

Kolhapur Institute of Technology's College of Engineering, Kolhapur



Curriculum (Structure)

for

B. TECH

**Robotics (Hons.) Programme
(Under Graduate Programme)
From Academic Year 2024-2025
As Per NEP**

**Kolhapur Institute of Technology's College of Engineering, (Autonomous)
Kolhapur.**

Department of Mechanical Engineering

Teaching and Credit scheme for

**Propose B.Tech. Robotics (Hons.) Programme in Mechanical Engineering
As per NEP**

Course No.	Course Name	Semester	No. of Hours /Week			
			L	T	P	Credits
UMEHN0351	FUNDAMENTALS OF ROBOTICS	III	3	1	--	4
UMEHN0451	FUNDAMENTALS OF MICROCONTROLLERS	IV	3	1	--	4
UMEHN0551	PROGRAMMING & SIMULATIONS FOR ROBOTICS	V	3	1	--	4
UMEHN0651	ROBOT KINEMATICS AND DYNAMICS	VI	3	1	----	4
UMEHN0751	MINI PROJECT	VII	-	-	4	2
			12	4	4	18

Total Credits - 18, Total Contact hours – 20

Title of the Course: Fundamentals of Robotics												L	T	P	Credit
Course Code: UMEHN0351												3	1	--	4
Course Pre-Requisite: Basics of Electrical and Electronics															
Course Description: This course introduces the stream of robotics. The course is designed to clear the fundamentals of the students related to robot anatomy, grippers, basic concepts along with number systems, and control systems which are essential for learning computations and advanced concepts in robotics.															
Course Objectives															
1. To provide graduates of mechanical engineering with fundamental knowledge in the field of robotics for advanced graduate studies in the area of Automation and Robotics.															
2. To prepare graduates of mechanical engineering with comprehensive knowledge of Robotics to enable them to apply the relevant knowledge for the learning upcoming advanced subjects in robotics.															
3. To introduce graduates of mechanical engineering with anatomy, grippers, control systems, and applications of robotic systems.															
Course Learning Outcomes:															
CO	After the completion of the course, the student should be able to												Bloom's Cognitive		
													level	Descriptor	
CO1	Demonstrate the fundamentals concepts and knowledge of digital circuits, robotics, grippers, tools used in industrial robots, and control systems.												II	Cognitive (Understand)	
CO2	Illustrate the robot anatomy, configurations, and applications of the robotic systems.												II	Cognitive (Understand)	
CO3	Explain the concepts related to the system, system types, system examples, transfer functions and analysis methods, and control elements of the systems.												II	Cognitive (Understand)	
CO-PO Mapping:															
CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	3	3			2				2		2	3	2	
CO2	2	2	2			2						2		3	
CO3	2	2	2											3	2
Assessments:															
Teacher Assessment:															
Assessment												Marks			
ESE												100			
No ISE I and ISE II and MSE:															
ESE: Fianl ESE Assessment is based on 100% course content for 100 marks.															

Course Contents:	
Unit 1:- Introduction to Robotics: Industrial Automation and Computers, Industrial Robots, The Laws of Robotics, Robot Population and Application, Misunderstanding about robotization (Unemployment, Uncontrolled operations, etc.) Economics of Robotics.	(06) Hrs.
Unit 2:- Robot Anatomy Introduction, Anatomy of Robots, Classifications of Robots, Robot Configurations & types of Work Volume, Technical specifications of Industrial Robot, Spatial Resolution, Accuracy, Repeatability, Degrees of Freedom, Static and Dynamic properties of Robots.	(08) Hrs.
Unit 3:- Grippers and Tools of Industrial Robots Gripper Designs, Different types of grippers and End effector, Selection of grippers, Degrees of Freedom, End Effectors: Grippers, Tools. Force Analysis of Grippers, Innovative Robotic Grippers.	(06) Hrs.
Unit 4:- Fundamentals of Sensors and Transducers Performance terminology, static and dynamic characteristics of transducers, classification of sensors and transducers, Need of sensors in Robotics.	(04) Hrs.
Unit 5:- Sensors in Robotics Contact and non-contact type switches and proximity sensors- inductive, capacitive, optical, pneumatic, potentiometric, incremental and absolute encoders, tachogenerator; Applications in position, displacement, velocity, force, torque and temperature measurement.	(06) Hrs.
Unit 6:- Miscellaneous Sensors in Robotics Contour sensors, 2D code readers, Profile sensors, Vision sensors, Safety sensors, Image Sensor	(06) Hrs.
Textbooks: 1. Introduction to Industrial Robotics by Ramachandran Nagarajan Pearson Education India (2016) 2. Fundamentals of Robotics_ Linking Perception to Action (Machine Perception and Artificial Intelligence, 54)-Ming Xie, World Scientific Publishing Company (2003) 3. Fundamentals of robotics _ analysis & control-Robert J. Schilling, Asoke K.Ghosh, Prentice-Hall of India (2003) 4. Fundamentals of Robotics Engineering-Harry H. Poole, Springer Netherlands (1989) 5. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, Industrial Robotics : Technology, Programming & Applications, McGraw–Hill International, 2011. 6. Richard D. Klafter , Thomas A. Chemielewski, Michael Negin, Robotic Engineering : An Integrated Approach , Prentice Hall India, 2002. 7. Saha S K, Introduction to Robotics, McGraw Hill Education (India) Private Limited, 2014.	
References: 1. Introduction to Robotics_ Analysis, Control, Applications- Saeed B. Niku ,Wiley (2010) 2. Introduction to Robotics Mechanics and Control- John J.Craig, 3rd edition-Pearson Education, Inc. (2005) 3. Fundamentals of Robotics- David Ardayfio, CRC Press (1987)	

