Mechatronics and control systems

Faculty of	**Mechanical and Power Engineering**
Name in English	**Mechatronics and control systems**
Name in Polish	**Mechatronika i systemy sterowania**
Main field of study	**Power Engineering**
Specialization	**-**
Level of studies	**II level**
Form of studies	**full-time**
Kind of subject	**obligatory**
Subject code	**W09ENG-SM2333**
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)	50		50		
Form of crediting	Zaliczenie		Zaliczenie		
For group of courses mark final course with (X)					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BU) classes	1,28		1,36		

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.

SUBJECT OBJECTIVES

C1	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	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	C3 Social competence enhancement C3.1 Acquiring and enhancing of the social competences regarding teamwork and co-operation during implementation of projects.

SUBJECT LEARNING OUTCOMES

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
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
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

Form of classes - lecture		Number of hours
Wy1	Introduction, Basic ideas, relations between mechatronics and other scientific disciplines	2
Wy2	Programmable control systems – an introduction. Process algorithms, Turing machine, von Neumann computer architecture.	2
Wy3	Microcontrollers – an introduction, basic ideas, internal architecture	2
Wy4	Microcontrollers – programming methods	2
Wy5	Microcontrollers – interfacing to I/O devices	2
Wy6	Microcontrollers – examples of applications, mobile robots.	2
Wy7	Sensors of fundamental physical quantities (pressure, temperature, displacement)	2
Wy8	Encoders, position sensors, examples of applications.	2
Wy9	Elements of motion transfer systems (gears, clutches, lead screw drives)	2
Wy10	Examples of mechatronic components application – CNC machines	2
Wy11	Mechatronics in biomedical applications – a pneumatic blood pressure wave sensor	2
Wy12	PLC controllers – an introduction, basic ideas.	2
Wy13	PLC controllers – a survey of market solutions and system architectures	2
Wy14	PLC controllers – programming methods, language-based coding of algorithm, exemplary programs	2
Wy15	PLC controllers – large control systems, SCADA software.	2
Total Hours		30

laboratory		Number of hours
La1	Presentation of the course, introduction, safety rules training	2
La2	Microcontrollers – development system with a mictrocontroller (an introduction)	2
La3	C language compiler for microcontrollers – an introduction	2
La4	Interfacing of LED diodes and microswitches with I/O ports of microcontroller	2
La5	Stepping motor service routines using I/O port of a microcontroller.	2
La6	LED display control using microcontroller	2
La7	An alphanumeric LCD display control with a microcontroller	2
La8	Built-in peripheral devices: A/D converter and serial port service routines.	2
La9	Programmable Logic Controllers (PLC)– an introduction. Interfacing of I/O signals to a PLC.	2
La10	PLC – ladder diagram programming (an introduction)	2
La11	PLC – timers and counters service routines	2

La12	PLC – programming of PLC operator panel and extension modules	2
La13	PLC – programming of modular production systems (MPS)	2
La14	PLC – implementation of an individual project, advanced programming methods	2
La15	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 EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1 (lecture)	PEU_W01¸PEU_W07, PEU_U01¸PEU_U07, PEU_K01¸PEU_K02	Written examination
F2 (laboratory)	PEU_W01¸PEU_W07, PEU_U01¸PEU_U07, PEU_K01¸PEU_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 with Experiments, Wiley 2015
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 literaturę	
1	Dorf. R.C, Modern control systems, 12th Ed., Prentice-Hall 2011
12	

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

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