COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	8.011	**SEMESTER**	8
COURSE TITLE	Industrial Control		

COURSEWORK BREAKDOWN	**TEACHING WEEKLY HOURS**	**ECTS Credits**
Theory	3	3
Exercises	1	1
Laboratory exercises	1	1
TOTAL	5	5

COURSE UNIT TYPE	Specialized general knowledge/Skills development
PREREQUISITES	-
LANGUAGE OF INSTRUCTION/EXAMS	Greek
COURSE DELIVERED TO ERASMUS STUDENTS	No
WEB PAGE (URL)	

(2) LEARNING OUTCOMES

Learning Outcomes

This course presents the basic principles in design and operation of industrial control systems. The capabilities, structure, installation, interconnectivity and programming of Programmable Logical Controllers (PLC) are analyzed, and an overview of the most common sensors, actuators and control schemes found in industry is provided. Furthermore, the basic industrial communication and networking protocols are presented (ControlNet, EtherNet/IP, Modbus, Profibus), as well as the notion of Supervisory Control and Data Acquisition (SCADA). The laboratory of the course provides practical training in the above topics.

Upon completion of the course the student will have acquired the necessary knowledge and skills to:

- Know and understand the difference among the various protocols of industrial networks
- Program a PLC for automation applications
- Design, develop and integrate complete industrial control systems, utilizing Programmable Logical Controllers (PLC) and Supervisory Control and Data Acquisition (SCADA)

General Skills

- Research, analysis and combination of data and information, utilizing the required technologies
- Promotion of free, creative and inductive thinking
- Connection of theoretical knowledge with practical skills
- Decision making

(3) SYLLABUS

Theory:

- Introduction on Industrial Control
- Structure and basic operation principles of Programmable Logical Controllers (PLC)
- PLC programming: Output commands, latching, differentiation, timers and counters, transfer, comparison and processing of data, numerical commands, subroutines and interrupts
- Sensors and transducers for industrial applications: Sensor interconnection, sampling and processing of measurements
- Types of Industrial control (single loop, cascade etc)
- Industrial applications of PID controllers
- Distributed control of processes
- Industrial networks: topologies, basic characteristics, introduction on protocols such as Industrial Ethernet, CanOpen, Profibus etc.
- Supervisory Control & Data Acquisition (SCADA)
- Human – Machine Interface (HMI)
- System reliability – availability
- Modern trends in industrial automation applications

Laboratory:

- Familiarization and practical training in programmable logic modern controllers with networking capabilities
- Identification of the basic component of a PLC
- Sequential systems with basic latching commands
- Counters, times and other design functions
- Applications: Elevator, Industrial conveyor, Object classification system based on the length, Greenhouse automation (On-Off temperature control, humidity, lighting, watering), Air temperature control (On-Off, continuous), PID control with PLC, AC Motor velocity control utilizing inverter and D/A converter
- Human-Machine Interface programming
- PLC-SCADA networking

(4) TEACHING METHODS - ASSESSMENT

<table>
<tr><td>MODE OF DELIVERY</td><td>In-Class Face-to-Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY</td><td>• Use of ICTs in lecturing
• Use of ICTs in laboratory exercises.
• Use of ICTs for the communication with students via the e-class platform</td></tr>
<tr><td>TEACHING ORGANIZATION</td><td>
<table>
<tr><th>Method description/Activity</th><th>Semester Workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Laboratory</td><td>13</td></tr>
<tr><td>Laboratory reports preparation</td><td>32</td></tr>
<tr><td>Non-guided individual study</td><td>66</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Total</td><td>150</td></tr>
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<tr><td>ASSESSMENT METHODS</td><td>Written exams (70%)

Laboratory reports (30%)</td></tr>
</table>

(5) RECOMMENDED BIBLIOGRAPHY

Suggested Bibliography:

- "Industrial Control Engineering", King Robert – Eric, Marcel Dekker Inc
- "Programming industrial automation systems", K. H. John, M. Tiegelkamp, Springer, 2010.
- "Programmable logic controllers", F. D. Petruzella, McGraw-Hill, 2005.

Related scientific journals:

- Control Engineering Practice
- IEEE Transactions on Automation Science and Engineering