Description of course	
Code of course	**1160-TRTSEM-MSA-0209**
Name of course	***Transport Automation – Intelligent Motor Vehicles***
Version of course	2021/22
A. *Place of the course in system of studies*	
Level of education	*Second-cycle degree*
Form and mode of studies	*Full-time studies*
Field of studies	*Transport*
Profile of studies	*General academic profile*
Specialization	*Transport systems engineering and management*
Place of teaching of course	*Warsaw University of Technology, Faculty of Transport, Division of Information and Mechatronic Systems in Transport*
Place of realization of course	*Not applicable*
Coordinator of course	*Marcin Koniak, PhD, Division of Information and Mechatronic Systems in Transport, Faculty of Transport, Warsaw University of Technology*
B. *General characteristic of the course*	
Group/*Block of courses*	*Specialization subject*
Level of course	*Advanced level*
Type of course	*Compulsory subject*
Language of course	*English*
Location of the course in the study plan – nominal semester	2
Location of the course in the academic year	*Summer semester*
Preliminary requirements - formal	*None.*
Limit of students	*Lecture: 100, laboratory: 10*
C. *Effects of education and manner of teaching*	
Purpose of course	*Acquisition of knowledge and skills necessary for the analysis of automated systems and means of transport with particular emphasis on APM (People Mover) vehicles, including automatic cars on L2, L3, L4 and autonomous vehicles.*

Effects of education with reference to the learning outcomes for the area and field of study

No. effect	***Description of the effect***	***Reference to the characteristics of learning outcomes***	***Reference to the learning outcomes in the program***
Assumed learning outcomes in terms of knowledge			
W01	*Knows and understands the definitions and principles of the operation of automated transport and intelligent vehicles.*	I.P7S_WG.o	Tr2A_W09
W02	*Knows and understands the development trends of automated transport, especially of intelligent vehicles: APM systems, L2, L3, L4 automatic vehicles, and autonomous vehicles.*	I.P7S_WG.o I.P7S_WK	Tr2A_W11
Assumed learning outcomes in terms of skills			
U01	*Can obtain information from literature, databases and other properly selected sources, as well as draw conclusions and formulate and justify opinions.*	I.P7S_UW.o I.P7S_UK	Tr2A_U01 Tr2A_U19
U02	*Be able to identify and formulate specifications for engineering tasks specific to automated transport, in particular intelligent vehicles: APM systems, automated vehicles L2, L3, L4, and autonomous vehicles, and solve them using analytical, simulation and experimental methods.*	I.P7S_UW.o III.P7S_UW.o	Tr2A_U06 Tr2A_U15
Assumed learning outcomes in the field of social competences			
KS01	*Understand the necessity of critical evaluation of received contents and of their own knowledge.*	I.P7S_KK	Tr2A_K01

Form of didactic studies and number of hours	*Lecture*	*Exercise*	*Laboratory*	*Project*	*Other*
On a weekly plan	1	0	1	0	0
Throughout the semester	15	0	15	0	0

Contents of education - separately for each form of didactic studies	*Lecture*: *Sources of knowledge in the field of the subject. Classification of motor vehicles due to their ability to perform tasks in an autonomous mode. HMI (Human Machine Interface): human-machine interface in intelligent modes of transport. Types of biological signals (acquisition carried out on a human / operator) and non-biological signals used in intelligent vehicles for monitoring and control. Signal processing for vehicles and smart devices:* *a) Basic issues in the field of neural networks,* *b) Basic issues in the field of fuzzy logic,* *c) Basic information about machine learning.* *PRT (Personal Rapid Transit) as an example of an automated, intelligent transport system. Autonomous cars, ATN, PodCar, APM, special vehicles and standards for the APM ATS network.* *Laboratory*: *Analysis and design of subsystems for an autonomous vehicle, Simulation of a vehicle location system, Simulation of a neural network.*
Teaching methods	*Lecture:* Mulitimedia presentation. *Laboratories:* Simulation studies using computer-aided methods.

Methods of verification of effects of education

No. effect	***Methods of verification***
	Assumed learning outcomes in terms of knowledge
W01	*2 open questions on the written test, a response of at least 50% on each is required.*
W02	*2 open questions on the written test, a response of at least 50% on each is required.*
	Assumed learning outcomes in terms of skills
U01	*Credit for laboratory classes. A prerequisite for passing is correct performance of each task, completion of reports, and passing the test with a grade of at least 60%.*
U02	*Credit for laboratory classes. A prerequisite for passing is correct performance of each task, completion of reports, and passing the test with a grade of at least 60%.*
	Assumed learning outcomes in the field of social competences
KS01	*Participation in class discussion, correct statement of effect required.*

Methods of evaluation	*Lecture:* *2 written tests containing 5 open questions. Passing the lecture requires obtaining a minimum of 60% of correct answers from each of the tests.* *Laboratory:* *1 written test with 2 open questions on each exercise (6 questions in total) and 3 reports on completed exercises. Minimum requirements for passing are: passing all reports and at least 60% of each test.* *Integrated degree:* *Average of the partial grades.*
Exam	*No*
Literature	*Basic literature*: 1) Bishop R.: Intelligent Vehicle Technology and Trends, Springer Velag, 2001. 2) Rutkowska D., Piliński M., Rutkowski L.: Sieci neuronowe, algorytmy genetyczne i systemy rozmyte, PWN, 1999. 3) Gang T, Koktovic P.V.: Adaptive Control of Systems with Actuator and Sensor Nonlinearities, John Wiley & Sons, 1996. 4) Vlacic L.: Intelligent Vehicle Technologies Teory and Applications, Butterworth – Heinemann, 2001. 5) Cichocki P., Jabłkowski P., Kaczmarek M.: Inteligentne systemy sterowania ruchem, Wydawnictwo Naukowe UAM, Poznań 2009.

	6) Riley Q.R.: Alternnative Cars in the 21st Centaury, S&A Inc.400, USA. 7) Szczepaniak C.: Samochody XXI wieku, Wydawnictwo Politechniki Krakowskiej, Kraków 2008. *Supplementary literature*: 1) UFLDL Tutorial Stanford University http://ufldl.stanford.edu/tutorial/ 2) Nielsen M.: Neural networks and Deeplearning http://neuralnetworksanddeeplearning.com/index.html 3) Goodfellow I., Bengio Y., Couville A.: Deep Learning, Systemy uczące się, PWN 2018.
Website of the course	–
D. *Student's activity*	
Number of ECTS credits	2
Number of hours of student's work to achieve effects of education	*60 hours, including: work at lectures 15 hours, work on laboratory exercises 15 hours, study of literature on the subject 10 hours, preparation for tests 7 hours, consultations 3 hours (including consultation in the field of laboratory exercises 2 hours), implementation of reports 10 hours.*
Number of ECTS credits on the course with direct participation of academic teacher	*1.5 ECTS (33 hours, including: work at lectures 15 hours, work on laboratory exercises 15 hours, consultations 3 hours)*
Number of ECTS credits on practical activities on the course	*1.0 ECTS (27 hours, including: work on laboratory exercises 15 hours, consultations in the field of laboratory exercises 2 hours, implementation of reports 10 hours)*
E. *Additional information*	
Notes	*As long as it does not cause changes in the relationship of a given subject with the directional effects in the content of education, changes may be introduced on an ongoing basis, taking into account the latest scientific achievements.*
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