(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: INDUSTRIAL NETWORKS AND DATABASES	**2. Course code**
3. Validity of course description: 2016/2017	
4. Level of studies: ~~BSc programme~~ / MSc programme	
5. Mode of studies: intramural studies	
6. Field of study: MACROCOURSE	AUTOMATIC CONTROL
7. Profile of studies: general	
8. Programme:	
9. Semester: 5	
10. Faculty teaching the course: Institute of Automatic Control, Rau1	
11. Course instructor: dr inż. Janusz Hajda	
12. Course classification: programme courses	
13. Course status: ~~compulsory~~ /elective	
14. Language of instruction: English	
15. Pre-requisite qualifications: Computer programming, Microprocessor systems, Computer networks, Measurement systems, Control fundamentals, Operating systems, Programmable Controllers, Sensors and Actuators. Student must be versed in the use and operation of personal computers and familiar with programming of Programmable Logic Controllers. Should know the basics of industrial measurements, sensors and actuators, and microprocessor systems.	
16. Course objectives: The aim of this lecture is to present an existing solutions for industrial network system, to point at features crucial while designing and installing control networks or dedicated networks for building and home automation, energy management systems and measurement systems. Each networks are describe relate to ISO/OSI model of network. The aim of laboratory is a practical usage of basic industrial networks on programmable logic controllers.	
17. Description of learning outcomes:	

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	The student knows the scope and methods of data exchange programming in several basic industrial networks.	Test, Laboratory	Multimedia lecture	T2A_W01
2.	The student knows basic concepts: industrial network, communication protocol, open system, ISO model	Test, Laboratory	Multimedia lecture	T2A_W05
3.	The student knows the ISO model of the presented industrial networks and can discuss the different layers of this model	Test, Laboratory	Multimedia lecture	T2A_W04
4.	The student can choose and configure a PLC for selected industrial networks	Laboratory exercise	Laboratory	T2A_U01
5.	The student is able to write a program on a PLC that communicates on the industrial network	Laboratory exercise	Laboratory	T2A_U02
6.	The student understands the need to choose the type of industrial network to meet the requirements of the control system	Laboratory exercise	Multimedia lecture, Laboratory	T2A_K02
7.	The student is able to assess the limitations of choosing a particular industrial network	Laboratory exercise	Multimedia lecture, Laboratory	T2A_K01
8.				

18. Teaching modes and hours

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

Sem 3 - 30 h./ / / / / Sem 3 - 15 h

19. Syllabus description:

Course description

Industrial networks are a very important part of the modern control systems. Sensor buses, device buses, field buses and data buses connect PLCs to the meters, sensors, remote input/output modules, other controllers, PLCs and SCADA systems.
This lecture is about networks efficiency and reliability. The aim is to show the best solutions for different cases by comparison strengths and weaknesses of various solutions.
The lecture is divided into 3 parts: An Introduction to Industrial Communication Networks, Protocols and Networks and Databases.
An industrial communication network is also called a control network, which is any group of devices working in a peer-to-peer fashion to monitor sensors, control actuators, communicate reliably, manage network operation, and provide complete access to network data.
This part of lecture defines elements used during communication, transmission methods and types, formulates requirements and positioning of the main networks.
On the basis of OSI model, the most popular transmission media, various topologies, medium access methods and concepts used at application level are described.
Protocols and networks discuss the most popular industrial protocols such as Modbus, Profibus, CANopen, DeviceNet, Unitelway, Interbus. Also dedicated solutions like LON and KNX or M-bus systems are presented.
The very important part of a control network is a database. A good database design allows to analyze trends, create customer lists, generate reports, maintain employee profiles or get a handle on any number of critical tasks unique to company and industry. The last part of the lecture shows industry database design methods.
Topics:

1. An Introduction To Industrial Communication Networks
2. Protocols and networks for control of process: Modbus, Modbus +
3. Protocols and networks for control of process: Modbus TCP
4. Protocols and networks for control of process: Profibus - Profibus DP
5. Protocols and networks for control of process: CAN – CANOpen
6. Protocols and networks for control of process: DeviceNet, Interbus
7. Protocols and networks for control of machine: sensor bus AS-i
8. Network systems: X-Way
9. Networks in HVAC and BEMS: Lonwoks
10. Networks in HVAC and BEMS: KNX
11. Protocols for measudement systems: M-Bus
12. Databases in Industry

Laboratory

1. Modbus Protocol on Modicon PLCs; Frame analysis and interpretation
2. Modbus Plus Network on Modicon PLCs
3. Modbus TCP Protocol on Modicon and WAGO IPC
4. CanOpen on WAGO IPC
5. Profibus DP Network on Siemens Simatic S7-300 and WAGO IPC

20. Examination: no

21. Primary sources:

1. Regis J. "Bud" Bates; Optical Switching and Networking Handbook; McGraw-Hill
2. B. A. Loyer, Howard L. Skolnik, G. McMillan; Process-Industrial Instruments and Control Handbook. Section 7: CONTROL COMMUNICATIONS
3. Modicon Modbus Protocol Reference Guide; MODICON, Inc.
4. Modicon Modbus Plus Network. Planning and Installation Guide; Schneider Electric Inc.
5. CAN Specification 2.0; CAN in Automation

22. Secondary sources:

1. Modicon Modbus Protocol Reference Guide; MODICON, Inc.
2. Modicon Modbus Plus Network. Planning and Installation Guide; Schneider Electric Inc.
3. CAN Specification 2.0; CAN in Automation
4. Internet sources

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/8
2	Classes	0/0
3	Laboratory	15/10
4	Project	0/0
5	BA/ MA Seminar	0/0
6	Other	5/2
	Total number of hours	50/20

24. Total hours: 70
25. Number of ECTS credits: 3
26. Number of ECTS credits allocated for contact hours: 3
27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):1
26. Comments:

Approved:

…… ……

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