Wrocław University of Science and Technology
Doctoral School

COURSE CARD

1. Basic information

Course name in English:	Recent research trends in civil engineering, geodesy and transport	
Course name in Polish:	Najnowsze kierunki badań w inżynierii lądowej, geodezji i transporcie	
Number of hours:	30	
Type of course:	Recent research trends in discipline	
Form of course:	lecture	
Code of course:	W02ILT-SD0139W / ILQ100335W	
Course leader:	Adrian Różański	
Faculty of the course leader:	W2 Faculty of Civil Engineering	
Email address of the course leader:	adrian.rozanski@pwr.edu.pl	
Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course):	Architecture and urban planning	☐
	Automation, electronic, electrical engineering and space technologies	☐
	Information and communication technology	☐
	Biomedical engineering	☐
	Chemical engineering	☐
	Civil engineering, geodesy and transport	☒
	Materials engineering	☐
	Mechanical engineering	☐
	Environmental engineering, mining, and energy	☐
	Mathematics	☐
	Chemical sciences	☐
	Physical sciences	☐
	Management and quality studies	☐

2. Objectives

Getting to know the latest techniques for solving large-scale geo- and hydrotechnical problems.

Getting to know the type and structure of network or systems

Getting to know the variations of line installations

Getting to know the trenchless construction methods

Getting to know the types of construction materials

Getting to know the rules of designing of road pavements.

Education and improving skills in the area of road materials.

Acquiring the knowledge of innovative technologies in road engineering.

3. Content

Detailed information about the course content, including topics and form of classes.

No.	Topic	Number of hours	Form of classes
1	Numerical modeling in a continuous medium of elasto-plastic deformations, history of subsoil loading, hysteresis effects. An example of numerical analysis of soil-steel structure exposed to water infiltration.	2	lecture
2	Numerical modeling of large-scale geo- and hydrotechnical engineering problems. Reconstruction of the spatial arrangement of layers in the subsoil with the use of geostatistical interpolation. Examples of numerical models of the subsoil of real structures: dams of dry flood protection reservoirs and mining waste reservoirs.	2	lecture
3	Time and spatial optimization of technological measures increasing the safety of geo-and hydrotechnical structures with simultaneous use of monitoring results and advanced 3D computational models.	2	lecture
4	Methods of the analysis of reinforced concrete structures - theory, experiments, case studies	2	lecture
5	Research related to the implementation of steel and concrete hybrid beams	2	lecture
6	Contemporary trends in research on the subject: structural conservation and strengthening of historical objects	2	lecture
7	Application of infrared thermography in building - passive and active thermography I	2	lecture
8	Application of infrared thermography in building - passive and active thermography II	2	lecture
9	Measurements of thermal resistance of masonry walls	2	lecture
10	Variations of line installatons	2	lecture
11	CIPP technologies	2	lecture
12	Microtuneling, Pipe Jacking, Direct Pipe	2	lecture
13	Road pavements and designing.	2	lecture
14	Modern materials in road pavement layers.	2	lecture
15	Recycling in road engineering.	2	lecture

4. Prerequisites

List of prerequisites relating to knowledge, skills and other competences for course participants.

Has knowledge of mechanics, strength of materials and rules for calculating and designing engineering structures.

Has knowledge of the types of underground structures

Has knowledge of the types of underground network infrastructure

Has knowledge of the classic methods of building underground structures

Has knowledge of the basics of mathematical and statistics

Has knowledge of of materials and technologies used in civil engineering

5. Learning outcomes

List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

Symbol	Learning outcome	
	KNOWLEDGE. Doctoral student knows and understands:	
SzD_W3	the main trends in the development of the scientific or artistic disciplines covered in the curricula;	☒
SzD_W4	research methodology;	☐
SzD_W5	the rules for the dissemination of scientific results, including in open access mode;	☐
SzD_W6	the fundamental dilemmas of modern civilization;	☒
SzD_W7	the legal and ethical conditions of scientific activity;	☐
SzD_W8	the economic and other relevant conditions of scientific activity;	☐
SzD_W9	basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results.	☐
	SKILLS. Doctoral student is able to:	
SzD_U2	use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular: - define the purpose and subject of scientific research, formulate a research hypothesis, - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres;	☐
SzD_U3	communicate on specialised topics to the extent that they enable an active participation in the international scientific community;	☐
SzD_U4	disseminate research results, including in popular forms;	☐
SzD_U5	initiate debates and participate in a scientific discourse;	☐
SzD_U6	be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment;	☐

SzD_U7	plan and implement an individual or collective research or creative activity, including in an international environment;	☐
SzD_U8	independently plan and act for one's own development and inspire and organize the development of others;	☐
SzD_U9	plan classes or groups of classes and implement them using modern methods and tools.	☐
	SOCIAL COMPETENCES. Doctoral student is ready to:	
SzD_K3	fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way;	☐
SzD_K4	maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection.	☐

6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

Essay

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

Multimedia presentation.

Personal computer, interactive whiteboard (calculations, drawings, descriptions, examples).

8. Literature

List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.

PRIMARY LITERATURE:

[1] Chaudhary, K. B., Phoon, K. K., & Toh, K. C. Large-Scale Geotechnical Finite Element Analysis on Desktop PCs.
[2] Łydżba et al. Safety analysis of the Żelazny Most tailings pond: qualitative evaluation of the preventive measures effectiveness. Studia Geotechnica et Mechanica. Vol. 43 (2) 2021.
[3] Łydżba et al. A comprehensive approach to the optimization of design solutions for dry anti-flood reservoir dams. Studia Geotechnica et Mechanica. Vol. 43 (2) 2021.
[4] Maldague X., Theory and practice of infrared technology for nondestructive testing. John Wiley & Sons, Inc., 2001.
[5] Minkina W., Dudzik S., Infrared thermography: errors and uncertainties. John Wiley and Sons, 2009.
[6] Nowak H.: Application of infrared thermography in building (in Polish), Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2012.

[7] Vollmer M., Mollmann K., P., Infrared Thermal Imaging. Fundamentals, research and Applications. Wiley-VCH Verlag, GmbH & KGaA, Germany 2010.
[8] Trenchless Technology for Installation of cables and Pipelines – Dietrich Stein, STEIN&PARTNER, Germany, 2005
[9] Trenchless Technology: Pipeline and Utility Design, Construction and Renewal - McGraw-Hill Education; 1 edition, 2005
[10] Robinson R., Road Engineering for Development, Taylor & Francis, 2004
[11] General Directorate for National Roads and Motorways (GDDKiA). Instruction for designing and embedding of mineral-cement-emulsion mixtures (MCE), Gdańsk, 2014.
[12] General Directorate for National Roads and Motorways, Catalog of typical flexible and semi-rigid pavement constructions, Warsaw, Poland, 2014.
[13] General Directorate for National Roads and Motorways – Asphalt pavements on national roads. WT-2 2014 – Part I. Bituminous mixtures. Technical requirements. Warsaw 2014.

SECONDARY LITERATURE:

[1] Hens H.: Applied building physics. Boundary Conditions, Building performance and material properties. Wilhelm Ernst & Sohn, Berlin 2011.
[2] Hens H.: Building physics – heat, air and moisture. Fundamentals and Engineering methods with examples and exercises. Wilhelm Ernst & Sohn, Berlin 2012.
[3] Siegel R., Howell J.R., Thermal Radiation Heat Transfer. McGraw-Hill, New York, 1981.
[4] http://inzynieria.com
[5] European Standards: Bituminous mixtures - series EN 12697

9. Other remarks

Additional remarks, comments, (e.g., language of the course)