GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Mechanical/Production/Manufacturing Engineering
SUBJECT NAME: Computer Aided Manufacturing
SUBJECT CODE: 2171903
BE semester VII

Type of course: Core

Prerequisite: Manufacturing Processes-I, Production Technology

Rationale:
Computer Aided Manufacturing is highly demanded area now a day. Computer Aided Manufacturing deals with Design of components to manufacturing and also includes Planning and controlling the processes. Industries widely use CNC, FMS and Robotics technology now a day. Students will be familiar with its hardware and software and also able to write programs for machining.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Learning Objectives:

1. To build concrete foundation for their core branch as a thinker, inter disciplinary thoughts
2. To educate students by covering different aspects of computer Aided Manufacturing.
3. To create strong skills of writing CNC programs, PLC programs.
4. To educate students to understand different advances in manufacturing system like: GT, CAPP and FMS
5. To educate students by covering robotics and different material handling system required in manufacturing shop floor.
6. To educate students by covering different Integrated production management system.

Content:

Unit No.	Topic	Teaching Hours	Weightage
1	**Computer Aided Manufacturing:** CAM Concepts, Objectives & scope, Nature & Type of manufacturing system, Evolution, Benefits of CAM, Role of management in CAM, Concepts of Computer Integrated	04	08%

	Manufacturing, Impact of CIM on personnel, Role of manufacturing engineers, CIM Wheel to understand basic functions.		
2	**NC/CNC Machine Tools:** NC and CNC Technology: Types, Classification, Specification and components, Construction Details, Controllers, Sensors and Actuators, CNC hardware: Re circulating ball screw, anti friction slides, step/servo motors. Axis designation, NC/CNC tooling. Fundamentals of Part programming, Types of format, Part Programming for drilling, lathe and milling machine operations, subroutines, do loops, canned Cycles, parametric sub routines.	09	25%
3	**Programmable Logic Controllers:** Relay Device components, Programmable controller architecture, programming a programmable controller, tools for PLC logic design.	02	05%
4	**Group Technology and CAPP:** Introduction, part families, part classification and coding systems: OPITZ, PFA, FFA, Cell design, rank order clustering, composite part concepts, Benefits of group technology. Approaches to Process Planning, Different CAPP system, application and benefits.	06	12%
5	**Flexible Manufacturing System:** Introduction & Component of FMS, Needs of FMS, general FMS consideration, Objectives, Types of flexibility and FMS, FMS lay out and advantages. Automated material handling system: Types and Application, Automated Storage and Retrieval System, Automated Guided Vehicles, Cellular manufacturing, Tool Management, Tool supply system, Tool Monitoring System, Flexible Fixturing, Flexible Assembly Systems.	07	20%
6	**Robot Technology:** Introduction: Robot Anatomy, Laws of Robot, Human System and Robotics, Coordinate system, Specifications of Robot. Power sources, actuators and Transducers, Robotic Sensors, Grippers, Robot Safety, Robot Programming and Robot Applications, Economic Considerations of Robotics system, Robot Kinematics and Dynamics, Robot Arm Dynamics. Concepts of Computer Vision and Machine Intelligence.	07	15%
7	**Integrated Production Management System:** Introduction, PPC fundamentals, Problems with PPC, MRP-I, MRP-II. Just in Time philosophy: JIT & GT applied to FMS, concepts of Expert System in Manufacturing and Management Information System.	07	15%
	Total Hours	**42**	**100%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Computer Aided Manufacturing by Tien Chien Chang, Pearson Education
2. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P Groover, Pearson Education
3. Robotics Technology and Flexible Automation, by S R Deb, S Deb, McGraw Hill Education Private Limited.
4. Flexible Manufacturing Cells and System -William. W. Luggen Hall, England Cliffs, Newjersy
5. P. Radhakrishnan, " Computer Numerical Control ", New Central Book Agency, 1992.
6. Computer integrated manufacturing -S. Kant Vajpayee – Prentice Hall of India.
7. System Approach to Computer Integrated Manufacturing. Nanua Singh, Wiley and sons Inc, 1996.
8. Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill, 1993
9. CAD/CAM, Principles and Applications –P N Rao, McGraw Hill, 2010
10. CAD/CAM, Introduction, -Ibrahim Zeid, Tata McGraw Hill, 2007

Course Outcome:

After learning the course the students should be able to:

1. Students will describe basic concepts of CAM application and understand CAM wheel
2. Students will prepare CNC programs for manufacturing of different geometries on milling and lathe machines.
3. Students will prepare logic diagram for different application of automation.
4. Students will classify different components using different techniques of group technology
5. Students will prepare Process planning for different components
6. Students will select layouts of FMS for industrial applications
7. Students will describe Robot for preliminary industrial applications like pick and place.
8. Student will identify application of PPC, JIT, MRP-I, MRP-II, and Expert system to CAM

List of Experiments:

1. Study of Computer Integrated System: Basics, Types of Manufacturing, role of management and CIM wheel
2. NC/CNC technology: Definition, Classification, Specification, Construction details, Sensors and Actuators, and different controllers.
3. CNC part Programming: Lathe and Milling jobs
4. Exercise on PLC for Simple problems.
5. Problems on GT and Industrial case problems on coding
6. Problems on CAPP and Industrial case problems
7. Study of Flexible Manufacturing system
8. Study of Robotics Technology
9. Problems on MRP-I, MRP-II
10. Study of Expert System in Manufacturing and MIS

Design based Problems (DP)/Open Ended Problem:

1. Industrial case problems on CNC programming
2. PLC programming on simple cases
3. Case problems on GT and CAPP
4. Problems on Understanding of Kinematics of Robotics

Major Equipment:

1. CNC Machine
2. Industrial Robot
3. Programming Software.

List of Open Source Software/learning website:

www.nptel.ac.in/ Prentice

Videos on CNC programming, PLC, Robotics and FMS