



UNIVERSITETI / UNIVERSITY  
"ISA BOLETINI"  
MITROVICË

| Course Curriculum Model (Syllabus) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |
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| Faculty:                           | <b>FACULTY OF MECHANICAL AND COMPUTER ENGINEERING</b>                                                                                                                                                                                                                                                                                                                                                                                                                           |                           |
| Department:                        | Mechanical Engineering and Economic Engineering                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |
| Study Program                      | MSc in Manufacturing Technology and Management                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |
| Level:                             | Master                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |
| Code of the course:                | 109MTM                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |
| Course:                            | <b>Smart Manufacturing and Industry 5.0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           |
| Course Status:                     | <b>Mandatory</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Mandatory/Elective</b> |
| Semester:                          | II                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Winter/ <b>Summer</b>     |
| Number of hours per week:          | 2+1                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                           |
| ECTS:                              | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |
| Time / location:                   | Monday, 9 <sup>00</sup> -10 <sup>30</sup> , K2                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |
| Academic Year / Semester           | 2026/2027                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |
| Language of Instruction:           | Albanian (with flexibility in English)                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |
| Lecturer:                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |
| Assistant:                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |
| Contact details:                   | Professor                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Assistant                 |
| Email:                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |
| Telephone:                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |
|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |
| Course Description                 | This course explores the transformative role of digital and intelligent technologies in manufacturing, focusing on the transition from Industry 4.0 to Industry 5.0. It examines cyber-physical systems, IoT, AI, human-machine collaboration, sustainability, and resilience in the context of modern smart factories.                                                                                                                                                         |                           |
| Course Purpose / Course Goals      | The purpose of this course is to equip students with advanced knowledge and practical skills in smart manufacturing systems, enabling them to understand and apply key concepts of Industry 5.0. The course aims to prepare students to design, manage, and improve modern production environments by integrating emerging technologies such as IoT, AI, robotics, and cyber-physical systems, with a strong emphasis on sustainability, human-centered design, and resilience. |                           |
| Course Objective                   | To understand the fundamental concepts of Smart Manufacturing and Industry 5.0.<br>To analyze digital transformation in manufacturing.<br>To apply digital tools and methods used in smart factories.<br>To develop skills in sustainable and human-centric manufacturing system design.                                                                                                                                                                                        |                           |

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| <b>Intended Learning Outcomes (ILOs)</b> | <b>Knowledge:</b> <ul style="list-style-type: none"> <li><b>K1: Explain principles of Smart Manufacturing and Industry 5.0.</b></li> <li><b>K2: Describe the role of technologies such as IoT, AI, and CPS in modern factories.</b></li> <li><b>K3: Define sustainability and resilience in the context of Industry 5.0.</b></li> </ul>                                                                                                                                                                                                                                                                  |
|                                          | <b>Skills:</b> <ul style="list-style-type: none"> <li><b>S1: Analyze the impact of digitalization in manufacturing systems.</b></li> <li><b>S2: Apply smart manufacturing tools and platforms.</b></li> <li><b>S3: Evaluate use-cases and performance of smart production systems.</b></li> </ul> <b>Competences:</b> <ul style="list-style-type: none"> <li><b>C1: Integrate human-centric approaches into technology-driven production.</b></li> <li><b>C2: Propose solutions for sustainable manufacturing.</b></li> <li><b>C3: Collaborate in teams to design smart factory concepts.</b></li> </ul> |

|                | <b>Weeks</b>           | <b>Lecture</b>                                                      |
|----------------|------------------------|---------------------------------------------------------------------|
| <b>Program</b> | <i>First week</i>      | 1 Introduction to Smart Manufacturing and Industry 5.0              |
|                | <i>Second week</i>     | 2 Evolution from Industry 4.0 to Industry 5.0                       |
|                | <i>Third week</i>      | 3 Cyber-Physical Systems (CPS) in manufacturing                     |
|                | <i>Fourth week</i>     | 4 Internet of Things (IoT) and Industrial Internet of Things (IIoT) |
|                | <i>Fifth week</i>      | 5 Artificial Intelligence and Machine Learning applications         |
|                | <i>Sixth week</i>      | 6 Digital Twins and Simulation in Smart Manufacturing               |
|                | <i>Seventh week</i>    | 7 Midterm Review and Case Study: Smart Factory Architecture         |
|                | <i>Eighth week</i>     | 8 Human-Centric Design in Industry 5.0                              |
|                | <i>Ninth week</i>      | 9 Collaborative Robots (Cobots) and Human-Machine Interaction       |
|                | <i>Tenth week</i>      | 10 Augmented Reality and Virtual Reality in manufacturing           |
|                | <i>Eleventh week</i>   | 11 Sustainable and Resilient Manufacturing                          |
|                | <i>Twelfth week</i>    | 12 Data analytics, predictive maintenance, and decision support     |
|                | <i>Thirteenth week</i> | 13 Smart Supply Chains and Logistics                                |
|                | <i>Fourteenth week</i> | 14 Capstone Group Project Presentations                             |
|                | <i>Fifteenth week</i>  | 15 Final Review and Feedback Session                                |

| <b>Literature / Reading List:</b> |                                                                                                                                                                                                                                                                                                                                                                                                        |
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| <b>Literature</b>                 | <p>Wang, L. (2021). Smart Manufacturing: Concepts and Methods. Springer.</p> <p>Dalenogare, L. S., et al. (2020). Industry 4.0 and 5.0: Technologies, Applications, and Challenges.</p> <p>Kagermann, H., et al. (2013). Recommendations for implementing the strategic initiative INDUSTRIE 4.0.</p> <p>Articles and case studies from IEEE, Elsevier, and Springer (provided during the course).</p> |

