University Open Elective – IV

UOE041 Industry 4.0

Teaching Scheme				Evaluation Scheme			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory (100)	FA	100	40

Course Description

This course provides a comprehensive overview of the role of digitization, big data, cyber-physical manufacturing systems, robots, human robot collaboration, artificial intelligence and all relevant Industry 4.0 technologies. In particular, we focus on applications and case studies in order to make the audience understand the new technologies and demonstrate the benefits of Industry 4.0. We also include contributions from researchers and industry to the opportunities and challenges of Industry 4.0. One of the greatest challenges in upgrading to Industry 4.0 is education, without young academics the transition to Industry 4.0 won't be sustainable.

Course Outcomes

After successful completion of the course, students will be able to

1. State basics, drivers and enablers of Industry 4.0 2
2. Explain modern methods and techniques of planning, dimensioning, design and optimization of Industry 4.0 production systems
3. Identify value chains in Industry 4.0
4. Develop skills in dealing with methods and techniques for various production system

Course Content

1. **Introduction to Industry 4.0 & Basic principles and technologies of a Smart Factory** (6)

Definition of Industry 4., Developments in India, Germany. USA, Europe, China and other countries, Comparison of Industry 4.0 Factory and today's Factory, Difference between conventional automation and Industry 4.0, Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services, Big Data, Cyber-Physical Systems, Value chains in manufacturing companies, Customization of products , Digital Twins, Cloud Computing / Cloud Manufacturing, Security issues within Industry 4.0 networks

2. **Cyber-Physical Systems (CPS) and Cyber-Physical Production Systems (CPPS)** (6)

Definitions, demarcation to embedded systems, ubiquitous computing, etc., Core elements of Cyber-Physical Systems and Cyber-Physical Production Systems, Control theory and real-time requirements, Self-organization principles, Communication in cyber-physical systems, Design Methods for Cyber-physical Systems (Modelling, Programming, Model-Integrated Development), Applications for cyber-physical systems

3. **Assistance systems for production** (6)

The connected worker within the Industry 4.0 scenario, Diversity-driven workplaces (barrier free workplaces, accessibility in production), Human-and task-centered assistance systems, Technical tools, Mobile information technologies, Shop floor information systems, Production line support systems (pick by light, assembly display systems, assembly control by vision), Manipulator systems and intelligent chairs, Human work support by using exoskeletons, Applications assistance systems in production

4. **Human-Robot Collaboration, Safety and Security** (6)

Human-Robot Collaboration in Industry, Collaborative Robots, examples Yumi, IIWA, UR, Panda, Types of Human-Robot Collaboration, Applications with Collaborative Robots, Safety with Industry 4.0, Safety for connected Machines and Systems, Safety in Human Robot cooperation, Security & Security Risks with Industry 4.0, Security and privacy risks in AI, Approach to Cyber-Physical Security in Industry 4.0

1. "Industry 4.0: The Industrial Internet of Things" by Alasdair Gilchrist
2. "Dynamic Factory Automation: Creating Flexible Systems for Competitive Manufacturing (Ibm Mcgraw-Hill Series)" by Alastair Ross
3. Quick Start Guide to Industry 4.0: One-stop reference guide for Industry 4.0 by Mr Kiran Kumar Pabbathi
4. Industry 4.0 for SMEs: Challenges, Opportunities and RequirementsDominik T. Matt, Vladimír Modrák, Helmut Zsifkovits, Springer Nature, 2020