COURSE OUTLINE

INTELLIGENT AUTOMATION TECHNOLOGIES IN FURNITURE AND INTERIORS

(1) GENERAL

SCHOOL	TECHNOLOGY		
DEPARTMENT	FORESTRY, WOOD SCIENCES & DESIGN		
LEVEL	POSTGRADUATE		
COURSE CODE	**M126**	**SEMESTER**	**2nd**
COURSE TITLE	INTELLIGENT AUTOMATION TECHNOLOGIES IN FURNITURE AND INTERIORS		
ACTIVITIES		**WEEKLY HOURS**	**ECTS**
	Lectures	2	6
	TOTAL	2	6
TYPE OF COURSE	MANDATORY OF TECHNOLOGY AND MANUFACTURING EXPERTISE, ELECTIVE OF SPECIALTIES PRODUCT DESIGN & MANAGEMENT AND MARKETING		
PREREQUISITES:	NO		
LANGUAGE OF TEACHING AND EXAMINATION	GREEK		
THE COURSE IS OFFERED TO ERASMUS STUDENTS	NO		
WEBPAGE COURSE (URL)	https://eclass.uth.gr/courses/FWSD_P_124/		

(2) LEARNING OUTCOMES

Learning Outcomes
The purpose of the course is to familiarize participants with the subject of Intelligent Automation and to present basic technologies that can be used to develop Intelligent Automation Systems in furniture and interiors. In the context of the course, the basic concepts of Intelligent Systems, Electronics and Automation, Automatic Control Systems, as well as Embedded Systems and Microcontroller technologies are presented. In addition, methodologies and tools for designing Intelligent Automations and programming microcontrollers are presented, as well as applications of Intelligent Automations in various sectors with an emphasis on furniture and interiors. Upon successful completion of the course students will be able to: • To know the basic concepts of Intelligent Systems • To know the basic concepts and technologies of Electronics and Automation • To understand the necessity of applying Intelligent Automation in furniture and interior spaces • To have knowledge of basic concepts of Automatic Control Systems and Embedded Systems • To know the basic characteristics and categories of microcontrollers • To have knowledge of design methodologies of intelligent functions and Automation Systems • Have knowledge of basic software tools for microcontroller modeling, simulation and programming • To know applications of Intelligent Automation Systems in furniture and interior spaces • Know how Intelligent Automation Systems can be designed and developed
General Skills

(3) COURSE CONTENT

In the theoretical part of the course the student is taught and learns about:

- Basic concepts of intelligent systems. Artificial Intelligence and Intelligent Systems. Introduction to Intelligent Automation, Basic Concepts of Embedded Systems and Automatic Control Systems, Definition and Properties of Intelligent Systems, Modeling of Intelligent Functions.
- **Intelligent automations in furniture and interiors.** Necessity to install automation in Furniture and Interiors. Automation categories. Intelligent Automation for special categories of people. Applications. Examples of automation in furniture and interiors.
- **Introduction to automation.** Basic concepts. Fundamental concepts and basics of Electronics. Structural elements of electrical automation. Automatic control of electric machines Photoelectric mechanisms. Applications of photoelectric mechanisms.
- **Automatic control system.** Objectives of automatic control. Theories of automatic control. Sensors and Transmitters. Smart Sensors and Output Converters. Control systems software. Interfacing of distributed control systems.
- **Design and programming of automation systems.** International standards for automation systems (IEC 61131-3 and IEC 61131-3). Automation function design methodologies. The LUCID methodology. Examples of application of LUCID methodology. Programming languages and tools for automation systems.
- **Intelligent automation systems using sensors.** Intelligent automation and control systems. Introduction to sensors. Sensor categories. Sensor characteristics, Sensor selection criteria, Sensor data processing, Interactive furniture applications using sensors.
- **Embedded systems and microcontrollers.** Integration of Computers in Electromechanical Systems, Modeling of Inputs and Actuators, Interconnection. Data Acquisition and Virtual Instruments, Recording and Real-Time Systems Monitoring. Modeling & Simulation. Arduino and Raspberry Pi microcontrollers.
- The ARDUINO microcontroller. Introduction to Arduino. Arduino UNO Programming. Inputs-Outputs-Power. Arduino IDE and PC connection. The Arduino programming language. Arduino Programming Examples. Arduino Expansion Boards.
- ARDUINO simulation using 123CIRCUITS. Introducing the 123CIRCUITS simulation environment. Simulation examples: light bulb, temperature sensors, light sensors, pressure sensors. Simulation of lighting and notification functions for moving objects.
- Introduction to programming with PYTHON. Algorithms and programs, Classes and objects, Principles of object orientation, Features of Python, Environments for writing and running Python programs. Running Raspbian on a Raspbery Pi.
- Microcontroller programming in PYTHON. Python Operators, Data Types, and Control Structures. Python libraries. Arduino management with Python. Connecting Raspberry Pi devices and sensors with Python. Using Raspberry Pi via VNC with Python. USB camera interface with Python.
- Examples of intelligent automatisms. Smart office programming. Intelligent workstation. Versatile kitchen furniture. Intelligent multifunctional bedroom space. Design and implementation of intelligent automation in furniture using microcontrollers.

