COURSE DESCRIPTION CARD - SYLLABUS

Course name
Telematic in Transport [N2Trans1-TrD>TwT]

Course

Field of study
Transport

Year/Semester
1/1

Area of study (specialization)
Road Transport

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
18

Laboratory classes
18

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

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 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. 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.

Course objective

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.

Course-related learning outcomes

Knowledge:
The student has advanced detailed knowledge of selected issues in the field of transport engineering
The student has knowledge of development trends and the most important new achievements of means of transport and other selected related scientific disciplines
The student has knowledge of ethical codes related to scientific and research work in the field of transport engineering

Skills:
The student is able to use information and communication techniques used in the implementation of projects in the field of transport
The student is able to make a critical analysis of existing technical solutions and propose their improvements (improvements)
The student is able - using, among others conceptually new methods - solve complex tasks in the field of transport engineering, including atypical tasks and tasks with a research component

Social competences:
The student understands that in the field of transport engineering, knowledge and skills very quickly become obsolete
The student understands the importance of using the latest knowledge in the field of transport engineering in solving research and practical problems

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
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.

Programme content

Road traffic problems concerning efficiency, safety and environmental impact. Telematics and Intelligent Transport Systems (ITS): information collection, processing and dissemination, electronic toll collection, traveller and driver information, and parking systems. Active safety systems, ADAS and autonomous vehicles. Design of transport applications, use of the GPX format and car-following modelling in Simulink. Microscopic traffic simulation using SUMO and VISSIM, including road networks, public transport, pedestrian traffic and traffic signal control.

Course topics

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

Teaching methods

1. Lecture with a multimedia presentation - a combination of an information and problem lecture;
2. Laboratories - solving problems with the use of MATLAB, SUMO, WISSIM software

Bibliography

Basic
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

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,

Breakdown of average student's workload

	Hours	ECTS
Total workload	96	4,00
Classes requiring direct contact with the teacher	36	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00