Title of the Course: Fundamentals of Microcontrollers Course Code: UMEHN0451													L	T	P	Credit
													3	1	-	4
Course Pre-Requisite: Basics of electronics, fundamentals of programming,																
Course Description: This course gives knowledge about the fundamentals of microcontrollers and types and some of the recent advances in microcontroller programming																
Course Objectives																
1. To understand basic terminologies and concepts associated with microcontrollers.																
2. To study fundamentals of 8051/AVR microcontroller architectures.																
3. To study the peripheral devices when connected to microcontrollers.																
4. Experiment with microcontrollers for simple applications.																
Course Learning Outcomes:																
CO	After the completion of the course the student should be able to												Bloom's Cognitive			
													level	Descriptor		
CO1	Describe the microcontrollers architectures and various registers associated with it												I	Cognitive (Knowledge)		
CO2	Interpret the results using IDE programming tools												II	Cognitive (Understand)		
CO3	Use the knowledge for interfacing external peripherals												III	Cognitive (Apply)		
CO4	Contrast the various architecture for various microcontrollers												IV	Psychomotor (Analyze)		
CO-PO Mapping:																
CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3	
CO1	2	2			3			2	2			2	3	2		
CO2	2	3	3	3	3				3			2		3		
CO3	2	3	3	3	3				2			2		3	3	
CO4	2	2			2				2			2		2	3	
Assessments:																
Teacher Assessment:																
Assessment										Marks						
ESE										100						
No ISE I and ISE II and MSE:																
ESE: Final ESE Assessment is based on 100% course content for 100 marks.																
Course Contents:																
Unit 1:- Microcontroller Basics Difference between microprocessor and microcontroller, CISC Vs RISC design philosophy, Von Neumann vs Harvard architecture.8-bit and 16-bit microcontroller. Architecture of microcontroller. I/O ports, stack and use of stack pointer, priority. Memory structure, Data Memory, Program Memory and execution of programs, different registers (SFR's), addressing modes, timing diagram.														(07)Hrs.		
Unit 2:-Integrated Development Environment (IDE) for Microcontrollers Editor, linker, loader, debugger, simulator, emulator. Instruction set, instruction formats, concept of assembler directives and various addressing modes of AVR microcontroller. Basic programming using AVR assembly instructions. Introduction to embedded- C, Integrated Development Environment (IDE), cross														(07)Hrs.		

compiler, ISP, simple program for delay generation	
Unit 3:- Peripheral Interfaces-1 I/O programming, interfacing with simple switch, LED. 8bit and 16 bit Timers, various modes of operations of timers, counters, PWM programming. Interrupt structure, Interrupt priority, Interrupt programming. Analog to Digital Converter, UART programming, RS232, RS 485 transceivers, I/O expansion techniques, Memory expansion, Communications Protocols	(08)Hrs.
Unit 4:-External Interfaces: LCD, Keyboard interfacing, Digital to Analog Converters, Stepper Motor interfacing, DC motor interfacing. Introduction to CAN Protocol and its interfacing. Introduction to Bluetooth and USB protocols.	(06) Hrs.
Unit 5:- Introduction to Other Advanced Microcontrollers Introduction to ARM and PIC processors of MSP 430 microcontroller, 16 bit Micro-controllers overview; features, architecture, addressing modes. Low power feature of MSP 430.	(06) Hrs.
Unit 6:- Fundamentals of Arduino and Raspberry Pi. Introduction to Arduino, Prototyping environment, Arduino Environment development, setting up Arduino board, creating sketches, Basic functionality of Raspberry Pi board and its processor ,setting and configuring board.	(06) Hrs.
Textbooks: 8. The 8051 Microcontroller: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, • 2012. 9. The AVR Microcontroller and Embedded Systems: A System Approach by Muhammad A. •Mazidi, 1st Ed., PHI, 2013.	
References: 1. Arm System Developer's Guide: Designing and Optimizing System Software - Andrew N. Sloss, Elsevier Publication, 2005 2. Embedded System - Raj Kamal, 2nd Ed.,TATA McGraw Hill, 2009. 3. Embedded C Programming and the ATMEL AVR by R H Barnett 2nd Ed., Cengage Learning Publication, 2006 4. Designing Embedded System with PIC microcontroller, Tim Wilmshurst, 2nd Ed., NewnesPublication, 2009	
Unit wise Measurable students Learning Outcomes: U01.1: Understand the architecture of AVR/8051 microcontrollers U02.1Understand and apply the basics fundamentals of IDE for microcontrollers U0 3.1 Understand and apply the basics fundamentals of timers of 8 bit and16bit U04.1: Students can study the different interrupts and interrupts programming. U05.1: Understand and apply the programming of stepper motors. U06.1: Students can study of various aspects advance microcontrollers.	