

MUJ Faculty of Engineering
Department of Mechatronics Engineering
The Proposed Curriculum Schema for
Bachelor's in technology (Robotics and AI) Degree Program Starting 2024-2025 Batch and
Onwards

First Semester			Second Semester		
Code	Course Name	Cr	Code	Course Name	Cr
CY10XX	Engineering Chemistry + Lab	3	PY1001	Engineering Physics + Lab	4
MA10XX	Mathematics 1	3	MA20XX	Mathematics 2	3
EC10XX	Basic Electrical Engineering	3		Environmental Studies	2
CV10XX	Basic Structural Engineering	3		Basic Mechanical Engineering	3
CE10XX	Biology for Engineers	2		Basic Electronics	3
CS10XX	Computer Programming+ Lab	4		Creativity & Innovation Lab	2
XX10XX	Arduino, IoT Fab Lab	1		Engineering Graphics	1
XXXXXX	Constitution of India	1		Technical Writing Clinic 1	1
			DA10XX	Universal Human Values	1
First Semester Credits		20	Second Semester Credits		20
Third Semester			Fourth Semester		
Code	Course Name	Cr	Code	Course Name	Cr
CY10XX	Statistics & Probability	3	XX22XX	Management	3
XX21XX	Linear Integrated Circuits	4	XX22XX	Design of Machine Elements	4
XX21XX	Kinematics and Dynamics of Machines	4	XX22XX	Digital System Design	3
XX21XX	Sensors, Actuators and Control	4	XX22XX	Flexi Core 1	4
XX21XX	Economics	3	XX41XX	Program Elective 1	3
XX31XX	University Elective 1	3	XX41XX	University Elective 2	3
	Design and Modeling Lab	1		PLC Lab	2
	Sensors and Actuators Lab	1		Robotics Lab	1
	Self-Study or Project	1		Project Based Learning 1	1
Third Semester Credits		24	Fourth Semester Credits		24
Fifth Semester			Sixth Semester		
Code	Course Name	Cr	Code	Course Name	Cr
	Robotics	4		Drives, Control and Automation	4
	Microcontrollers and applications	3		Flexi Core 3	4
	Flexi Core 2	4		Program Elective 4	3
	Program Elective 2	3		Program Elective 5	3
	Program Elective 3	3		University Elective 4	3
	University Elective 3	3		Technical Writing Clinic 2	1
	Microcontroller Lab	1		Advance Robotics Lab	1
	Pneumatics and Hydraulics Lab	2		Control and Automation Lab	1
	Project Based Learning 2	1		Res, Innov & Entrepreneurship	3
Fifth Semester Credits		24	Sixth Semester Credits		23
Seventh Semester			Eighth Semester		
Code	Course Name	Cr	Code	Course Name	Cr
	University Elective 5	3		Major Project	12
	Program Elective 6	3			
	Program Elective 7	3			
	Program Elec 8 / Univ Elect 6	3			
	Internship (Industry/ Research)	1			
Seventh Semester Credits		13	Eighth Semester Credits		12

Key Phrases and Expectations in the New Curriculum Schema in MUJ Faculty of Engineering (FOE):

Department Core (DC) Courses: Fundamental courses for the program of study. Mandatory for all students in the program. Each program has eleven departmental core courses of 4 credits each and 8 labs of 1 credit each for a total of 40 credits. Departments can shuffle the credits and labs or develop integrated didactic and laboratory courses.

Flexi Core (FC) Courses: Core Courses based on emerging trends in the field. Students have the opportunity to select three FCs (4Cr x 3) from a bucket offered during the fourth, fifth or sixth semester for a total of 12 Credits.

Program Electives (PE): Departments will offer a set of program specific elective courses for each semester. Students have the flexibility to select PEs from all Faculty of Engineering departments. For example, a student from Civil Engineering can study PEs offered by the Department of Computer Science and Engineering. Students will be responsible for completing the prerequisites from other department courses as online value-added courses. No additional credit is offered for these prerequisite courses taken online or value-added courses.

- **Industry Expert Courses:** Selected few Program Electives will be jointly developed by FOE faculty and industry experts, introducing the latest learnings from industry. In these courses, one or more industry experts may conduct a significant portion (> 50%) of the course. These courses will be marked with an IEC in our Course Catalog.

