

Branch Name:	Mechanical Engineering
Program Code:	ET101
Course Name:	Manufacturing Automation
Course Code:	2ET1010604T
Pre-requisite Course:	Manufacturing Processes

Course Objectives:

1. To understand the importance of automation in the of field machine tool based manufacturing
2. To get the knowledge of various elements of manufacturing automation – CAD/CAM, sensors, pneumatics, hydraulics and CNC
3. To understand the basics of product design and the role of manufacturing automation

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
03	03	-	-	03	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction: Definition; Reasons for automating; Strategies; Types of automation; Numerical control (NC, CNC, DNC); Introduction to CNC programming and computer-aided process planning.	6	20
2	Machine and Process Automation: CNC machines, Automated flow lines (types, selection); Work part transport and transfer mechanisms; Feedback systems and control; Modular and reconfigurable machines, adaptive machine controls.	6	20
3	Automated Assembly Systems: Historical developments; Choice of assembly methods; Design for automated assembly; Transfer systems; Vibratory and non-vibratory feeders; Feed tracks, part orienting and placing mechanisms.	8	20
4	Factory Automation: Lean manufacturing, Automation scalability (fixed, programmable, flexible and reconfigurable); Design and analysis of automated flow lines; Average production time, production rate, line efficiency; Analysis of transfer lines without storage; Partial and full automation.	6	15

5	Automation Tools and Techniques: Mechanical, electro-mechanical, pneumatic and hydraulic systems; Sensors integration; Process monitoring, data analysis and control using actuators; Robots (pick, place, assembly, welding, painting, etc.); Automatic Guided Vehicles; Automated inspection and measurement (CMM and 3D Scanning); Machine vision, AI and machine learning; Human-machine interfaces; Examples and case studies.	6	10
6	Advanced Automation Trends: Digital, inclusive, smart and distributed manufacturing; Industry 4.0; Digital transformations in shop-floors (CIM to Smart factory; Intelligent machines to Smart Machines; Factory automation to Distributed automation; Human sense to system sensed).	4	5
7	Examples and Case Studies: Pick and place robots, testing and sorting based systems, etc; Orientation of parts: in-bowl and out-of-bowl toolings; Manufacturing equipment embedded with digital data and driven by adoptive controls; Manufacturing automation with autonomous decisions taken by computers based on the realistic process/machines (production conditions) data acquired from the resources.	6	10

Reference Books:

1. M. P. Groover, Automation, Production Systems and Computer-integrated Manufacturing, Prentice Hall, 2018.
2. S. Kalpakjian and S. R. Schmid, Manufacturing – Engineering and Technology, Pearson
3. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill, 2005
4. CAD/CAM Principles and Applications, P.N. Rao, Tata McGraw Hill, 2010.

E-Resources:

1. <https://archive.nptel.ac.in/courses/112/104/112104288/>

Course Learning Outcomes (CLO):

CLO	Description	Bloom's Taxonomy Level
CLO1	Define the concepts, types, and strategies of manufacturing automation.	1 Remembering
CLO2	Explain CNC systems, automated flow lines, and machine controls.	2 Understanding
CLO3	Analyze automated assembly systems and design for automation.	4 Analyze
CLO4	Evaluate factory automation methods including lean and flexible systems.	5 Evaluating
CLO5	Apply automation tools like sensors, robots, and inspection systems in manufacturing processes.	3 Applying
CLO6	Interpret advanced trends like Industry 4.0, smart factories, and autonomous decision-making systems.	2 Understanding 6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	H	M	L		L		L			L		M	L	
CLO2		H	M	M		M		L			M		H	
CLO3	M			M			M		L		L			L
CLO4		H			M			L	M	M			H	
CLO5			H			M		M				L	M	
CLO6	H		H		M		M			L				H

H: High, M: Medium, L: Low