European Commission

MICROGUIDE

Project acronym:

Microguide

Project full title: DEVELOPING GUIDELINES
FOR THE IMPLEMENTATION OF
MICRO-CREDENTIALS IN HIGHER EDUCATION
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PILOT MICRO-CREDENTIAL 2 – AUSTRIA

Name of the micro-credential:

Mechatronics engineering

Provider information:

FH JOANNEUM Graz, Styria, Austria

Programme level:

Suitable for students (academic purpose) or/and LLL.

Link to the EQF:

Level EQF-6, equivalent to MECES-2

Duration:

50 h

Modality:

Blended learning

ECTS:

2

Justification

The development of a Mechatronics engineering micro-credential is crucial given the evolving demands of the labour market. Here are key justifications:

- **Interdisciplinary Skill Integration:** Mechatronics engineering combines skills from mechanical engineering, electronics, computer science, and control engineering. This interdisciplinary approach equips graduates with a versatile skill set that is highly valued across various industries;
- **Technological Advancements:** As technology rapidly advances, there is a growing need for professionals who can develop and manage complex mechatronic systems. These systems are essential in modern manufacturing, robotics, automation, and smart technologies, all of which are pivotal in the current industrial landscape;
- **Versatility and Career Opportunities:** Mechatronics engineers have the

flexibility to work in various sectors, including automotive, aerospace, healthcare, and consumer electronics. This versatility enhances employability and allows for career adaptability in an ever-changing job market;

- **Economic Development:** By fostering innovation and efficiency in production processes, mechatronics engineers contribute significantly to economic growth. Their ability to design and implement advanced technological solutions helps businesses stay competitive and boosts overall productivity;
- **Educational Demand:** There is increasing interest among students for mechatronics engineering courses. This growing demand reflects the recognition of the field's relevance and potential for future career prospects.

The objective of the training

The purpose of the micro-credential is to acquaint participants with the basic principles of fields of mechatronics (identification of technical systems in mechatronics and dynamics of mechatronic systems), sensors and measuring technologies (fundamentals in measuring technologies, effects and errors in measuring technologies and sensors in mechatronic systems), actuators and drives (rotating electrical drives, linear electrical actuators, fluidic actuators and novel actuator systems), automation and control (automation concepts, open and closed loop control and data processing and microprocessor applications in mechatronics) and mechatronics systems (development of mechatronics systems and systems and subsystems in mechatronics).

Learning Outcomes

Upon successful completion of the micro-credential, the participant is able to:

- work with different sensors and actuators in mechatronic systems;
- process and evaluate sensor signals and control different actuators;
- design and run a mechatronic system;
- design and simulate electronic circuits;
- design a digital twin and simulate different scenarios.
- analyse technical tasks in mechatronic systems and solve problems given
- Grasp and understand the core principles of mechatronics
- apply methodical principles when dealing with tasks in mechatronic systems
- understand the theory of operation of mechatronic systems and evaluate the pros and cons of the different system solutions
- analyse, compute, and solve basic problems in mechatronic systems; design appropriate systems and structures and define the required system components.

Access and admission

This micro-credential is suitable for students who have already passed the following exams from the study programme of Production Technology and Organisation study programme: Mechanical Engineering Dynamics; Machine Elements and Design Theory 1 & 2, Electrical Engineering and Electronics 1 & 2, and Industrial IT 1 & 2.

Curriculum structure

Content of theoretical education (30 hours)

- **Fundamentals of Mechatronics:** Introduction to mechatronics systems, integration of mechanical and electronic systems, basic principles of sensors and actuators;
- **Control Systems:** Concepts of feedback control, PID controllers, state-space analysis, and digital control systems;
- **Microcontrollers and Embedded Systems:** Programming microcontrollers, interfacing with sensors and actuators, real-time operating systems;
- **Electronics and Electrical Systems:** Circuit analysis, power electronics, signal processing, and electronic instrumentation;
- **Mechanical Systems:** Mechanics of materials, dynamics of mechanical systems, CAD/CAM, and manufacturing processes.
- **Robotics:** Kinematics, dynamics, and control of robotic systems, robotic programming, and applications in automation;
- **Software Engineering:** Object-oriented programming, software development for mechatronics applications, simulation and modelling tools.

Content of practical education (20 hours)

- **Laboratory Work:** Hands-on experiments with sensors, actuators, and microcontrollers; circuit design and testing; control system implementation;
- **Industrial Training:** Internship or co-op experience in industry to apply theoretical knowledge in real-world settings;
- **Integrated Design Projects:** Team-based projects that require designing, building, and testing a mechatronic system, often in collaboration with industry partners;
- **Final Year Projects:** Individual or group projects that involve extensive research and development of innovative mechatronic solutions;
- **Workshops and Seminars:** Specialized workshops on advanced topics like artificial intelligence in robotics, IoT applications in mechatronics, and emerging technologies;

Evaluation methodology

The syllabus is developed with master classes where the teacher explains the theoretical concepts and practical activities.

The evaluation is done by delivering documents showing evidence that the practical activities have been carried out correctly. In addition, it will also be necessary to include texts that demonstrate that the concepts worked on in each activity have been understood.

Teaching staff

The teaching staff must have expertise in the following areas:

- Mechatronics for manufacturing industries;
- Material handling;
- CNC-machining systems;
- Robots and PLC-system technology.

Material resources

This micro-credential needs a classroom that has:

- Blackboard
- Projector
- One computer for each student. The student will need administration permissions to enable him/her to use corresponding software for practical activities.
- Internet connection