(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: CONTROL OF MOBILE ROBOTS	**2. Course code**
3. Validity of course description: 2016/2017	
4. Level of studies: MSc programme	
5. Mode of studies: intramural studies	
6. Field of study: MACROCOURSE	(FACULTY SYMBOL) RAU0
7. Profile of studies: general	
8. Programme: Automatic Control	
9. Semester: 1	
10. Faculty teaching the course: Institute of Automatic Control, Rau1	
11. Course instructor: Dr Krzysztof Skrzypczyk	
12. Course classification: programme courses	
13. Course status: elective	
14. Language of instruction: English	

15. Pre-requisite qualifications:

It is assumed that before starting the course, a student has some background on computer vision, control fundamentals, optimization methods and artificial intelligence.

16. Course objectives:

The main objective of this course is presenting fundamental problems related to mobile robotics. The course is focused on basic issues related to construction and control of wheeled mobile robots. During the lecture students are given the knowledge of both hardware devices used in mobile robotics and the methods of controlling robotized vehicles. The lecture is presented as a slideshow and illustrated with some movie clips and computer programs.

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	A student knows basic problems related to mobile robot control system synthesis	SP	WM	T1A_W07
2.	A student knows devices and equipment used for mobile robot construction	SP	WM	T1A_W03
3.	A student is able to design and program basic motion control algorithms		L	T2A_U08
4.	A student can make decision himself about the most appropriate construction solutions and control methods related to mobile robot .	SP	WM/L	T1A_K04
5.				
6.				
7.				
8.				

18. Teaching modes and hours

Lecture / BA /MA Seminar / Class / Project / Laboratory

Sem 1 - Lecture 30 h., Sem 1 Laboratory 15 h

19. Syllabus description:

Semester 1:

Lectures

Mobile Robotics is a branch of contemporary Robotics with is focused on designing and creating vehicles that are intended to perform autonomously (or at least semi-autonomously) tasks related to the locomotion. The key issue in the problem of synthesis of mobile robot is designing algorithms that provide the robot with the ability of collision free navigation. The solution to this problem requires many issues to be taken into account. The lecture presents briefly the main challenges and problems that appear during designing a mobile robot.

The course touches following subjects:

- Introduction to mobile robotics: notions and definitions, control system of a mobile robot- general diagram, brief description of the main components of the system;
- Kinematics of mobile vehicles bodies;
- Sensors for mobile robotics;
- Actuators: devices and the methods of control;
- Mobile robot localisation; Large scale positioning system , TRANSIT/ GPS/GLONAS/GALILEOI;
-Data representation models, map types and the methods of creating of them;
- Motion planning problem: problem definition and the methods of solution of the problem;
- Control system architectures: deliberative systems, reactive/ behaviour based systems, hybrid systems;
- Multirobot systems.

Laboratories

1. Introduction, operation manual of the equipment used in the laboratory (Khepera II,III robot, pioneer DX-3 robot, MoWay robots)
2. Implementation of the method of passive localization based od the incremental odometry (Khepera II, III)
3. Basics of reactive control idea. Implementation of the collision avoidance methods (MoWay robots)
4. Mapping the environment using laser scanner (robot DX-P3)

20. Examination: No

21. Primary sources:

1. R.C. Arkin : Behavior based robotics. The MIT Press, Cambridge, Massachusetts, London, England, 1998.
2. J. Borenstein , H. R. Everett , and L. Feng: Where am I? Sensors and methods for mobile robot positioning, Technical raport of University of Michigan, 1996
http://www-ersonal.umich.edu/~johannb/shared/pos96rep.pdf
3. S. Russel, P. Norvig. Artificial Intelligence – a Modern Approach, Prentice Hall, New Dehli, 2008
4. LaValle S.: Planning Algorithms, Cambrige University Press, NY, USA, 2006
5. Siegwart R. et al: Introduction to Autonomous Mobile Robots, The MIT Press, London, 2011

22. Secondary sources:

1. M. J. Giergiel, Z. Hendzel, W. Żyliński: Modelowanie i Sterowanie Mobilnych Robotów Kołowych. Wydawnictwo Naukowe PWN, Warszawa 2002.
2. A. Morecki, J. Knapczyk: Podstawy robotyki teoria i elementy manipulatorów i robotów. Wydawnictwa Naukowo Techniczne, Warszawa 1999.
3. K. Tchoń, A. Mazur, I. Hossa, R. Dulęba: Manipulatory i roboty mobilne. Wydawnictwo PLJ, Warszawa 2000.
4. T. Zielińska: Maszyny Kroczące. Podstawy, projektowanie, sterowanie i wzorce biologiczne. Wydawnictwo Naukowe PWN, Warszawa 2003.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/20
2	Classes	/
3	Laboratory	15/10
4	Project	/
5	BA/ MA Seminar	/
6	Other	15/10
	Total number of hours	60/40

24. Total hours:100

25. Number of ECTS credits: 4

26. Number of ECTS credits allocated for contact hours:2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):2

26. Comments:

Approved:

…….
(date, Instructor's signature)

……
(*date , the Director of the Faculty Unit signature)*