



Syllabusi		
Faculty:	FACULTY OF MECHANICAL AND COMPUTER ENGINEERING	
Department:	Mechanical Engineering	
Level:	Bachelor	
Course code:	115 IM	
Subject:	Fundamentals of Mechatronics	
Subject statute:	Elective	Compulsory/Elective
Semestre:	(II)	Winter/summer
Number of hours in week:	2+2	
ECTS:	4	
Time/Place	Wensday, 9 ⁰⁰ -10 ³⁰ , 10 ⁴⁵ - 12 ¹⁵ S203	
Vitii i studimeve:	2025/2026	
Lectures:	Prof. Ass. Dr. Luan Mulaku	
Assistenti:		
Contact:	Professor	Assistant
Email:	luan.mulaku@umib.net	
Telephone:	+38344495600	
Course description	Mechatronics is an interdisciplinary field that combines mechanical engineering, electrical engineering, and computer science to design and develop intelligent systems. This course provides an introduction to the fundamental concepts, principles, and techniques of mechatronics, with a focus on the design and control of mechatronic systems. It covers the basic principles of sensors, actuators, microcontrollers, programming, feedback control, and robotics. Students will gain hands-on experience through lab exercises and projects involving the design, construction, and testing of mechatronic systems.	
	The aim of the course Fundamentals of Mechatronics is to provide students with a broad understanding of the interdisciplinary field of mechatronics, which combines mechanical engineering, electrical engineering, and computer science. The course intends to introduce students to the basic principles, concepts, and techniques of mechatronics, including sensors, actuators, microcontrollers, programming, feedback control, and robotics. It is designed to offer students practical experience through laboratory exercises and projects, as well as to develop their ability to analyze and evaluate the performance of mechatronic systems. The course also aims to prepare students for further studies and research in mechatronics or related fields.	
Learning outcomes	After completing this course, students will be able to: • Understand the basic principles of sensors, actuators, microcontrollers, programming, feedback control, and robotics • Apply these principles to the design and construction of mechatronic systems • Analyze and evaluate the performance of mechatronic systems • Work in groups to complete laboratory exercises and projects • Communicate technical information effectively through written and oral presentations • Develop problem-solving skills	

	Week	Ligjerata
	Week I	Introduction to Mechatronics • Definition of mechatronics • Historical and contemporary examples of mechatronic systems • Overview of the mechatronic design process
	Week II	Sensors and Actuators • Overview of sensors and their types • General overview of actuators and their types • Selection and application of sensors and actuators in mechatronic systems
	Week III	Microcontrollers and Programming • Overview of microcontrollers and their types • Basic programming skills for controlling mechatronic systems • Programming languages and software tools for mechatronics
	Week IV	Feedback Control • Introduction to the principles of feedback control • PID control and its applications in mechatronic systems • Tuning of feedback control systems
	Week V	Design and Integration of Mechatronic Systems • Principles and methodologies of design for mechatronic systems • Integration of mechanical, electrical, and software components • Simulation and testing of mechatronic systems
	Week VI	Analysis and Evaluation of Mechatronic Systems • Performance analysis of mechatronic systems • Evaluation of system performance based on design specifications • Troubleshooting and maintenance of mechatronic systems
	Week VII	• Midterm Exam
	Week VIII	Introduction to Robotics • Definition of robotics and its relationship with mechatronics • Historical and contemporary examples of robots

		Overview of the robot design process
	<i>Week IX</i>	Kinematics and Dynamics of Robots - Introduction to robot kinematics - Introduction to robot dynamics
	<i>Week X</i>	Robot Control - Introduction to robot control systems - PID control and its applications in robot control
	<i>Week XI</i>	Sensors and Actuators in Robots - Overview of sensors and actuators used in robots - Selection and application of sensors and actuators in robotic systems - Integration of sensors and actuators with robot control systems
	<i>Week XII:</i>	Design and Integration of Robots - Principles and methodologies of design for robotic systems - Integration of mechanical, electrical, and software components in robots - Simulation and testing of robotic systems
	<i>Week XIII</i>	Robot Programming - Introduction to robot programming languages - Programming techniques for robot control - Simulation and programming tools for robots
	<i>Week XIV</i>	Applications of Robots - Overview of contemporary applications of robots - Examples of industrial, medical, and entertainment robots - Ethical and social considerations related to robots
	<i>Week XV</i>	Course Review - Review of course topics and concepts - Course evaluation and feedback

