STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Telematic in Transport		**1010615311010612216**

Field of study	Profile of study (general academic, practical)	Year /Semester
Transport	**general academic**	**1 / 1**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Road Transport	**Polish**	**obligatory**

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

No. of hours					No. of credits
Lecture: **18**	Classes: **-**	Laboratory: **18**	Project/seminars: **-**		**4**

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

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

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	The student has a basic knowledge of metrology, has a basic knowledge in the field of automation, has a basic knowledge of electrical engineering and electronics, has a basic knowledge of the organization and management
2	**Skills**	Is able to use the languages: native and international (English) at a level sufficient to enable understanding of technical texts. Is able to obtain information from the literature, internet, databases and other sources. Can integrate the information to interpret and learn from them, create and justify opinions. Has the ability to self-educate using modern teaching tools.
3	**Social competencies**	Understands the need and knows the possibilities of lifelong learning, knows the need for acquiring new knowledge for professional development. Is aware of and understands the importance and impact of non-technical aspects of transport engineering activities and its impact on the environment and responsibility for own decisions in short and long-term aspect.

Assumptions and objectives of the course:

Make students familiar with with the basic problems accompanying the development of transport systems. Discussion of the idea of Intelligent Transport Systems as a method of improving the efficiency of transport systems without modernizing road infrastructure. Acquainting with the basics of the use of process control in transport through the use of telematics with emphasis on the importance of quality of information available in real time. Discussing and analyzing examples of ITS applications currently available and developed, and the benefits of their application.

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

Knowledge:

1. The student has knowledge about transport problems and its impact on the economy, society and the environment - [T2A_W03]

2. The student knows modern technical solutions and directions of development of Intelligent Transport Systems, including infrastructure, communication technologies and vehicles - [T2A_W04]

3. The student has knowledge about the possibilities of using transport control systems leading to the creation of Intelligent Transport Systems, understands the importance of acquiring and processing information in real time in these systems and the quality of algorithms - [T2A_W07]

Skills:

1. The student can acquire information from foreign language literature in the field of telematics systems in transport (Intelligent Transport Systems) - [T2A_U02]

2. The student is able to identify and interpret existing ITS systems, can make their comparisons in the functional scope as well as the applied technical solutions - [T2A_U08]

3. The student can explain the essence of operation of various applications within Intelligent Transport Systems and the analysis of necessary data - [T2A_U10, T2A_U11]

Social competencies:

1. The student understands the need for development and importance of advanced control techniques in the field of transport, their limitations and consequences, impact on the environment and human safety - [T2A_K03]

2. The student understands the need and knows the possibilities of continuous learning, knows the need to acquire new knowledge for professional development, can organize the process of teaching other people - [T2A_K04]

3. The student is aware of the importance and understands the non-technical aspects and effects of the transport engineer's activities and its impact on the environment and the responsibility for the decisions made, the consequences of own actions in the short and long term - [T2A_K02]

Assessment methods of study outcomes

-Written test, which is based on answers related to the selection of given answers and open questions. Credits will be given after achieving at least 50% of points. Answers are scores from 0 to 1 point.

Course description

lectures

1. Problems caused by traffic in terms of time and economic efficiency (costs of traffic jams, problems with the number of vehicles and the capacity of infrastructure, average traffic speeds in the city).

2. Problems caused by traffic in terms of safety and ecology - the number of road accident victims among pedestrians and drivers, the costs of road accidents.

3. The concept of using telematics and intelligent transport systems (ITS) to improve the functioning of transport systems, the history of ITS development, a brief overview of the whole area of ??ITS activity with the characteristics of proposed solutions in the field of ITS.

4. The significance and types of information in ITS systems, information gathering technologies in ITS systems - using infrastructure and information from a vehicle carried in a traffic stream.

5. Technologies of dissemination and information processing - basic information about the functioning, disadvantages and advantages of the most commonly used information dissemination technologies.

6. Electronic toll collection systems (ETC) - development and use of ETC, technologies necessary for the implementation of ETC.

7. Overview of different variants of ETC systems implementation (microwave systems - Italian, Czech, Polish, satellite system - German)

8. Advanced information systems for travelers and drivers? Static and dynamic information, pre-departure information for passengers and drivers, route planning for public transport and drivers.

9. Advanced information systems for travelers and drivers? travel information for passengers and drivers, dynamic route planning, service information, navigation systems, driver information delivery system, assistants systems.

10. Examples of ITS systems solutions in Polish cities - examples of ITS solutions in Poznań and other cities

11. Parking assistance system? local parking systems - access control and payment systems, indoor parking navigation systems, automated car parks.

12. Parking assistance system - urban parking systems (parking information, P & R car parks, electronic payment systems)

13. Advanced vehicle control systems - factors conducive to accidents, types of errors committed by drivers of vehicles, active safety systems.

14. Advanced vehicle control systems - advanced driver assistance systems.

15. Advanced vehicle control systems - autonomous cars.

Laboratories:

- Developing the algorithm and prototype of the application informing about the nearest time of departure of the means of public transport.
- eXchange GPS format - its structure, visualization and acquisition methods.
- Comparison of the functionality of travel planners for private means of transport.
- Car following model:
  - simplified scenario in Simulink taking into account only the speed difference between vehicles,
  - taking into account limitations of the dynamics of the tracking vehicle and the driver's limitations
  - modeling the motion of many vehicles
  - development of the car following model for modeling chains that follow vehicles
- Microscopic simulation of motion in SUMO (Simulation of Urban MObility):
  - Creating the road network

- traffic generation
- traffic control with traffic lights
- Optimization of traffic lights control
- Microscopic simulation of traffic using the VISSIM system:
- construction of the road system (road sections and connectors) using maps / photos of real intersections / road sections.
- generation of vehicles (identification of types and streams of vehicles), defining the course of vehicle routes.
- identification and determination of collision fields and other restrictions, defining pedestrian traffic and pedestrian crossings.
- defining tram and bus communication (defining routes and schedules of public transport).
- construction of traffic lights (defining sirens and traffic lights control system), modification of collision fields

Basic bibliography:

1. Nowacki G.: Telematyka transportu drogowego, Wydawnictwo ITS, 2008,

2. Adamski A.: Inteligentne systemy transportowe: sterowanie, nadzór i zarządzanie, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, 2003

3. Perallos A., Hernandez-Jayo U., Onieva E., Garcia-Zuazola I.: Intelligent Transportation Systems - technologies and applications, John Wiley & Sons, Ltd., 2016

Additional bibliography:

1. PIARC : The Intelligent Transport Systems handbook, 2nd Edition, PIARC- 2004.

2. Towpik K., Gołaszewski A., Kukulski J.: Infrastruktura transportu samochodowego, Oficyna Wydawnicza Politechniki Warszawskiej, 2006,

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	18
2. Preparation for written exam	2
3. Preparation for laboratories/raport preparation	32
4. Participation in laboratories	18
5. Participation in written test solving.	1

Student's workload

Source of workload	hours	ECTS
Total workload	101	4
Contact hours	37	2
Practical activities	52	2