STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Traffic Engineering**		Code **1010611261010610465**
Field of study **Transport**	Profile of study (general academic, practical) **(brak)**	Year /Semester **3 / 6**
Elective path/specialty **Road Transport**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **1** Classes: **-** Laboratory: **1** Project/seminars: **-**		No. of credits **2**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **2 100%** **2 100%**

Responsible for subject / lecturer:

dr inż. Marek Maciejewski
email: marek.maciejewski@put.poznan.pl
tel. 61 665 2775
Faculty of Machines and Transport
ul. Piotrowo 3 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Fundamental concepts from the scope of traffic engineering and rules for organization of road traffic. Basic knowledge about modelling and computer simulation.
2	**Skills**	Skills related to approximation and discretization of continuous problems. Numerical methods from the scope of linear algebra and computer graphics. Basics of information technology for typical computer systems.
3	**Social competencies**	Definition of hierarchy and timetables of particular tasks to formulate mathematical and numerical problems. Independence. Responsibility.

Assumptions and objectives of the course:

Road traffic flow and its states. Principles of planning for road transportation: for goods and persons, and for private and public transport. Traffic flow models: macroscopic, mesoscopic, microscopic and submicroscopic ones. Modelling and computer simulation of traffic flow. Traffic lights and their planning. Modelling of the coordinated traffic light systems. Computer simulations.

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

Knowledge:

1. Knows universal principles of modelling and simulation of deterministic problems - [K1A_W06]
2. Exhaustively knows classification and description of macroscopic road traffic models - [K1A_W05]
3. Knows selected macroscopic models and their computer implementation - [K1A_W06]
4. Exhaustively knows classification and description of microscopic road traffic models - [K1A_W05]
5. Knows selected microscopic models and has practice in their computer simulations - [K1A_W06]
6. Knows methods of traffic lights steering and the light-signalling devices - [K1A_W05]

Skills:

1. Is able to create road network models for computer simulation - [K1A_U18]
2. Is able to put traffic light programmes into road network models - [K1A_U18]
3. Is able to define initial and boundary conditions for numerical traffic simulations - [K1A_U07]
4. Is able to use selected systems for road traffic simulation - [K1A_U18]
5. Is able to carry out a simulation of traffic lights and its optimization - [K1A_U07]

Social competencies:

1. Is able independently carry out simulations on the basis of external data - [K1A_K06]
2. Is able to define priorities for traffic flow optimization - [K1A_K05]
3. Understands the need for cooperation in preparation and runing a simulation - [K1A_K04]
4. Understands the need for applying safety- and environmentally-friendly solutions - [K1A_K07]

Assessment methods of study outcomes

Lectures: credit on the grounds of written tests

Exercise: individual reports from performed road traffic simulations

Course description

Fundamental parameters of road traffic flow: the traffic flow rate (volume), the traffic density and the traffic flow velocity. Basic definitions from scope of modelling and simulation. Classification and description of selected traffic models and their application. Theoretical essentials of the macroscopic models. Basic relations between traffic flow parameters. Selected traffic models of the first and second order. Meaning of particular terms of equations. Traffic characteristics and the fundamental diagram, and other relationships. Macroscopic simulations. Hiperbolic problems and wave phenomena. Numerical methods for approximation and discretization of traffic flow relations described in space and time. Classification of solution methods. Upwind approach and the Riemann problem. Limitations of macroscopic models. Theoretical essentials of the microscopic models. Classification of the microscopic models. The car-following model - description of selected models. Computational costs and other limitations. Calibration problems. Review of selected microscopic models. Remarks on the running the microscopic simulations. Arrangement of a road network topology. Introduction of traffic lights to simulations and appropriate modification of initial and boundary conditions. Running the simulation, the visualization and analysis of results. Traffic lights: the purpose and conditions for their introduction. Classification considering the range of control and types of signalling. Traffic light timing. Concepts of coordinating traffic signals. Signalling systems on motorways. Traffic detectors, controllers, and the traffic controller and coordination systems. Location of light-signalling devices, and signal description. Construction of light-signalling devices. Classification of signalling devices according to: physical working principles, methods of installation, and methods of measurement.

Basic bibliography:

1. Daganzo C.F., Fundamentals of transportation and traffic operations, Pergamon Press, 1997
2. Helbing D., Verkehrsdynamik, Springer-Verlag, Berlin, Heidelberg 1997
3. Traffic flow theory, A state-of-the-art report (ed. Gartner R., Messer C.J., Rathi A.K.), TRB 1995
4. Leśko M., Guzik J., Sterowanie ruchem drogowym: sygnalizacja świetlna i detektory ruchu pojazdów, Gliwice, WPŚ 2000

Additional bibliography:

1. Adamski A., Inteligentne systemy transportowe: sterowanie, nadzór i zarządzanie, Kraków, UWN 2003

Result of average student's workload

Activity	Time (working hours)
1. Lectures	15
2. Office hours	1
3. Preparation for test	7
4. Participationin the test	1
5. Labs	15
6. Office hours	1
7. Preparation for test	2
8. Participation in the test	1

Student’s workload

Source of workload	hours	ECTS
Total workload	43	2
Contact hours	34	1
Practical activities	15	1