



Mechatronics Systems in Manufacturing		
Faculty:	Mechanical and Computer Engineering	
Department:	Mechanical Engineering and Economic Engineering	
Level:	Master's	
Course code:	108MTM	
Course Title	Mechatronics Systems in Manufacturing	
Course Status:	Elective	(Compulsory or Elective)
Semester:	I	(Winter /Summer)
Contact Hours:	2+2	(According to approved program)
ECTS:	5	(According to approved program)
Schedule/Room:	Wednesday, 9 ⁰⁰ -12 ¹⁰ ,K5	
Academic year:	2026/27	
Lectures:	Prof. Ass. Dr.sc. Luan Mulaku	
Assistent:		
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Descriptions of course Goal Course objectives	This course covers the key concepts and technologies of mechatronic systems and their application in the manufacturing industry. Students will become familiar with mechanical, electronic, and software components that interact to create intelligent automatic systems. Through lectures and practical exercises, they will learn the design, programming, and control of these systems within the context of manufacturing processes. The course also includes the use of industrial robotics, sensors, actuators, and integrated systems to optimize efficiency and quality on production lines. In addition to technical aspects, topics such as safety in automated systems and ethical considerations related to the use of advanced manufacturing technologies will be discussed.	
	The aim of this course is for students to gain in-depth knowledge and practical skills in the design, programming, and control of mechatronic systems used in the manufacturing industry. The course intends to develop an understanding of the integration of mechanical, electronic, and software components to create efficient and reliable automated systems. Additionally, it aims to prepare students to address the technical and ethical challenges involved in using advanced technologies in manufacturing processes, promoting performance optimization and operational safety.	
	• Describe the basic concepts and key components of mechatronic systems in the manufacturing industry. • Analyze and solve control and automation problems in mechatronic systems. • Design and program simple mechatronic systems using sensors, actuators, and electronic controls. • Apply integrated industrial robotics techniques in manufacturing processes. • Evaluate and optimize the performance of mechatronic systems in industrial environments. • Implement safe practices and professional ethics in the use of mechatronic technologies in manufacturing. • Work effectively in teams to complete practical projects involving mechatronic systems in manufacturing.	

Expected Learning Outcomes	Knowledge • K1: Explain the fundamental principles of mechatronic systems and their role in modern manufacturing processes. • K2: Describe the main components of mechatronic systems, including sensors, actuators, PLCs, and control systems. • K3: Discuss the integration of mechanical, electronic, and information technologies in industrial automation. Skills • S1: Analyze and model mechatronic systems used in production lines. • S2: Program and configure mechatronic devices, including PLCs and microcontrollers. • S3: Identify and diagnose problems in mechatronic systems using advanced tools and methods. Competence • C1: Design mechatronic solutions to optimize manufacturing processes and improve industrial efficiency. • C2: Apply sustainable and cost-effective approaches in the design and maintenance of mechatronic systems. • C3: Work effectively in interdisciplinary teams and communicate technical results professionally, both in writing and orally.
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	Weeks	Subjects
Program	Week - I	Introduction to Mechatronic Systems and Manufacturing: Definition of mechatronics, components of mechatronic systems, role in manufacturing and automation.
	Week - II	Sensors and Transducers in Manufacturing: Types, operating principles, practical examples, and integration in production lines.
	Week - III	Actuators and Motion Devices: Types of actuators (electric, pneumatic, hydraulic), characteristics, and their control.
	Week - IV	PLCs and Logical Control: Basics of PLC programming, functional blocks, and application in industrial automation.
	Week - V	Industrial Robotics – Introduction: Robotic structures, robot kinematics, applications in manufacturing.
	Week - VI	System Interfacing and Communication: Communication between components (sensors, PLC, PC), industrial protocols (Modbus, CAN, Ethernet/IP).
	Week - VII	Midterm Exam (Colloquium I) – Review and testing of units I–VI.
	Week - VIII	Visualization and SCADA: Supervisory systems, data acquisition, and user interfaces (HMI/SCADA).
	Week - IX	CNC Systems and Automated Manufacturing: Operating principles, basic programming, interaction with mechatronics.
	Week - X	Performance Analysis and Maintenance: Equipment condition monitoring, fault detection, and maintenance planning.
	Week - XI	Intelligent Systems in Manufacturing: Integration of IoT, AI, and sensors for automated decision-making.
	Week - XII	Group Project – Design of a Mechatronic System: Component selection, planning, construction, and testing.
	Week - XIII	Project Continuation and Testing: Practical measurements, performance evaluation, technical documentation.
	Week - XIV	Project Presentations: Presentation of constructed solutions, analysis, and class discussion.
	Week - XV	Final Exam Review and Testing – Project feedback and learning assessment.