University Electives (UE): These are graded, open elective courses offered across the University. This is an opportunity for our students to expand their knowledge base and learn topics in non-engineering domains. FOE students cannot take FOE offered UEs.

Focus Areas: Focus Areas provide students an opportunity to study and develop expertise in any University discipline. Focus Areas are offered within FOE departments and across the University.

- For Focus Areas, students need to take four courses from a pre-selected bucket of six plus Program Electives from across FOE. For example, a Mechanical Engineering student can put together four PEs and attain a Focus Area in: Blockchain, Cybersecurity, Robotics, AI/ML, Electrical Vehicle Technology, or any other area of their interest.
- Similarly, Focus Areas are also available University-wide by taking four courses from a pre-selected bucket of six plus University Electives. For students pursuing a Focus Area outside of Engineering, they can substitute PE8 for a sixth University Elective in the Seventh Semester.

Self-Study Courses; Problem Based Learning; Research Innovation and Entrepreneurship:

These courses offered in the third through sixth semester offer students an opportunity to enhance their academic curricula with learning new skills, taking online classes, conducting guided research projects or developing innovative solutions to societal problems.

In a **Self-Study Course**, students have the opportunity to learn a new skill or computer programming language in Online mode. Producing a completion certificate and a brief assessment with a guide is necessary to receive a grade and credit.

Problem

Research Innovation and Entrepreneurship (RIE): In this course, students can pursue a broader research investigation, innovation or a startup. The expected outcome is a research paper presented at a conference, a paper publication, a patent application for an innovation or launching a startup.

Proposed List of Courses offered by Department of Mechatronics for B.Tech in Robotics and AI

Proposed Department Core Courses

1. Linear Integrated Circuits
2. Kinematics and Dynamics of Machines
3. Robotic Components
4. Data Structure
5. Digital System Design
6. Basics of AI and Machine Learning
7. Microcontrollers and applications
8. Design of Robotic Elements

Proposed Flexi- Courses

1. FC1: Object Oriented Programming
2. FC2: Robot Kinematics and Dynamics
3. FC3: Mobile Robots
4. FC4: Robot Path Planning and Control
5. FC5: Cyber-Physical System
6. FC6: Control systems for robotics

Proposed Department Program Electives

1. Strength of Materials
2. Signal and System
3. Digital Signal Processing
4. Finite Element Methods
5. Image processing
6. Vision Intelligence in Robotics
7. Smart Materials

8. Cyber Physical System
9. Computer Networks and Protocols
10. Financial reporting and analysis
11. Biomedical Robots
12. Optimal control
13. Collaborative Robots
14. Business Applications of AI and ML techniques
15. Augmented Reality and Virtual Reality
16. Micro Aerial Robots
17. Advanced Robot programming and simulation
18. Robot Gripper Design
19. Advance AI Techniques for the supply chain
20. Digital marketing
21. Agricultural Robotics
22. AI based Agriculture
23. Advance AI
24. Design and Analysis of Algorithms

Focus Areas offered by Department of Mechatronics for B.Tech in Robotics and AI

Focus Area 1: DRONE TECHNOLOGY

1. Drone and its Components (PE 1)
2. Aerial Robot Kinematics (PE 2)
3. Drone Dynamics (PE 3)
4. Drone Modelling and Simulation (PE 4)
5. Control of Drones (PE 5)
6. Applications of Unmanned Aerial Vehicle (PE 6)

7. Drone Surveillance and Monitoring (PE7)

Focus Area 2: IOT SYSTEM

1. Wireless Sensor Networks (PE 1)
2. Automated Manufacturing Systems (PE 2)
3. Project Planning and Machine Learning (PE 3)
4. IOT Security (PE 4)
5. Digital Twin (PE 5)
6. IOT Communication Protocol (PE 6)
7. IOT Applications (PE 7)

Proposed Department University Electives

1. Fundamentals of Robotics
2. Automation in Industry
3. Fundamentals of Cyber-Physical Systems
4. Project Planning and Control
5. Building Automation
6. Smart Farming
7. Optimization and decision techniques
8. Sensor Technologies
9. Predictive maintenance
10. Drone Technology
11. Inventory and Quality Control
12. Biomedical Instrumentation
13. Emotional Intelligence
14. System Analysis and Management