Literature				
Literature	• "Mechatronics: Principles and Applications" by Godfrey C. Onwubolu - 2015 • "Introduction to Mechatronics and Measurement Systems" by David G. Alciatore and Michael B. Hstand - 2012 • "Mechatronics: A Foundation Course" by Clarence W. de Silva - 2017 • "Robotics, Mechatronics, and Artificial Intelligence: Experimental Circuit Blocks for Designers" by Newton C. Braga - 2021 • "Embedded Systems: Introduction to Arm® Cortex™-M Microcontrollers" by Jonathan Valvano - 2013 • "Control Systems Engineering" by Norman S. Nise - 2015			
Teaching Methodology	Teaching Methodology for the Fundamentals of Mechatronics course may include a combination of the following: Lectures: The instructor may use lectures to present and explain the basic principles, concepts, and techniques of mechatronics. Lectures can include visual aids such as slides, videos, and demonstrations. Laboratory Exercises: The course may include lab exercises where students apply concepts learned in class to real-world scenarios. Exercises can involve designing, building, and testing mechatronic systems using hardware and software tools. Group Projects: Students may be assigned group projects that require collaboration to design and build mechatronic systems addressing specific problems or achieving particular objectives. Projects may include multiple iterations and feedback from the instructor and peers. Discussions: Classroom discussions can be used to encourage active learning and critical thinking. The instructor may use open-ended questions, case studies, and problem-solving exercises to stimulate discussion. Online Resources: The instructor may provide online resources such as videos, tutorials, and quizzes to supplement lectures and lab exercises. These resources can reinforce concepts taught in class and offer additional opportunities for self-paced learning. Feedback and Assessment: The instructor can provide feedback and assessments on student progress through quizzes, exams, lab reports, and project presentations. Feedback can help identify areas for improvement and guide students toward achieving the course learning outcomes.			
	Contribution to Student Workload (This should correspond with the student learning outcomes – 1 ECTS credit = 25 hours)			
	Activity	hour	day/week	Total
	Lecture	2	15	30
	Exercises	2	5	10
	Practical work	2	10	20
	Office Hours			
	Field Work	1	2	2
	Seminare	1	1	2
	Homework Assignments	3	2	6
	Independent Work	1	5	5
	Preparation for the Final Exam	3	3	9
	Time Spent on Tests	1	1	2
	Projects, Presentations, etc.	2	2	4
Total				125

Assessment	Assessment Methodology: Assessment methods may include the following: • Quizzes and exams to evaluate knowledge of course concepts and principles • Laboratory exercises and projects to assess practical skills and competencies • Written reports and oral presentations to evaluate communication skills • Class participation and engagement in discussions and group activities <i>(Based on the Statute and Study Regulations at UMIB)</i>		
	Tests / Midterms (Two tests, each worth 10%)	15%	
	Practical Tests during Exercises	15%	
	Seminar Work		
	Professional and Logical Structure and Varied Use of Language. Interpretation and Presentation of Creativity.		
	Assignment	15%	
	Practical project	15%	
	Final Exam	45%	
	Total	: 100%	
	Final Grade	Points (%)	Mark
		91 – 100	10
		81 - 90	9
		71 - 80	8
		61 - 70	7
		51 - 60	6

ACADEMIC POLICIES	Further Instructions: ○ Computer Work All written assignments must be typed on a computer. Assignments are required to meet both visual and content criteria. During the preparation of assignments, spelling rules and APA style must be strictly followed. ○ Academic Ethics All semester assignments must be the original work of each student. There will be zero tolerance for plagiarism, copying from the internet, or any other materials. Identical or similar works will receive negative evaluations in the final student assessment. ○ Deadlines Submission deadlines will be agreed upon with students. No delays in submission will be tolerated. Absence from the class when the assignment is explained does not excuse a student from submitting the work on time. Deadlines will be communicated in advance. If you plan to travel abroad, you must submit your assignment earlier. Students have the right to request consultations with the professor whenever they consider it necessary for completing their work. ○ Rules of Conduct and Academic Policies: ○ Active participation of students in lectures ○ Participation in discussions, comments, and free expression of opinions, thoughts, and academic positions (with arguments) ○ Independent work is mandatory, along with the use of additional information sources (various scientific websites, scientific journals, conference proceedings, etc.) ○ Respect for lecture schedules without compromising academic freedom (cell phones must be on silent) ○ Respect for the opinions and ideas of colleagues ○ Low tolerance for late arrivals and leaving without a valid reason ○ Preparation and having the necessary materials for lectures (an obligation of the instructor) ○
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