GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (CAD/CAM) (08)

COMPUTER INTEGRATED MANUFACTURING

SUBJECT CODE: 2720815

SEMESTER: II

Type of course: Engineering Science

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.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
4	0	2#	5	70	30	20	10	10	10	150

Content:

Sr. No	Topic	Lectures	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.	4	5%
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.	6	10%
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.	7	10%
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.	5	10%
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	4	10%

	Vehicle Based Systems, Conveyor Analysis. Engineering Analysis of AS/RS and Carousel Systems.		
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.	**6**	**15%**
7	**Computer Aided Process Planning:** Retrieval CAPP Systems, Generative CAPP Systems, Graph Based Approach, Attribute Adjacency Graph, Benefits of CAPP.	**4**	**10%**
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.	**7**	**10%**
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**	**10%**
10	**Rapid Prototyping** Introduction, Prototype design methods, prototype design tools, liquid, solid and powder based RP processes, STL format and STL file problems.	**6**	**10%**

References:

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

Course Outcome:

On completion of this course students will:

1. Gain an overall understanding of automated systems integration.
2. Be able to use and program programmable controllers, robots and CNC machines in an integrated system.
3. Be able to develop interfaces necessary to integrate machines with a conveyor system and a host control system for a flexible manufacturing system.
4. Demonstrate their understanding by producing a product through an integrated flexible manufacturing system and documenting the results

List of Experiments

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

Design based Problems (DP)/Open Ended Problem:

1. Design a work-cell which includes two workstations, AS/RS and machine vision system. Select an appropriate component to be processed and inspected within work-cell. Develop process plan, compute time for work/part movement within cell and validate the same.

Major Equipment:

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

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website