Course code **Course item**

1. INFORMATION ABOUT THE COURSE

a. Basic information

Course title	***Control Engineering and Robotics***
Field of study	*Mechanical Engineering*
Cycle	*first degree*
Study profile	*general academic*
Study mode	*full-time*
Specialisation	*Machine technology*
Unit responsible for the field of study	*Faculty of Mechanical Engineering*
Lecturer	*assoc. prof. Kazimierz Peszyński,* *Sylwester Wawrzyniak, PhD*
Introductory courses	*Fundamentals of Electronics and Electrical Engineering*
Prerequisites	*Basic knowledge on the use of Scilab, Basic knowledge of electrical elements and systems*

b. Semester/ weekly timetable

Semester	Lectures (W)	Classes (C)	Laboratories (L)	Project classes (P)	Seminars (S)	Fieldwork (T)	ECTS credits ECTS*
winter / summer	30		15				4

C. Assumed outcomes and aims - aims bind the course programme with the study programme and are referred to in learning outcomes point 2

2. LEARNING OUTCOMES (acc. to National Qualifications Framework)

No.	Description of learning outcomes	Reference to learning outcomes for the field of study	Reference to learning outcomes for the area of study
KNOWLEDGE			
K1	know basis of classic control theory and state space analysis of dynamic systems, carry out analysis on open loop and closed loop systems based on transfer functions, evaluate correspondence between models' characteristic parameters and their time and frequency response,	KW11	P6S_WG
K2	Basic knowledge about PLC controlers, languages of programming	KW11	P6S_WG

Skills			
S1	Student can design of continuous control circuits, their tuning and analysis, design efficient combinational and sequential logic circuit implementations from functional description of digital systems	K_U07	P6S_UW
SOCIAL COMPETENCES			
SC1	After the course, students should: - actively and creatively, develop basic control circuits with proper instruments (measurement device, controller, actuator), - identify and classify robots in use, depending on industry or application.	K_K04	P6S_KO

3. TEACHING METHODS

Lectures: multimedia lectures, problem solving, simulation exercises (PLC controllers, Scilab), report writing (group work)
Laboratory: Excersises with PLC programming.

4. METHODS OF EXAMINATION

Lecture: Written examination and reports. The reports will be derived through the course. The written exam will be multiple-choice exam. The reports and the exam will evaluated together
Laboratory: performing exercises with PLC controllers and prepare reports bases on performed exercises.

5. COURSE CONTENT

Specify the content separately for each type of classes in accordance with point I.B.	Lecture: Digital circuits. Boolean algebra and switching theory. Manipulation and minimization of Boolean functions. Combinational circuits analysis and design, multiplexers, decoders and adders. Sequential circuit analysis and design, basic flip-flops, clocking and edge-triggering, registers, counters, timing sequences, state assignment and reduction techniques. Continuous systems. Fundamental concepts in control systems with feedback. Formulation of models of physical systems. Linearization. Differential equations Laplace transformation and transfer functions. Root locus and frequency analysis. Stability. Basic design methods. Application of standard controllers and compensators. The theory and methods reviewed are supported by many practical examples. Robotics. Overview of industrial robots. Principles of kinematics, dynamics, and control as applied to industrial robotic systems; robotic sensors and actuators; path planning; programming an industrial robot in the laboratory; survey of application of robots in manufacturing; and guidelines to robot arm selection. Laboratory: Combinational circuits analysis and design, multiplexers; Sequential circuit design, basic flip-flops; Counters and mathematical operations; Timers in PLC controllers; Processing of analog signals in measurements and PLC controllers; Operation panels for visualisation of controlled process.

6. VALIDATION OF LEARNING OUTCOMES

(Each learning outcome from the list requires validation methods to ensure that it was achieved by a student.)

Learning outcome	Form of assessment					
	Oral examination	Written examination	Test	Project	Report	Class attendance
W1 – W2		x		x	x	x
U1 – U2					x	x
K1				x	x	x

7. LITERATURE

Basic literature	Ogata K., Modern Control Engineering, Third Edition, Prentice-Hall International, Inc., University of Minnesota 2004 Kuo B. C., Golnaraghi F, Automatic Control Systems –, John Wiley & Sons, 2003 Spong M.W, Hutchinson S., Vidyasagar M.. Robot Modeling and Control, John Wiley & Sons, Inc 2006
Supplementary literature	Azzo, J.J.D. and C.H. Houpis, Feedback control system analysis and synthesis, McGraw – Hill International, 3rd Edition, 1998. Instructions for laboratory exersises

8. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity		Student workload– number of hours
Classes conducted under a direct supervision of an academic teacher or other persons responsible for classes	Participation in classes indicated in point 2.2	45
	Supervision hours	5
Student's own work	Preparation for classes	16
	Reading assignments	16
	Other (preparation for exams, tests, carrying out a project, preparing reports)	18
Total student workload		100
	Final number of ECTS credits	4