GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Subject Code : ME02000441

Subject Name : Computer Integrated Manufacturing

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Zeal to learn the subject
Rationale:	To address high end technologies used to automate manufacturing operations using computerized integration of product design, planning, production, distribution, and management.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Gain an overall understanding of automated systems integration.	20
2	Be able to use and program programmable controllers, robots and CNC machines in an integrated system.	20
3	Be able to develop interfaces necessary to integrate machines with a conveyor system and a host control system for a flexible manufacturing system.	30
4	Demonstrate their understanding by producing a product through an integrated flexible manufacturing system and documenting the results	25
5	Gain an overall understanding of automated systems integration.	15

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Manufacturing Automation:** Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Strategies-The USA Principle, Ten Strategies for Automation and Process Improvement, Automation Migration Strategy.	3	6

2.	**Automated Flow lines:** System Configurations, Workpart Transfer Mechanisms, Storage Buffers, Control of Production Line, Analysis of Transfer Lines-Transfer Lines with No Internal Parts Storage, Transfer Lines with Internal Storage Buffers.	4	8
3.	**Manual Assembly Lines:** Assembly Workstations, Work Transport Systems, Line Pacing, Coping With Product Variety, Analysis of Single Model Assembly Lines-Repositioning Losses, The Line Balancing Problem, Line Balancing Algorithms-Largest Candiate Rule, Kilbridge and Wester Method, Ranked Positional Weights Method.	6	14
4.	**Automated Assembly Systems:** System Configurations, Parts Delivery at Workstations, Applications, Quantitative Analysis of Assembly Systems-Parts Delivery System at Workstations, Multi-station Assembly machines, Single Station Assembly Machines, Partial Automation.	4	8
5.	**Automatic Material Handling and Storage systems:** Design Considerations in Material Handling, Material Transport Equipment-Industrial Trucks, Automated Guided Vehicles, Monorails and Other Rail-Guided Vehicles, Conveyors, Cranes and Hoists, Analysis of Vehicle Based Systems, Conveyor Analysis. Engineering Analysis of AS/RS and Carousel Systems.	4	8
6.	**Automated Inspection systems:** Overview of Automated Identification Methods, Bar Code Technology, Radio Frequency Identification, Other AIDC Technologies-Mangnetic Stripes, Optical Character Recognition, and Machine Vision.	5	12
7.	**Computer Aided Process Planning**: Retrieval CAPP Systems, Generative CAPP Systems, Graph Based Approach, Attribute Adjacency Graph, Benefits of CAPP.	4	8
8.	**Flexible Manufacturing Systems:** Types of flexibility, types of FMS, FMS components, FMS Components-Workstations, Material Handling and Storage Systems, Computer Control System, Human Recourses, FMS Applications and Benefits., Quantitative analysis of FMS, Sizing the FMS, System performance measure.	5	**12**
9.	**Computer Integrated Manufacturing:** The Scope of CAD/CAM and CIM, Computerized elements of a CIM System, Components of CIM, Database for CIM, Planning , Scheduling and Analysis of CIM Systems.	5	**12**
10.	**Rapid Prototyping** Introduction, Prototype design methods, prototype design tools, liquid, solid and powder based RP processes, STL format and STL file problems.	5	**12**
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
-	**20**	**30**	**30**	**20**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Automation, production Systems and Computer Integrated Manufacturing, Mikell P Groover, Prentice Hall, 2007.
2. System Approach to Computer Integrated Manufacturing, Nanua Singh, Wiley & Sons Inc., 1996.
3. Intelligent Manufacturing System, Andrew Kusiak, Prentice Hall Inc., 1992

(b) Open-source software and website:

https://nptel.ac.in/

Suggested Course Practical List:

List of Laboratory/Learning Resources Required:

1. Problems on automated flow lines
2. Problems on line balancing, Ranked Positional Weights Method etc. for manual assembly lines
3. Problems on automated assembly systems
4. Problems on quantitative analysis of FMS
5. Sizing problems on FMS
6. STL file format reading and use of related algorithm for its manipulation
7. Problems on scheduling for CIM
8. Demonstration / programming exercise on automated inspection system
9. Demonstration / programming exercise on Automated material handling system

Suggested Project List:

Equipment / Computational facility:

1. AS/RS
2. AGV
3. Workstations.
4. Controlling software and hardware
5. Machine Vision System
6. Loading / Unloading Mechanisms.
7. RP Machine.

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