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|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|------------|
| Teaching and Learning Methods | <ul style="list-style-type: none"> <li>Lectures with multimedia presentations</li> <li>Case studies and group work</li> <li>Practical exercises and simulations (e.g., VSM, layout redesign)</li> <li>Guest lectures from industry</li> <li>Individual and team projects</li> <li>PBL</li> <li>Flip classroom.</li> </ul> |       |            |            |
|                               | Contribution to student workload (which should correspond to student learning outcomes - 1 ECTS credit = 25 hours)                                                                                                                                                                                                        |       |            |            |
|                               | Activity                                                                                                                                                                                                                                                                                                                  | Hours | Days/weeks | Total      |
|                               | Lectures                                                                                                                                                                                                                                                                                                                  | 2     | 15         | 30         |
|                               | Exercise sessions (with TA)                                                                                                                                                                                                                                                                                               | 1     | 15         | 15         |
|                               | Practical work                                                                                                                                                                                                                                                                                                            | 3     | 3          | 9          |
|                               | Office hours                                                                                                                                                                                                                                                                                                              | 1     | 15         | 15         |
|                               | Fieldwork                                                                                                                                                                                                                                                                                                                 | 1     | 2          | 2          |
|                               | Midterms, seminars                                                                                                                                                                                                                                                                                                        | 2     | 2          | 4          |
|                               | Homework                                                                                                                                                                                                                                                                                                                  | 3     | 5          | 15         |
|                               | Self-study                                                                                                                                                                                                                                                                                                                | 4     | 3          | 12         |
|                               | Final exam preparation                                                                                                                                                                                                                                                                                                    | 3     | 4          | 9          |
|                               | Time spent in exams                                                                                                                                                                                                                                                                                                       | 2     | 2          | 4          |
|                               | Projects, presentations, etc.                                                                                                                                                                                                                                                                                             | 2     | 2          | 4          |
| <b>Total</b>                  |                                                                                                                                                                                                                                                                                                                           |       |            | <b>125</b> |

|            |                                                               |            |      |
|------------|---------------------------------------------------------------|------------|------|
| Evaluation | <b>Assessment Methods and Criteria:</b>                       |            |      |
|            | Activity                                                      | Weight (%) |      |
|            | Midterm Exam                                                  | 20%        |      |
|            | Project Report & Defense                                      | 20%        |      |
|            | Attendance and participation                                  | 10%        |      |
|            | Lab Exercises and Assignments                                 | 20%        |      |
|            | Final Exam                                                    | 30%        |      |
|            | Total                                                         | 100%       |      |
|            | (according to the Statute and Regulation for studies of UMIB) |            |      |
|            | Final grade                                                   | Points (%) | Mark |
|            | 91 – 100                                                      | 10         |      |
|            | 81 - 90                                                       | 9          |      |
|            | 71 - 80                                                       | 8          |      |
|            | 61 - 70                                                       | 7          |      |
|            | 51 - 60                                                       | 6          |      |

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| Academic policies | <p><b>Attendance, Ethics and Deadlines (Smart Manufacturing and Industry 5.0)</b></p> <p>Criteria for regular attendance and rules of conduct during the teaching process are established. Students are expected to actively participate in lectures, exercises, case studies, and discussions related to smart manufacturing systems and Industry 5.0 concepts.</p> <p><b>Computer-Based Work</b></p> <p>All assignments, projects, simulations, and reports must be prepared using appropriate digital and engineering tools (e.g., CAD/CAE software, simulation tools, data analytics platforms, and smart manufacturing systems). Students are required to comply with technical, analytical, and professional standards in system modeling, analysis, and documentation. Clear presentation of data, models, and results is mandatory.</p> <p><b>Academic Ethics</b></p> <p>All assignments, projects, and reports must be the original work of the student or assigned group. Copying models, analyses, or materials from other sources without proper citation is strictly prohibited. Any violation of academic integrity will result in negative evaluation.</p> <p><b>Deadlines</b></p> <p>Submission deadlines for assignments, projects, and reports will be defined at the beginning of the semester or activity. Late submissions will not be accepted without valid justification. Students are responsible for completing all course requirements within the specified deadlines.</p> <p><b>Consultations</b></p> <p>Students have the right to request consultations with the instructor regarding assignments, smart manufacturing topics, Industry 5.0 applications, simulations, and technical report preparation whenever necessary.</p> <p><b>Rules of conduct and academic policies:</b></p> <ul style="list-style-type: none"> <li>• active participation of students in lectures o participation in discussion, comments and free expression of opinion, opinion and academic position (with arguments)</li> <li>• mandatory independent work and use of additional sources of information (various scientific websites, scientific journals, conference proceedings, etc.)</li> <li>• respecting lecture schedules without compromising academic freedom (silent cell phones) of respecting the word, thoughts and ideas of colleagues,</li> <li>• it is not allowed to arrive late and leave without a valid reason from the lecture, test or exam o preparation and holding of relevant lectures, (obligation of the teacher).</li> <li>• if the student is absent more than four times without reason in lectures and exercises, does not receive the signature for attendance. o the student cannot take the exam without an official document,</li> <li>• if the student is dissatisfied with the grade obtained, has the right to complain in writing to the dean, within two working days after the announcement of the results, UMIB Statute o if the student does not follow the rules, in the exam uses tools that are not allowed, it is evaluated with a negative grade.</li> </ul> <p>Plagiarism or cheating will be penalized according to university regulations.</p> |
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