COURSE OUTLINE

INDUSTRY 4.0 APPLICATIONS

(1) GENERAL

SCHOOL	TECHNOLOGY		
DEPARTMENT	FORESTRY, WOOD SCIENCES & DESIGN		
LEVEL	POSTGRADUATE		
COURSE CODE	**M114**	**SEMESTER**	**1st**
COURSE TITLE	INDUSTRY 4.0 APPLICATIONS		

ACTIVITIES	**WEEKLY HOURS**	**ECTS**
Lectures	2	6
TOTAL	2	6

TYPE OF COURSE	OBLIGATORY
PREREQUISITES	NO
LANGUAGE TEACHING AND EXAMINATION	GREEK
THE COURSE OFFERED TO STUDENTS ERASMUS	NO
WEBPAGES COURSE (URL)	https://eclass.uth.gr/courses/FWSD_P_104/

(2) LEARNING OUTCOMES

Learning Outcomes

The purpose of the course is to familiarize the participants with the subject of the 4th Industrial revolution and to present the basic technologies used in smart factories to carry out digitized production. In the context of the course, the basic concepts and architecture of smart factories are presented, as well as Internet of Things, Big Data Analytics, and Intelligent Systems technologies. In addition, applications of the digitized production approach are presented in various industrial sectors with an emphasis on furniture manufacturing.

Upon successful completion of the course, the student will be able to:

- To know the basic concepts related to the 4th Industrial Revolution
- Understand the transformations required to digitize a production process
- To recognize the main advantages and perspectives of digitized production
- To know the basic concepts and functions of Intelligent Systems
- Have knowledge of basic concepts of Internet of Things, Big Data Analytics and Virtual/Augmented Reality
- Know the most basic software tools for digitized production management
- To know applications of digitized production in Industry
- Know how automated digitized production systems can be designed

General Skills

(3) COURSE CONTENT

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

- Basic concepts of the 4th Industrial Revolution. What is the 4th Industrial revolution, definitions of key concepts, use of electronics and IT for production automation.
- Artificial intelligence and intelligent systems. Historical overview, definition of artificial intelligence, characteristics of intelligent systems, multi-agent systems, collective

intelligence, genetic and bio-inspired algorithms, fuzzy logic, neural networks.

- Digitized industrial production. Value Chain Reengineering, Smart Factory, Smart Transportation, Digitization and Interconnection of Everything, Cyber-Physical Systems, Smart Factory Architecture, Smart Products.
- Technologies of the 4th industrial revolution. Sensors and RFID, internet of things, cloud computing, machine-to-machine (M2M) communication, big data management, data analytics and decision making, digital manufacturing management software, intelligent agents and robotics, autonomous systems, value chain traceability – cybersecurity in 4th Industrial Revolution.
- • Internet of Things. Basic concepts of Internet of Things (IoT) and data networks, sensor networks and wireless IoT communication protocols, cloud computing platforms for IoT data storage, IoT management software, examples of IoT applications in smart products and smart machines.
- Big data analytics. Basic big data concepts, big data storage and management technologies, big data analysis methodologies and tools, applications in digitized production.
- Preventive maintenance and intelligent production monitoring. Fundamentals of preventive maintenance and intelligent production monitoring, intelligent models of preventive maintenance, preventive maintenance and intelligent production monitoring using sensors and data analytics.
- Virtual/augmented reality & cyber-physical systems. Basic concepts of virtual/augmented reality (VR/AR), tools (VR/AR), ways and benefits of using technologies (VR/AR) in smart manufacturing, examples of use cases (VR/AR).
- Additive manufacturing and 3D printing. Basic Prosthetic Manufacturing Concepts, Prosthetic Manufacturing Process, Intelligent Models and Prosthetic Manufacturing Technologies, Examples of Digitized Intelligent Prosthetic Manufacturing Applications in Industry.
- 4th industrial revolution use cases in industry. Gas separation units in the oil industry, warehouse inventory management, energy consumption management in industrial units, gas pressure management in production units, sensor data and machine handling security.
- 4th industrial revolution and furniture industry. Intelligent furniture factory architecture, intelligent furniture distribution network, intelligent furniture, intelligent indoor automation.

From the 1st lesson, a suggested list of assignments 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 PCs, 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 Work (40%).	

(5) RECOMMENDED-BIBLIOGRAPHY

- Suggested Bibliography:

- Gilchrist, A. (2016). Industry 4.0: The Industrial Internet of Things, Apress.
- Russell, S., & Norvig, P. (1995). Artificial Intelligence: A modern approach. Prentice-Hall, Englewood Cliffs, 25.
- Schwab, K. (2017). The Fourth Industrial Revolution, Crown Business.
- Yan, L., Zhang, Y., Yang, L. T., & Ning, H. (2008). The Internet of Things: From RFID to the Next-Generation Pervasive Networked Systems (Wireless Networks and Mobile Communications). CRC Press.
- Lu, Y. (2017). "Industry 4.0: A survey on technologies, applications and open research issues." Journal of Industrial Information Integration **6**: 1-10.
- Liao, Y., F. Deschamps, E. d. F. R. Loures and L. F. P. Ramos (2017). "Past, present and future of Industry 4.0 - a systematic literature review and research agenda proposal." International Journal of Production Research **55**(12): 3609-3629.
- Chen, B., J. Wan, L. Shu, P. Li, M. Mukherjee and B. Yin (2018). "Smart Factory of Industry 4.0: Key Technologies, Application Case, and Challenges." IEEE Access **6**: 6505-6519.
- Santos, M. Y., J. Oliveira e Sá, C. Costa, J. Galvão, C. Andrade, B. Martinho, F. V. Lima and E. Costa (2017). A Big Data Analytics Architecture for Industry 4.0, Cham, Springer International Publishing.
- Thames, L. and D. Schaefer, Eds. (2017). Cybersecurity for Industry 4.0: Analysis for Design and Manufacturing Springer Series in Advanced Manufacturing, Springer.
- Bartodziej, C. J. (2017). The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics, Springer Gabler.
- Yang, J., Y. Chen, W. Huang and Y. Li (2017). Survey on artificial intelligence for additive manufacturing. 2017 23rd International Conference on Automation and Computing (ICAC).

- Related scientific journals:

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