

**Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering and Technology, Baramati.
(An Autonomous Institute)**



Faculty of Science and Technology

Board of Studies

Mechanical Engineering

Syllabus

**Honors with Specialization in
Robotics & Automation**

**(Pattern 2023)
(w.e.f. AY: 2024-25)**

Syllabus: Honors with Specialization in Robotics & Automation

(Pattern 2023) w.e.f. AY:2024-2025

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	ACT	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
ME23281	Automation and Robotics	2	2	-	10	20	50	20	20	-	120	2	1	-	3
ME23291	Industrial Robotics & Material Handling Systems	2	2	-	20	20	50	20	20	-	130	2	1	-	3
ME23381	Industrial Automation	3	2	-	20	20	70	20	20	-	150	3	1	-	4
ME23391	Manufacturing Systems and Simulation	3	2	-	20	20	70	20	20	-	150	3	1	-	4
ME23481	Computer Integrated Manufacturing	3	2	-	20	20	70	20	20	-	150	3	1	-	4
Total		13	10	-	90	100	310	100	100	-	700	13	5	-	18

Dept. Academic Coordinator
Mr. S. C. Mahadik

Head of Department
Dr. M. S. Lande

Dean Academic
Dr. S. M. Bhosle

Principal
Dr. R. S. Bichkar

Head
Department of Mechanical Engineering
VPKBIET Baramati - 413133



ME23281:- Automation and Robotics		
Teaching Scheme:	Credits:03	Examination Scheme:
TH: 02 Hrs/Week	Theory : 02 Practical : 01	Course Activity: - 10 Marks
		In-Semester Exam: 20 Marks
End-Semester Exam: 50 Marks		
PR Exam: - 20 Marks		
PR: 02 Hrs/Week		Term-Work: 20 Marks

Prerequisites: Engineering Physics, Engineering Mathematics, Basics of Electrical Engineering, Basics of Electronics Engineering & Engineering Graphics.

Objectives:

1. To provide students with foundational knowledge of industrial automation systems, and their applications in modern industries.
2. To introduce students to the fundamentals of PLC programming.
3. To introduce various types of Robots and the functional elements of Robotics.
4. To introduce various types of end effectors.

Course Outcomes:

The students will be able to learn:

C01: To design and implement basic automation systems.

C02: To develop and troubleshoot ladder logic programs using PLCs.

C03: UNDERSTAND basic concepts of robotics.

C04: To COMPARE and SELECT robot and end effectors as per application.

Course Contents

Unit-1: Basics of Industrial Automation	[08 Hrs.]
Definition of Industrial Automation, Types of Automation (Fixed, Programmable, Flexible), Applications in modern industries, Basic Components of Automation Systems Sensors and Transducers: Types and Functions, Actuators: Role in Automation Controllers: Overview of PLC and SCADA Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations, Hydraulic Actuators-Types and applications, Components of Basic hydraulic	

systems, Hydraulic circuits for Single acting and double acting actuator, Components of Basic Pneumatic systems, application of pneumatics in industrial automation.

Unit-2: Programmable Logic Control

[08 Hrs.]

Introduction to PLC, Architecture of PLC, Ladder logic programming for different types of logic gates, Latching, Timers and Counters, Practical examples of Ladder programming.

Unit-3: Fundamentals of Robotics

[07 Hrs.]

Historical development of Robotics, Definitions of Industrial Robot, Type and Classification of Robots, Asimov's laws of robotics, Robot configurations, Robot Components, Robot Degrees of Freedom, Work volume and work envelope, Robot Joints and symbols, Robot Coordinates, Robot Reference Frames, Resolution, accuracy and precision of Robot.

Unit-4: End Effectors

[07 Hrs.]

Grippers, Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingere and Three Fingere Grippers; Internal Grippers and External Grippers; Advance Grippers- Adaptive grippers, Soft Robotics Grippers, Tactile Sensor Grippers; Various process tools as end effectors; Robot end effectors interface, Active and passive compliance, Selection and Design Considerations.

Text Books:

1. Anthony Esposito, Fluid Power with Applications, PHI Learning Pvt. Ltd. , New Delhi.
2. William Bolton, Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering.
3. Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, Industrial Robotics, Technology, Programming & Applications, Tata McGraw Hill Education Pvt. Ltd. New Delhi
4. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.

Reference Books:

1. Andrew Parr, Hydraulics and Pneumatics: A Technician's and Engineer's Guide, Butterworth-Heinemann, 3rd Edition
2. C. D. Johnson, Process Control Instrumentation Technology, Prentice Hall, New Delhi
3. S B Niku, Introduction to Robotics, Analysis, Control, Applications, 2nd Edition, Wiley Publication, 2015.
4. Mikell P. Groover, Automation, Production Systems & Computer Integrated Manufacturing, PHI Learning Pvt. Ltd., New Delhi, ISBN: 987-81-203-3418-2, 2012.

Guidelines for Lab /TW Assessment (All Practical's are compulsory)

1. Study of various components of Hydraulic system.
2. Study of various components of Pneumatic system.
3. Simulation of Single Acting/ Double Acting Hydraulic actuators for simple reciprocating circuit using suitable Simulation Software.
4. Simulation of simple Electrohydraulic or Electro pneumatic circuit using suitable Simulation Software.
5. Ladder logic programming of various logic gates using suitable Simulation Software.
6. Ladder logic programming involving Latching, Timers and Counters using suitable Simulation Software.

Guidelines for Activity:

A mini project in “Automation studio” or similar software for designing any industrial application and/or real life technical problems related to automation. A design report giving all necessary calculations and specifications of the components should be submitted in separate file.

Mini project will give students hands-on experience in designing, simulating, and programming systems within Automation Studio while covering essential aspects of hydraulics, pneumatics, and PLCs.

Final evaluation will be based on completeness of the design, correctness of hydraulic/pneumatic circuits. Efficiency and functionality of the PLC program and creativity in solving practical industrial automation problems.