STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Pavement structure design**		Code **1010102121010126030**
Field of study **Civil Engineering Second-cycle Studies**	Profile of study (general academic, practical) **general academic**	Year /Semester **1 / 2**
Elective path/specialty **Roads and Highways**	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				No. of credits **3**
Lecture: **30**	Classes: **-**	Laboratory: **15**	Project/seminars: **-**	

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**	Knows the foundations of mathematics, physics. Understands the general principles of mechanics pavement. He knows the classification of roads broken down into its elements and understands the multifactorial nature of the pavement loadings. He knows the basic method of calculation of new pavements and those to be reinforced according to flexible, semi-rigid and rigid ones. He knows simple methods of dimensioning reinforcement of pavement structures.
2	**Skills**	Knows how to properly assess the pavement type and build its a simple model. He knows how to determine the material parameters of the individual layers of pavement structures and using any computer application licensed under the GNU GPL (or other) determine the state of stress in the characteristic points of the pavement model. Calculates the reinforcement for a simple model pavement and knows the simplified methods.
3	**Social competencies**	Alone complements and extends knowledge in the field of modern processes and technologies. He is aware of the need to raise professional and personal competences. He is with the rules of ethics and respect for the Polish language.

Assumptions and objectives of the course:

Discussion with students theoretical and practical knowledge that will allow them for relatively conscious shaping solutions of typical and atypical pavement reinforcement design tasks for pavements to be for various purposes.

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

Knowledge:

1. He has knowledge of advanced topics about modeling the strength of materials, materials and pavement construction - [K_W04]

2. He knows the basics of migration of heat and moisture through pavement courses   - [K_W06]

3. He knows the classification and scope of computer programs supporting the analysis and design of pavement structures - [K_W08]

4. Knows the principles of design and analysis of pavement structures to be of varying purposes (roadways, maneuvering squares, terminals, airport pavements) - [K_W09]

5. Knows and applies the law in relation to the formulation of construction solutions while strengthening the pavement - [W_W17]

6. He has the knowledge on how to design the road transport infrastructure - [K_W19]

Skills:

1. He can make the classification of simple and complex pavement structures - [K_U02]

2. He uses advanced specialized tools to find useful information, communication and acquisition of software to support the work of the designer roads   - [K_U05]

3. He is able to correctly define alone the computational models of computer analysis of pavement structures   - [K_U06]

4. Able to critically assess the results of the numerical analysis of engineering structures   - [K_U07]

5. Can design the pavement reinforcement using the mechanistic approach   - [K_U15]

Social competencies:

1. Alone complements and extends knowledge in the field of modern processes and technologies in pavements industry   - [K_K03]

2. He is aware of the need for sustainable development in the pavement construction industry - [K_K04]

3. Understands the need to inform the public knowledge about road construction - [K_K08]

Assessment methods of study outcomes

Knowledge is transmitted in the form of multimedia presentations and contact with the Students when discussing issues that require direct contact with the teacher. Examination of lectures is based on a term paper and takes the form of a written defense. The assessment consists of the sum of the points awarded for the work of the semester and a written test.

Grading scale:

> 100 excellent

91 - 100 very good (A)

81 - 90 good plus (B)

71 - 80 good (C)

61 - 70 satisfactory plus (D)

51 - 60 satisfactory (E)

below 50 failed (F)

Course description

Introduction to the pavements analysis of different purposes: roadways, maneuvering squares, loading terminals, airports, pavements (Law basics, classification, technical conditions)

Definition, classification and loadings of pavements: mechanical, temperature, humidity

Determination of parameters for numerical models of pavements: laboratory methods and testing of in-situ

The testing of pavement model in the laboratory, the parameter EV2, evaluation of density (using VSS)

Analysis and interpretation of research results by VSS

GPR studies and their interpretation

Physics of the layered pavement system, the definition of aggressive environments for pavements

Life Cycle Cost Analysis

The chosen items of estimating the costs of pavements construction

Pavement structures failures (introduction to the understanding of the need to know the genesis of pavement defects)

Pavement mechanics (the elements of diagnosis and prognosis)

Modeling the pavement subgrades (practical issues)

Modeling the flexible pavement (practical issues)

The aspects of semi-rigid pavement reinforcing

Modeling the rigid pavement without the reinforcement

Rigid layers with reinforcement

Flooring - jointless pavement modeling

Basic bibliography:

1. Firlej S., The pavement mechanics, Petit s.c. Lublin, 2007

2. Nagórski R., Machanics of pavements, PWN, 2014

3. Huang Y, Pavement analysis and design, 2004

4. PN-S-02205 _1998.Drogi samochodowe.Roboty ziemne.Wymagania i badania

5. Van Cauwelaert,F, Pavement Design And Evaluation. The Required Mathematics And Its Applications, Federation of the Belgian Cement Industry, 2003

Additional bibliography:

1. Nita P., Construction and maintance of airport pavements, WKŁ 1999

2. Maro L., Geosynthetics for subgrade reinforcing, Lemar 2010

3. Szydło A., Pavements of cement concrete, Polish Cement, Kraków 2004

4. Hajduk P., Industrial flooring design, PWN 2014

5. PN-S-02205 _1998. Roadways.Earthworks. Requirements and testing

http://www.put.poznan.pl/

Result of average student's workload	
Activity	**Time (working hours)**
1. Lectures	30
2. Laboratory exercises	15
3. Own work	10
4. Defense of the project and test of lectures	2
Student's workload	

Source of workload	hours	ECTS
Total workload	75	3
Contact hours	20	1
Practical activities	15	1