From the 1st lesson, a suggested list of tasks is given that the student should undertake and prepare (individually) until the end of the semester of the MSc.
The final assignment includes, in addition to paper and electronic submission, a public oral presentation on the chosen topic, on a set date (usually the 12th or 13th week of classes). The presentation lasts 15 minutes and is followed by 5 minutes of questions from the students present. The teacher intervenes - if necessary - for comments, observations, corrections.
Students are graded on the overall performance of their final paper: 70% on the content and editorial specifications and 30% on the preparation of the online presentation and its oral support.
These grades count for a total of 100% in the overall grade that students will receive after the final written theory exam.

(4) TEACHING AND LEARNING METHODS - EVALUATION

COURSE DELIVERY METHOD	In class and remotely
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	• Use of PC, ppt slides, projector. • Support of the learning process through the e-class electronic platform
MANAGEMENT OF TEACHING	

Activity	***Semester Workload***
Lectures	26
Small individual practice tasks	20
Final Assignment	60
Independent Study	44
Course Total (25 workload hours per credit unit)	***150***

STUDENT EVALUATION	I. Written final exam (60%) which includes: - Short answer questions from all the material in the book - Critical presentation questions and solving various costing problems. II. Delivery and presentation of Individual Assignment (40%).

(5) RECOMMENDED-BIBLIOGRAPHY

- Suggested Bibliography:

- Alippi, C. (2014). Intelligence for Embedded Systems: A Methodological Approach, Springer Int'l Publishing.
- Russell, S., & Norvig, P. (1995). Artificial Intelligence: A modern approach. Prentice-Hall International.
- Craig, J. J. (2009). Εισαγωγή στη Ρομποτική, Μηχανική και Αυτόματο Έλεγχο. Θεσσαλονίκη, Εκδόσεις Τζιόλα
- Jamshidi, M. and H. R. Parsaei (1995). Design and Implementation of Intelligent Manufacturing Systems: From Expert Systems, Neural Networks, to Fuzzy Logic, Prentice Hall.
- Πανταζής, Ν. Α. (2015). Συστήματα αυτομάτου ελέγχου και αυτοματισμοί, Εκδόσεις Σταμούλη.
- Πογαρίδης, Δ. (2015). Ενσωματωμένα συστήματα, οι μικροελεγκτές AVR και ARDUINO, Εκδόσεις Δίσιγμα.
- Fraden, J. (2016). Handbook of Moder Sensors: Physics, Designs, and Applications, Springer Int'l Publishing.
- Norris, D. (2016). Python for Microcontrollers: Getting Started with MicroPython, McGraw-Hill Education.
- Bell, C. (2017). MicroPython for the Internet of Things: A Beginner's Guide to Programming with Python on Microcontrollers, Apress.
- Desai, P. (2016). Python Programming for Arduino, PACKT publishers.
- Παπάζογλου, Π. Μ. and Σ.-Π. Λιωνής (2017). Ανάπτυξη εφαρμογών με το Arduino, Εκδόσεις Τζιόλα.

- Meng, S.-H., A.-C. Huang, C.-J. Lee, T.-J. Huang and J.-N. Dal (2018). Design for Intelligent Control System of Curtain Based on Arduino. Advances in Smart Vehicular Technology, Transportation, Communication and Applications, Cham, Springer International Publishing.
- Wang, J.-M., M.-T. Yang and P.-L. Chen (2017). "Design and Implementation of an Intelligent Windowsill System Using Smart Handheld Device and Fuzzy Microcontroller." Sensors (Basel, Switzerland) **17**(4): 830.

- Related scientific journals:

- Transactions in Autonomous Adaptive Systems
- Journal of Manufacturing Technology Management
- Journal of Intelligent Manufacturing
- Transactions on Industrial Informatics