STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Underground Structures**		Code **1010102121010120210**
Field of study **Civil Engineering Second-cycle Studies**	Profile of study (general academic, practical) **general academic**	Year /Semester **1 / 2**
Elective path/specialty **Bridges and Underground Engineering**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **-** Laboratory: **-** Project/seminars: **30**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **other**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art		ECTS distribution (number and %)

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge of the strength of materials, structural mechanics, soil mechanics, concrete structures, steel structures, foundation design and fundamentals
2	**Skills**	Skills related to the static calculations and design of concrete and steel structures, self-learning skills
3	**Social competencies**	Ability to adapt of the type of any civil engineering structure to the communication requirements and social expectations, respect for the Polish language, understand the need for lifelong learning and group collaboration

Assumptions and objectives of the course:

The aim of the subject is presentation of basic problems of design, construction and building of underground structures.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student knows the specifics of the work and design of different types of underground structures - [K_W08, K_W09]
2. Student knows the basis form of underground structures - [K_W09]
3. Student knows the main loads acting on the underground structures - [K_W10]

Skills:

1. Student can name create the form of underground structures - [K_U02, K_U03]
2. Student can perform the basic static-strength calculations of main structural components of any underground structure - [K_U02, K_U04]
3. Student can conduct calculations in accordance with the principles set out in the new system of European standards PN-EN - [K_U08]

Social competencies:

1. Student can adapt the type of structure to the communication requirements and social expectations - [K_K08]
2. Student can collaborate and work together in a group, is aware of the need for self-education - [K_K07]
3. Student complies with the principles of the Polish language and the rules of preparation of technical documentation - [K_K01, K_K03]

Assessment methods of study outcomes

Written test of the student's knowledge in the field of material presented during the lectures
Preparation of some static-strength calculation of simple underground structure (project)

Course description

Lectures:

Definitions. Classification of underground structures. Initial design of tunnels. Cross-section design factors. Shallow founded tunnels structural elements and construction. Loads and static computations of shallow founded tunnels. Tunnel fittings. Shallow founded tunnels building methods.

Basic bibliography:

1. Furtak K., Kędracki M.: Podstawy budowy tuneli, Wydawictwo PK, Kraków 2005
2. Świst E.: Hydrotechniczne i komunikacyjne budowle podziemne, Wydawnictwo STO, Katowice 2006
3. Stamatello H.: Tunele io mkiejskie budowle podziemne, Arkady, Warszawa 1970
4. Józef Bartoszewski, Stanisław Lessaer: Tunele i przejścia podziemne w miastach, WKiŁ Warszawa 1971

Additional bibliography:

1. Arkadiusz Madaj, Witold Wołowicki: Podstawy projektowania budowli mostowych, WKiŁ Warszawa 2003/2007
2. Arkadiusz Madaj, Witold Wołowicki: Projektowanie mostów betonowych, WKiŁ Warszawa 2010
3. Henryk Czudek, Wojciech Radomski: Podstawy mostownictwa, PWN Warszawa 1983

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	60
2. Studying	30

Student's workload

Source of workload	hours	ECTS
Total workload	90	4
Contact hours	60	2
Practical activities	30	2