STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Optimization in the designing roads		**1010102121010121022**

Field of study	Profile of study (general academic, practical)	Year /Semester
Civil Engineering Second-cycle Studies	**(brak)**	**1 / 2**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Roads and Airfields	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours				No. of credits
Lecture: **2**	Classes: **-**	Laboratory: **-**	Project/seminars: **2**	**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**4 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	K_W01. The student has knowledge of the fields of mathematics useful for solving problems related to road engineering. K_W06. The student has knowledge within the scope of the design guidelines of roads, grade junctions and grade separated interchanges and associated technical requirements. K_W07, K_W09 i K_W10. The student has the knowledge and knows the rules of dimensioning, construction and designing of road earthworks.
2	**Skills**	K_U01. The student is able to classify the elements of roads, intersections and grade separated junctions. K_U08. The student knows how to dimension the details of roads, intersections and grade separated junctions. K_U14. The student knows how to prepare the project documentation for roads, intersections and grade separated junctions concerning the preliminary design.
3	**Social competencies**	K_K01. The student can work independently and collaborate as a team on a designated task. K_K06. The student is aware of the need to improve his professional skills. K_K10. The student follows the rules of ethics.

Assumptions and objectives of the course:

1) Transfer of knowledge within the scope of the analysis of road objects (understanding the theoretical and practical aspects of the application of optimization methods in the design and management of roads).

2) Developing ability to identify and solve important problems in phase of the design and operation of road construction objects (multi-criteria optimization as a component supporting the process of decision-making).

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

Knowledge:

1. The student has advanced knowledge of mathematics, which is the basis of subject in the field of a process of the organizational - investment strategies (he knows the base of economic and financial analysis and the analysis of single-and multi-criteria). - [K_W01]

2. The student has the knowledge and knows the rules of formation of the project for the optimization of transport solutions and of test its effectiveness. - [K_W04]

3. The student has the knowledge on the effectiveness, costs and execution time of construction works, including knows the rules of the optimization of traffic at the traffic light controlled cross-roads and the methods and principles of optimization of geometric details of grade separated junction. - [K_W10]

Skills:

1. The student is able to define and explain the multicriteria decision problem. - [K_U06]

2. The student is able to define the costs and benefits of a transport project and establish the basic rates of economic and financial efficiency. - [K_U06]

3. The student is able to critically assess the results of technical and economic analysis of road building objects, including able to assess the need for a traffic light at the intersection and calculate the efficiency of its operations, which evaluation measure is the average time loss caused by vehicle stop. - [K_U07]

Social competencies:

1. The student can work independently. - [K_K01]

2. The student is aware of the need to improve his professional skills. - [K_K06]

3. The student follows the rules of ethics. - [K_K10]

Assessment methods of study outcomes

Student's knowledge is assessed based on a written pass (test), which takes place on the last lectures per semester (according to the plan of studies).

Multiple choice test consists of 15 questions, the test duration is 30 minutes.

Information about the form and date of test and its duration shall be provided to students during the first lecture in the semester.

Students' skills are assessed on the basis of two projects, and their qualitative assessment is based on essential and aesthetic performing of drawings and computational exercises (the subject and content of the projects are given on the theme cards).

Completion date of the first project is established on mid-semester, and the completion date of the second project is the last class of design exercise in the winter semester.

Course description

Multi-criteria supporting the process of decision-making in the design of road building objects (education of the designing understood as a process of creation on the basis of skilful decision-making).

Economical and financial analysis for optimization of transport designs (basic aspects of the design approach to analysis, function of the sector plans, an economical and financial advantages, analysis of a risk and sensitivity).

Criteria of optimization of a road network, network of streets in urban areas as well as of a public transport.

Objectives, means and methods of traffic organization. Assessment of necessity of application of road traffic signalling for junction. Criterions of traffic efficiency on an junction with road traffic signalling. Criteria of optimization of a coordination of road traffic signalling in the course of street.

Theoretical and practical methods of the solving some optimization tasks with the scope of the designing a layers system of road pavement.

Basic bibliography:

1. Instrukcja oceny efektywności ekonomicznej przedsięwzięć drogowych i mostowych, Praca zbiorowa pod redakcją Szrajber J., Instytut Badawczy Dróg i Mostów, Warszawa, 2007.

2. Inżyniera Ruchu, Datka S., Suchorzewski W., Tracz M., Wydawnictwo Komunikacji i Łączności, Warszawa, 1999.

3. Koszty i korzyści transportu zbiorowego i indywidualnego w miastach, Rozkwitalska C., Instytut Gospodarki Przestrzennej i Komunalnej, Warszawa, 1997.

4. Metody wielokryterialnej analizy porównawczej, Szwabowski J., Deszcz J., Wydawnictwo Politechniki Śląskiej, Gliwice, 2001.

5. ?Optymalizacja teoria i zadania, Nowak A., Wydawnictwo Politechniki Śląskiej, Gliwice, 2007.

6. ?Teoria i praktyka rozwiązywania zadań optymalizacji, Stadnicki J., Wydawnictwa Naukowo-Techniczne, Warszawa, 2006.

Additional bibliography:

1. Economic Appraisal of Transport Projects. A Manual with Case Studies, Adler H. A., The Johns Hopkins University Press, Baltimore and London, 1987.

2. Podstawy optymalizacji konstrukcji, Ostwald M., Wydawnictwo Politechniki Poznańskiej, Poznań, 2005.

3. Podstawy organizacji robót drogowych, Biruk S., Jaworski K. M., Tokarski Z., Państwowe Wydawnictwo Naukowe, Warszawa, 2007.

4. Wielokryterialne metody podejmowania decyzji, w: Informatyka stosowana w inżynierii produkcji budowlanej, (praca zbiorowa) pod redakcją prof. O. Kaplińskiego, Thiel T., Wydawnictwo Politechniki Poznańskiej, Poznań, 1996.

5. Zastosowanie metody wielokryterialnego wspomagania decyzji do oceny konstrukcji nawierzchni drogowych, materiały konferencyjne I Międzynarodowa Konferencja Naukowo-Techniczna "Nowoczesne technologie w budownictwie drogowym", Thiel T., Słowik M., Wydawnictwo Politechniki Poznańskiej, Poznań, 10-11 września 1998.

Result of average student's workload

Activity	Time (working hours)

1. Direct participation of the student in the lectures. 2. Direct participation of the student in the design classes (including additional consultation with the teacher). 3. Independent execution by the student of the project. 4. Teaching student to prepare himself to pass the test. 5. Direct participation of the student in the writing pass.	30 33 24 24 1

Student's workload

Source of workload	hours	ECTS
Total workload	112	4
Contact hours	60	2
Practical activities	30	1