Faculty of Electronics, Fotonics and Microsystems (W12N) / Department of Cybernetics and Robotics (K29W12ND02)

SUBJECT CARD

Name of subject in Polish: **Robotyka mobilna**
Name of subject in English: **Mobile robotics**
Main field of study (if applicable): **Control Engineering and Robotics (AiR)**
Specialization: **Embedded Robotics (AER)**
Profile: **academic**
Level and form of studies: **2nd level, full-time**
Kind of subject: **facultative**
Subject code: **W12AIR-SM0726**
Group of courses: **No**

	Lecture	Exercise	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		30		
Number of hours of total student workload (CNPS)	30		90		
Form of crediting	Examination		Crediting with grade		
For group of courses mark (X) the final course					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes			2.0		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1.2		2.0		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. knowledge of elementary mathematics (probbility)
2. good programming skills required

SUBJECT OBJECTIVES

C1. Obtaining knowledge about the methods of robot localization
C2. Acquiring knowledge about the methods of mapping
C3. Development of the ability to implement algorithms for mobile robots

SUBJECT LEARNING OUTCOMES
Relating to knowledge: PEU_W01 - Students can name and explain typical problems of mobile robotics PEU_W02 - Students can characterize the methods of locating mobile robots PEU_W03 - Students can distinguish between the tasks of building maps and SLAM and characterize the basic algorithms Relating to skills: PEU_U01 - Students can solve the problem of self-localization of a mobile robot PEU_U02 - Students are able to develop and implement an algorithm for mapping by a mobile robot PEU_U03 - Students can use sensors and a map of the environment to navigate the robot PEU_U04 - Students are able to design and implement a system to navigate mobile robots in presence of obstacles

PROGRAM CONTENT		
Lecture		**Number of hours**
Lec1	Introduction. Applications and problems of mobile robots. Models of mobile robots.	1
Lec2	Review of mathematical tools used during the course	2
Lec3	Methods of filtration and fusion of data from sensors of mobile robots	2
Lec4	Robot localization: odometry, Markov models, EKF	2
Lec5	Mapping: metric, topological and hybrid maps	2
Lec6	Basics of SLAM: idea and methods	2
Lec7	The problem of exploration	2
Lec8	Current research trends in mobile robotics	2
	Total hours:	15

Laboratory		**Number of hours**
Lab1	Introduction and OHS in the laboratory. Communication in the ROS system with mobile robots	3
Lab2	Robot self-localization using incremental methods	3
Lab3	Marker based localization	3
Lab4	Data fusion in localization	6
Lab5	Mapping	6
Lab6	Robot motion planning	3
Lab7	Robot navigation using a constantly updated map	6
	Total hours:	30

TEACHING TOOLS USED
N1. Lecture N2. Laboratory classes N3. Consultation N4. Self education – self study and preparation for the final test

N5. Self education – preparation for laboratory classes

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation: F — forming (during semester), C — concluding (at semester end)	Learning outcome code	Way of evaluating learning outcome achievement
F1	PEU_U01 - PEU_U04	Oral answers, evaluation of the implementation of laboratory tasks, laboratory reports
F2	PEU_W01 - PEU_W03	Exam
P(lecture)=F2, P(laboratory)=F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] R.Siegwart, Introduction to Autonomous Mobile Robots, MIT Press, 2011.

[2] S.Thrun i in., Probabilistic robotics, MIT Press, 2006.

[3] A.Kelly, Mobile Robotics: Mathematics, Models, and Methods, Cambridge University Press, 2013.

SECONDARY LITERATURE:

[1] Handbook of robotics, Springer, 2008.

[2] M. Ben-Ari, F. Mondada, Elements of Robotics, Springer 2018.

[3] H.Choset et al, Principles of Robot Motion: Theory, Algorithms, and Implementations, A Bradford Book, 2005.

[4] The DARPA Urban Challenge, Springer, 2010.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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