(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: CONTROL OF BIOTECHNICAL SYSTEMS	**2. Course code**
3. Validity of course description: 2014/2015	
4. Level of studies: MSc programme	
5. Mode of studies: full time stationary studies	
6. Field of study: BIOTECHNOLOGY	(FACULTY SYMBOL) RAU1
7. Profile of studies: General academic	
8. Programme: bioenergy engineering	
9. Semester: 2	
10. Faculty teaching the course: Institute of Automatic Control, Rau1	
11. Course instructor: dr inż. Witold Nocoń	
12. Course classification: specialization course	
13. Course status: compulsory	
14. Language of instruction: English	
15. Pre-requisite qualifications: Control theory, Differential equations, Fundamentals of computer programming. Prior to this course, students should learn how to calculate derivatives, solve linear differential equations, implement algorithm is text-based programming languages,.	
16. Course objectives: The objective of this course is to present topics concerning design and implementation of control systems for biotechnological plants, selection of measurement devices and actuators and integration of control systems. The objective of laboratory exercises is to teach students the practical aspects of control algorithms implementation, controller tuning and programing of PLCs (Programmable Logic Controllers)	

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
W1	Student knows the common measurement devices and actuators in biotechnological systems control	Written test	Multimedia lecture, traditional lecture	K_W01, K_W18
W2	Student know basic control algorithms an computer methods used in control systems	Written test,	Multimedia lecture, traditional lecture Laboratory exercise,	K_W04, K_W12
U1	Student is able to select measurement devices and actuators for control of biotechnical systems	Written test, Laboratory reports	Multimedia lecture, traditional lecture Laboratory exercise	K_U03, K_U07
U2	Student is able to implement control algorithms in programmable logic controllers and to specify requirements for integration of the control system	Written test, Laboratory reports	Multimedia lecture, traditional lecture Laboratory exercise	K_U07, K_U30,
K1	Student is aware of the need to apply control systems in biotechnical systems and is able to specify a general structure of the control system for a selected process.	Laboratory reports	Multimedia lecture, traditional lecture Laboratory exercise	K_K03
K2	Student is able to present and exaplain the proposed structure of the control system for the biotechnical process.	Laboratory reports	Laboratory exercise	K_K07

18. Teaching modes and hours

Lecture 30 h, Laboratory 30 h

19. Syllabus description:

Lectures

- The control system: measurement, control algorithm, actuators(examples)
- Measurements in biotechnology (description of the commonly used measurements in biotechnology, for example level, flow, temperature, ion selective measurements etc.)
- Actuators (pumps, valves, mixers etc..)
- Industrial controllers (processor units, I-O modules, A-D converters etc.)
- Controllers programming foundations (in a selected language)
- PID controller (algorithm, implementation)
- Selected control systems (level, flow, temperature dissolved oxyen, pH etc,.)
- Supervisory Control and Data Acquisition Systems (SCADA).
- Selected advanced control systems topics (redundancy, identification, advanced control algorithms etc..)

Laboratory

- Measurements in control systems
- Valves and other actuators.
- ON/OFF control for a selected process.
- Programming of controllers (part 1)
- Programming of controllers (part 2)
- PID controller implementation
- PID controller – tuning and application in a control loop.
- Supervisory and Data Acquisition (SCADA)systems
- Integration of measurement devices, controllers and actuators.
- A case study: Control system of a biotechnological plant.

20. Examination: No

21. Primary sources:

1. Z. Bubnicki "Teoria i algorytmy sterowania", PWN, Warszawa, 2005.
2. J. Kuźnik, Regulatory i układy regulacji. Wydawnictwo Politechniki Śląskiej, Gliwice, 2006.
3. Kasprzyk J.: Programowanie sterowników przemysłowych. WNT, Warszawa, 2006, 2007 (II wyd.).

22. Secondary sources:

1. R.Jakuszewski, "Podstawy Programowania Systemów SCADA–Proficy HMI/SCADA iFIX 5.0 PL", Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, Gliwice 2010
2. Stanisaw Flaga. Programowanie sterowników PLC w języku drabinkowym. Helion, Gliwice, 2010.
3. Legierski T., Kasprzyk J., Wyrwał J., Hajda J.: Programowanie Sterowników PLC . Wyd. Prac. Komp. J. Skalmierskiego, Gliwice, 2008 (II wyd.).

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/30
2	Classes	0/0
3	Laboratory	30/30
4	Project	0/0
5	BA/ MA Seminar	0/0
6	Other	10/10
	Total number of hours	70/70

24. Total hours: 140

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:

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(date, Instructor's signature) (*date , the Director of the Faculty Unit signature)*