field of environmental engineering. Introduction to basic numerical methods for solving nonlinear equations, systems of linear and nonlinear equations, interpolation and approximation methods, methods for numerical integration and elements of optimization .

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	complete tutorial	60.0%	40.0%
	complete lecture	60.0%	30.0%
	complete laboratory	60.0%	30.0%
Recommended reading	Basic literature	1. Szymkiewicz R. Metody numeryczne w inżynierii wodnej, Pomorska biblioteka cyfrowa, Gdańsk, 2013 (pdf). 2.HEC-RAS, River Analysis System, Reference Manual, US Army Corps of Engineers, Institute For Water Resources, Hydrologic Engineering Center, Davis 2003. 3. HEC-RAS, River Analysis System, Hydraulic Reference Manual, US Army Corps of Engineers, Institute For Water Resources, Hydrologic Engineering Center, Davis 2003. 4. Hydrauliczne podstawy obliczania przepustowości koryt rzecznych, red. nauk. J. Kubrak, E. Nachlik, Wyd. SGGW, Warszawa 2003. 5. EPANET 2 USERS MANUAL, Water Supply and Water Resources Division, National Risk Management Research Laboratory, Cincinnati.	
	Supplementary literature	1. Fortuna Z. i inni Metody numeryczne WN-T, Warszawa, 1993, 2. Ralston A. Wstęp do analizy numerycznej, PWN, Warszawa, 1971	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1). List and review known Public Domain packages supporting the work of an engineer in the field of environmental engineering?2) Replace and describe the main modules of the HEC-RAS program?3). What data are needed to perform a river flow simulation using the HEC-RAS package.4). What possibilities does the EPANET software have.5). List and review known to you commercial packages supporting the work of an engineer in the field of environmental engineering?		
Work placement	Not applicable		