Module Description, available in: EN

Human Centered Production Systems

General Information

Number of ECTS Credits

3

Module code

TSM_HuCePSys

Valid for academic year

2024-25

Last modification

2023-06-20

Coordinator of the module

Andrea Bettoni (SUPSI, Andrea.Bettoni@supsi.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction				**X** E 100%			
Documentation				**X** E 100%			
Examination				**X** E 100%			

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

- **Basic concepts of production design and management**: Familiarity with fundamental manufacturing processes, such as machining, assembly, and material handling, is essential. Students should understand the basics of how products are manufactured and how manufacturing systems are designed and managed.
- **Basic programming and automation skills**: students should have basic programming skills. Knowledge of languages like Python or familiarity with automation concepts would be advantageous.

Brief course description of module objectives and content

Human-Centred Production Systems refers to an approach in engineering and manufacturing where the design, development, and operation of production systems are centered around human needs, capabilities, and experiences. This concept emphasizes the importance of considering human factors such as ergonomics, cognitive abilities, social interactions, and user preferences in the design and optimization of production processes and systems.

In a Human-Centred Production System, the goal is to create efficient and effective production processes that not only **maximize productivity and quality** but also ensure the **well-being and satisfaction of the workers involved**. This approach takes into account the physical and mental well-being of the workers and promotes a safe and comfortable working environment.

By providing an understanding of its key principles, this course provides students with the competences to design and manage a Human-Centred Production System, in which a **harmonious balance between technological advancements and the well-being of the people involved** is found, ultimately leading to more sustainable, efficient, and socially responsible manufacturing practices.

Aims, content, methods

Learning objectives and acquired competencies

- **Undertanding Human Factors and Ergonomics in Production Systems:**
  - **Objective:** To gain a deep understanding of human factors and ergonomics in the context of production systems, focusing on the physical aspects of human capabilities and limitations, and the application of ergonomic principles in industrial settings.
  - **Learning Outcomes:** Students should be able to analyze the physical aspects of human performance, assess ergonomic challenges in industrial environments, and propose engineering solutions to enhance worker safety, comfort, and productivity. Additionally, students should understand the importance of worker upskilling and be able to design training programs that align with human-centered production practices and technologies.

- **Integration of Automation and Human-Centred Design:**
  - **Objective:** To explore the integration of automation technologies, including collaborative robotics, artificial intelligence, and machine learning, within the framework of human-centered design principles.
  - **Learning Outcomes:** Students should be capable of evaluating appropriate applications of automation technologies in production systems, understanding the interaction between humans and robots, and designing interfaces that facilitate seamless collaboration between human workers and automated systems.

- **Implementing Ethical and Sustainable Practices:**
  - **Objective:** To instill a sense of ethical and social responsibility in the design and management of production systems, considering the social implications and ethical dilemmas arising from technology implementation.
  - **Learning Outcomes:** Students should be able to assess the ethical implications of production decisions on workers, communities, and society at large. They should also understand the social consequences of automation on the workforce, including issues related to employment, diversity, and inclusivity. Additionally, students should be capable of proposing strategies to promote social sustainability within production systems, fostering a positive impact on the community and the workforce.

Contents of module with emphasis on teaching content

1. Introduction to human-centered production systems: This includes an overview of the principles and objectives of human-centered production systems, as well as the benefits and challenges of implementing these systems in manufacturing and other industries.

2. Human factors: This topic focuses on the ways in which the design of production systems and equipment can affect the comfort, safety, and performance of human workers.

3. Ergonomics: Human-centered production systems are designed with ergonomics in mind, taking into account the physical capabilities and limitations of human workers. This can include designing workstations and equipment to reduce strain and fatigue and providing adequate lighting, ventilation, and other environmental factors to support human comfort and performance.

4. Human-machine interaction: This topic delves into the ways in which humans and machines, particularly robots and AGV, can work together effectively in a production stetting, supported by artifical intelligence in their interaction, and including issues related to safety, trustworthiness, communication, and task allocation.

5. Collaborative robotics: This topic covers the basics of collaborative robotics, including different types of collaborative robots and their capabilities,

the collaboration modes and the benefits and potential challenges of integrating these robots into production systems.

6. Safety in human-centred production systems and in collaborative robotics: Human-centered production systems prioritize the safety of human workers, implementing measures such as barriers, guards, and other protective devices to reduce the risk of accidents and injuries.

7. Ethical Decision-Making in Human-Centred Production Systems: This topic explores the ethical dilemmas and decision-making processes faced by engineers and managers when designing and implementing human-centered production systems.

Teaching and learning methods

- **Lectures and Discussions:** Traditional lectures in presence to deliver foundational knowledge on human-centered production systems and structured discussions to encourage active participation and critical thinking.
- **Case Studies:** Analyzing real-world case studies related to the implementation of human-centered production systems in various industries so providing valuable insights into challenges, solutions, and ethical dilemmas.
- **Hands-On Exercises:** Real-world problems for which students are asked to design or optimize a production system with a focus on human factors, ergonomics, and collaborative robotics.

Literature

Assessment

Certification requirements

Module does not use certification requirements

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

No aids permitted

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

No aids permitted