FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name of course in Polish: Mechatronika i systemy sterowania
Name of course in English: Mechatronics and Control Systems
Main field of study (if applicable): Power Engineering
Specialization (if applicable):
Profile: academic
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code: W09ENG-SM0056
Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
Number of hours of total student workload (CNPS)	60		60		
Form of crediting	Examination		Crediting with grade		
For group of courses mark final course with (X)					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BU) classes	1		1,5		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES:
1. Basic competences in mathematics and physics as acquired on the 1st level studies
2. Basic knowledge of electric circuit theory and electromagnetism as acquired on the 1st level studies.

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SUBJECT OBJECTIVES

C1 Acquisition of the basic knowledge regarding the following parts of a mechatronic system:
- C1.1 Sensors of physical quantities
- C1.2 Actuators
- C1.3 Control systems and devices – microcontrollers, PLC controllers.

C2 Acquisistion of the basic qualifications regarding:
- C2.1 The design methodology of the structure of a mechatronic system
- C2.2 The parametrization of the components deployed in a mechatronic system
- C2.3 Design and software implementation of the control algorithm for a control system.

C3 Social competence enhancement
C3.1 Acquiring and enhancing of the social competences regarding teamwork and co-operation during implementation of projects.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
PEU_W01 – the student is able to define a model of a mechatronic system

PEU_W02 - the student has the basic knowledge regarding sensors
PEU_W03 - the student knows the fundamentals of microcontroller programming
PEU_W04 - the student knows the fundamentals of PLC programming
PEU_W05 - the student is familiar with the internal structure & operation of a microcontroller
PEU_W06 - the student has acquired some basic knowledge of power drive systems and applications of them.
PEU_W07 - the student is familiar with large control systems and SCADA software technology.

relating to skills:
PEU_U01 – the student is able to define and evaluate the technical parameters of a mechatronic system
PEU_U02 – the student is able to design & assemble a simple test circuit with a microcontroller
PEU_U03 – the student is able to specify and select sensors and actuators for a particular mechatronic system
PEU_U04 – the student is capable of writing of simple control programs for a PLC controller used in a particular technological process
PEU_U05 – the student is able to design and build a simple mechatronic system using a PLC controller together with sensors and actuators
PEU_U06 – the student is able to interface electromechanical and electropneumatic components with a PLC controller.
PEU_U07 – the student is able to analyze and investigate the structure and mode of operation of an existing control system.

relating to social competences:
PEU_K01 – the student is able to search for technical information by his own hand
PEU_K02 – the student is prepared to mutual co-operation during teamwork

PROGRAMME CONTENT

Lectures		**Number of hours**
Lec 1	Introduction, Basic ideas, relations between mechatronics and other scientific disciplines	2
Lec 2	Programmable control systems – an introduction. Process algorithms, Turing machine, von Neumann computer architecture.	2
Lec 3	Microcontrollers – an introduction, basic ideas, internal architecture	2
Lec 4	Microcontrollers – programming methods	2
Lec 5	Microcontrollers – interfacing to I/O devices	2
Lec 6	Microcontrollers – examples of applications, mobile robots.	2
Lec 7	Sensors of fundamental physical quantities (pressure, temperature, displacement)	2
Lec 8	Encoders, position sensors, examples of applications.	2
Lec 9	Elements of motion transfer systems (gears, clutches, lead screw drives)	2
Lec 10	Examples of mechatronic components application – CNC machines	2
Lec 11	Mechatronics in biomedical applications – a pneumatic blood pressure wave sensor	2
Lec 12	PLC controllers – an introduction, basic ideas.	2

Lec 13	PLC controllers – a survey of market solutions and system architectures	2
Lec 14	PLC controllers – programming methods, language-based coding of algorithm, exemplary programs	2
Lec 15	PLC controllers – large control systems, SCADA software.	2
	Total hours	30
Laboratory		**Number of hours**
Lab 1	Presentation of the course, introduction, safety rules training	2
Lab 2	Microcontrollers – development system with a mictrocontroller (an introduction)	2
Lab 3	C language compiler for microcontrollers – an introduction	2
Lab 4	Interfacing of LED diodes and microswitches with I/O ports of microcontroller	2
Lab 5	Stepping motor service routines using I/O port of a microcontroller.	2
Lab 6	LED display control using microcontroller	2
Lab 7	An alphanumeric LCD display control with a microcontroller	2
Lab 8	Built-in peripheral devices: A/D converter and serial port service routines.	2
Lab 9	Programmable Logic Controllers (PLC)– an introduction. Interfacing of I/O signals to a PLC.	2
Lab 10	PLC – ladder diagram programming (an introduction)	2
Lab 11	PLC – timers and counters service routines	2
Lab 12	PLC – programming of PLC operator panel and extension modules	2
Lab 13	PLC – programming of modular production systems (MPS)	2
Lab 14	PLC – implementation of an individual project, advanced programming methods	2
Lab 15	Additional activities, final assessment.	2
	Total hours	30

TEACHING TOOLS USED

N1. Lecture: General lecture, multimedia presentation
N2. Laboratory: Lab report preparation, self-study accompanied by lab instruction sheets
N3. Consultations with the tutor

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Learning outcomes number	Way of evaluating learning outcomes achievement
F1 (lecture)	PEK_W01÷PEK_W07, PEK_U01÷PEK_U07, PEK_K01÷PEK_K02	Written examination
F2 (laboratory)	PEK_W01÷PEK_W07, PEK_U01÷PEK_U07, PEK_K01÷PEK_K02	Lab reports assessment, micro-tests during lab sessions
P1=F1 (lecture), P2=F2 (laboratory)		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Cetinkunt S., Mechatronics, Wiley 2007

[2] Michael B. Histand, David G. Alciatore, Introduction to mechatronics and measurement systems, McGraw-Hill Education, 2007

[3] Jędrusyna A.,Tomczuk K.,Mechatronics and Control Systems Handbook. Wyd. PWr 2010.

SECONDARY LITERATURE:

[1] Dorf. R.C, Modern control systems, 12th Ed., Prentice-Hall 2011

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

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