Literature	
Literature	Literatura kryesore: • Dear, P.A. (2017). <i>Introduction to Surface Engineering</i>. Cambridge University Press. • Dwivedi, D.K. (2018). <i>Surface Engineering: Enhancing Life of Tribological Components</i>. Springer. • Knudsen, O.O. & Forsgren, A. (2017). <i>Corrosion Control Through Organic Coatings (Corrosion Technology)</i>. • Wierzchon, T. & Burakowski, T. (2020). <i>Surface Engineering of Metals (Materials Science & Technology)</i>, 1st Edition. • Wang, J. (2025). <i>Surface Engineering - Foundational Concepts, Techniques and Applications</i>. • Mphasha, N.P. & Rabothata, M.S. (2025). <i>Advanced Surface Modification Techniques</i>. Open access peer-reviewed chapter. • Walia, R.S., Murtaza, Q., Pandey, S.M., & Tyagi, A. (2022). <i>Surface Engineering</i>, 1st Edition. CRC Press. • Gupta, G. (2020). <i>Surface Engineering of Modern Materials</i>. Springer.
Teaching methodology	The learning process is developed by combining traditional and modern methods to ensure a deep acquisition of theoretical knowledge and the development of practical skills applicable in modern manufacturing industry. The main methods used are: • Structured Lectures (Lecturing): For the systematic presentation of basic and advanced concepts of mechatronic systems, automation, and robotics in manufacturing. • Problem-Based Learning (PBL): Students engage in identifying and solving real manufacturing and automation problems through the application of interdisciplinary knowledge (mechanical, electronic, software). • Flipped Classroom: Learning materials are distributed in advance in the form of videos, diagrams, and manuals. Contact sessions are used for discussions, testing, practical demonstrations, and problem-solving. • Project-Based Learning: Students work in groups to design and implement a functional mechatronic system applied to a production line—going through stages of analysis, design, construction, and testing. • Case Study Method: Analysis and discussion of real cases from manufacturing and automation industries, focusing on the use of PLCs, robotics, sensors, and SCADA to solve practical challenges. • Laboratory Demonstrations: Practical application of technologies such as PLC programming, interfacing with sensors and actuators, use of HMI/SCADA, industrial robotics, and CNC systems. • Computer Simulations: Use of software such as: ○ TIA Portal / LOGO Soft Comfort (PLC programming) ○ MATLAB/Simulink (modeling and automatic control)

	○ Factory I/O (production line simulation) ○ Proteus / Multisim (electronic circuits and control systems simulation) • Industry Lecturers: Invitations to professionals and engineers from the industrial sector to share experiences, standards, and technologies currently used in automated manufacturing.			
	Student Workload Contribution (which should correspond to the student learning outcomes – 1 ECTS credit = 25 hours)			
	Activity	Hour	Day/week	Total
	Lecture	2	15	30
	Theoretical exercises	2	15	30
	Practical work	3	3	9
	Meetings with the instructor/consultations	1	15	15
	Field exercises	1	2	2
	Tests, quizzes, seminars	2	2	4
	Homework assignments	3	2	6
	Student’s independent study time (in library or at home)	4	3	12
	Final exam preparation	3	3	9
	Time spent on assessments (tests, quizzes, final exam)	2	2	4
	Projects, presentations, etc.	2	2	4
Total			125	

Assessment	Assessment Methods and Criteria:	
	Activity	Weight (%)
	Test	20%
	Project report & Defense	30%
	Seminar Presentations	10%
	Final exam	40%
	Total	100%
	• (According to the statute and regulations for studies at UIBM.)	
	Final grade:	Pikët (%) Nota
		91 – 100 10
	81 - 90 9	
	71 - 80 8	
	61 - 70 7	
	51 - 60 6	

Academic Policies	Attendance, Ethics and Deadlines (Mechatronic Systems in Manufacturing) Criteria for regular attendance and rules of conduct during the teaching process are established. Students are expected to actively participate in lectures, laboratory sessions, practical exercises, and discussions related to mechatronic systems in manufacturing. Computer-Based Work All assignments, simulations, technical reports, circuit designs, and presentations must be prepared using appropriate engineering and software tools (e.g., CAD, simulation, and control system software). Students are required to comply with technical and professional standards in system design, analysis, and documentation. Clear presentation of diagrams, control schemes, and results is mandatory. Academic Ethics All assignments, projects, and reports must be the original work of the student or assigned group. Copying designs, simulations, or materials from other sources without proper citation is strictly prohibited. Any violation of academic integrity will result in negative evaluation. Deadlines 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. Consultations Students have the right to request consultations with the instructor regarding assignments, mechatronic system design tasks, simulations, and technical report preparation whenever necessary. Rules of Conduct and Academic Policies: • Active participation in lectures and exercises is expected. • Engagement in discussions, comments, and free expression of opinions, arguments, and academic viewpoints is encouraged. • Independent work and the use of additional information sources (scientific websites, journals, conference proceedings, etc.) are mandatory. • Respect for the schedule of lectures and exercises, without infringing on academic freedom (mobile phones must be on silent). • Respect for colleagues' words, opinions, and ideas. • Late arrivals and early departures without valid reasons from lectures, exercises, tests, or exams are not allowed. • Preparation and delivery of lectures is the responsibility of the instructor. • Students who miss more than four lectures or exercises without valid reasons will not receive attendance approval. • Students must have official documentation to take exams. • Students dissatisfied with their grade may appeal in writing to the Dean within two working days after results are announced, in accordance with the UMIB Statute. • Violation of exam rules, including use of unauthorized aids, will result in a failing grade. Plagiarism or copying will be sanctioned according to university regulations. ○
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