25MMET301	INTRODUCTION TO SMART MANUFACTURING	Category	L	T	P	R	Credit	Year of Introduction
		VAC	4	0	0	0	4	2025

Preamble: This course introduces the concepts of smart manufacturing and digital transformation in production systems. It covers automated manufacturing systems, CAD/CAM, CIMS, robotics, automated material handling systems, e-manufacturing, cloud-based manufacturing, and Industry 4.0 technologies. Emphasis is placed on integration of information technology, intelligent systems, and cyber-physical systems to enhance productivity, flexibility, and competitiveness in modern industries.

Prerequisite: None

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Describe automated manufacturing systems, CAD/CAM, CIMS and smart manufacturing concepts.	K2 Understand
CO2	Choose appropriate automated material handling systems and industrial robots based on manufacturing requirements.	K3 Apply
CO3	Apply design principles of AGV and AS/RS systems for smart manufacturing integration.	K3 Apply
CO4	Explain and apply Industry 4.0, IoT, cloud manufacturing and agile manufacturing concepts in modern industrial environments.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	-	1	-	-	-	-	-	2	1	1
CO2	2	2	2	-	2	-	-	-	-	-	2	2	2
CO3	2	3	2	-	2	-	-	-	-	-	2	2	2
CO4	2	2	3	-	2	-	-	-	-	1	2	2	2
Avg	2	2	2	-	1.75	-	-	-	-	1	2	1.75	1.75

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*	_	*	*	_
CO2	*	*	*	*	*	*	*	*	_
CO3	*	*	*	*	*	*	*	*	_
CO4	*	*	*	*	*	*	*	*	*

WKs Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*	*	*	*	*

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	**40**	**60**	**2.5 hrs**

Continuous Internal Evaluation Pattern:

Attendance : 5 marks
Continuous Assessment Test : 20 marks
Continuous Assessment Assignment : 15 marks

SYLLABUS

Module 1 (14 hrs)

Automated Manufacturing Systems – Computerized Manufacturing Support Systems – CAD/CAM – Computer Integrated Manufacturing Systems (CIMS) – Need for automation – Process improvement – Computer-based integration between design, manufacturing and materials management – Introduction to smart manufacturing systems.

Module 2 (14 hrs)

Introduction to robot technology – Basic terminologies – Classification and characteristics of robots – Physical configurations – Structure of industrial robots – Robot programming basics – Applications in manufacturing – Case studies.

Module 3 (14 hrs)

Introduction to material handling systems – Conveyor systems – Automated Guided Vehicle (AGV) systems: guidance, routing, control and design – Automated Storage and Retrieval Systems (AS/RS): components, control systems and applications – Integration of automated material handling and storage systems.

Module 4 (14 hrs)

Agent-based manufacturing – IT-based supply chain – Cloud-based manufacturing – Agile manufacturing – E-manufacturing systems – Evolution of industrial revolutions – Introduction to Industry 4.0 – Cyber-physical systems – Internet of Things (IoT) in manufacturing – Smart supply chain – Industrial case studies.

Text Books:

1. Bahga, A., & Madisetti, V., *Internet of things: A hands-on approach* (1st ed.). CreateSpace Independent Publishing Platform, 2014.
2. Sarath, S., Karle, A. H., Ahasan, M., Raman, V., & Selvakumaran, T., *Introduction to smart manufacturing*. Sree Global Publications, 2024.
3. Skilton, M., & Hovsepian, F., *The 4th industrial revolution: Responding to the impact of artificial intelligence on business*. Springer Nature, 2017.
4. Groover, M. P., *Automation, production systems, and computer integrated manufacturing* (4th ed.). Pearson Education, 2016.
5. Groover, M. P., Weiss, M., Nagel, R. N., & Odrey, G., *Industrial robotics: Technology, programming, and applications* (2nd ed.). McGraw Hill, 2017.

Reference Books:

1. Gilchrist, A., Industry 4.0: *The industrial internet of things* (1st ed.). Apress, 2016.
2. Jeschke, S., Brecher, C., Song, H., & Rawat, D. B., *Industrial internet of things: Cyber manufacturing systems* (1st ed.). Springer, 2017.
3. Erl, T., Mahmood, Z., & Puttini, R., *Cloud computing: Concepts, technology & architecture* (1st ed.). Prentice Hall, 2013.
4. Viswanadham, N., & Narahari, Y., *Performance modeling of automated manufacturing systems* (1st ed.). Prentice Hall, 1994.
5. Saha, S. K., *Introduction to robotics* (2nd ed.). Tata McGraw Hill Education, 2014.

END SEMESTER EXAMINATION - MODEL QUESTION PAPER

Course Code	**25MMET301**
Course Name	**INTRODUCTION TO SMART MANUFACTURING**
Max. Marks: 60	**Duration: 2.5 Hours**

Part A

(Answer all questions. Each question carries 3 marks)

Qn No.	**Question**	**Marks**	**CO**	**BL**
1.	Describe automated manufacturing systems and the need for automation in modern industries.	3	1	L2
2.	Explain how CAD/CAM and CIMS support integration between design and manufacturing.	3	1	L2
3.	Use robot configuration characteristics to identify a suitable robot for a manufacturing task.	3	2	L3
4.	Illustrate robot programming steps for a simple pick-and-place manufacturing operation.	3	2	L3
5.	Demonstrate the use of AGV guidance, routing, and control in	3	3	L3

	a smart manufacturing layout.			
6.	Illustrate the components and working of an Automated Storage and Retrieval System (AS/RS).	3	3	L3
7.	Use IoT and cloud manufacturing concepts to improve data sharing in a smart factory.	3	4	L3
8.	Demonstrate the use of agile manufacturing concepts in a modern industrial environment.	3	4	L3
	Part B **(*Answer any one full question from each Module. Each carry 9 marks*)**			
	Module I			
Qn No.	**Question**	**Marks**	**CO**	**BL**
9	Explain automated manufacturing systems, computerized manufacturing support systems, CAD/CAM, CIMS, and their role in smart manufacturing.	9	1	L2
	OR			
10	Describe the need for automation and process improvement in manufacturing industries with suitable examples.	9	1	L2
	Module II			
Qn No.	**Question**	**Marks**	**CO**	**BL**
11	Use robot selection criteria to identify a suitable industrial robot for a manufacturing cell.	9	2	L3
	OR			
12	Demonstrate robot programming methods and applications using a suitable industrial case.	9	2	L3
	Module III			
Qn No.	**Question**	**Marks**	**CO**	**BL**
13.a	Apply AGV design principles for material movement in a smart manufacturing system.	5	3	L3
13.b	Demonstrate the role of guidance, routing, and control in AGV system operation.	4	3	L3
	OR			
14.a	Use AS/RS components and control systems to develop an automated storage solution for a manufacturing unit.	5	3	L3
14.b	Illustrate the integration of conveyor, AGV, and AS/RS systems in automated material handling.	4	3	L3
	Module IV			
Qn No.	**Question**	**Marks**	**CO**	**BL**
15.a	Use Industry 4.0, cyber-physical systems, and IoT concepts to develop a smart manufacturing information flow.	5	4	L3

15.b	Demonstrate cloud-based manufacturing and smart supply chain concepts in an industrial case.	4	4	L3
	OR			
16.a	Employ agent-based manufacturing and agile manufacturing concepts for flexible production planning.	5	4	L3
16.b	Illustrate e-manufacturing systems and cloud-based manufacturing for modern industrial environments.	4	4	L3