B.E Semester: VII

Mechanical Engineering

Subject Name: Computer Integrated Manufacturing

A. Course Objective

- To develop a problem oriented in depth knowledge of Computer Integrated Manufacturing.
- To address the underlying concepts, methods and application of different manufacturing processes with aid of computers.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
ME703	Computer Integrated Manufacturing	3	0	2	5	4	3	70	30	20	30	150

C. Detailed Syllabus

1. Introduction:
Rationale for CAD/CAM, Computer aided Manufacturing, The CAM hierarchy, elements of CAM-Database, Production Management, Manufacturing control, NC/CNC, Product Design & Development, benefits, limitations and applications

2. Numerical control in machine tools:
Types-Numerical, Direct Numerical, Computerized Numerical and Distributive Numerical, evolution of controller, adoptive control, tool conditioning monitoring, classification of NC/CNC machine tools, velocity control and position control, block diagrams for NC and CNC machines, factors considered for selecting components for NC/CNC machining, factors influencing selection of NC/CNC machine tools. Construction and working of Main parts of NC/CNC machine tools:-Speed drives, feed drives, re circulating ball screw, linear motion guide, machine slides, spindle, bed, structure, linear and rotary transducers, chip conveyor, automatic tool changer, tools and tool holders, CNC systems and their specifications and advanced features, MCU types and functions, interpolators- functions, types, hardwares and softwares, NC tape, tape formats and various types of tape readers. CNC lath, turning center, CNC milling machine and Machining centers.
NC coordinate systems, work piece zero systems, absolute and incremental programming, NC motion control (PTP, Straight cut and Contouring), open loop and closed loop systems, Component Drawing Instruction and its use.
Manual part programming :- Various types of programming formats, G codes, M codes and other codes, Canned cycles, radius compensation, programming exercises for drilling, milling and turning, subroutine, parametric subroutine.
Computer assisted programming: - Enlist languages, Automated programmed Tools (APT)-geometrical motion, auxiliary and post processor statements, APT programs for drilling, milling and turning, tool path generation and verification. CNC programming based on CAD/CAM
Software: - The CAD/CAM approach to part programming- machining from 3D models.
3. **Computer aided production & operation management**:
Basic concepts of Computer Aided Forecasting and Computer Aided Plant Layout
Material Requirement Planning Systems:- basics, input -product tree structure, Master Production Schedule and Inventory Status File, structure, output report, working of system, benefits and limitations, Pegging, Cycle counting, Updating and Time fence, Capacity Requirement Planning.
Scheduling:- Single machine-Branch and bound method

Flow shop-Johnson's rule, and CDS heuristic
Job shop- Priority Dispatching rules, heuristic and Indexing method

Group Technology:- Objectives, part families, similarities, design and Manufacturing attributes, two hurdles in implementing G. T., classification methods- visual inspection, product flow analysis and coding, need and types of structure, Opitz, MICLASS and CODE coding systems, G.T. machine cells and types, concept of composite part, benefits and limitations.

Computer Aided Process Planning:- Variant and Generative CAPP, benefits, Machinability Data System, Computer Generated Time Standard forward and backward planning, implementation considerations, CAPP Systems-CAM-I CAPP, MUL TICAPP, APPAS and CADCAM, AUTOPLAN, GARI, CPPP and TIPPS.

Computer Aided Quality Control:- Computer in Q.C., Contact inspection methods, non contact inspection such as optical and non optical methods, computer aided testing, benefits and limitations.

4. Flexible Manufacturing Systems:-

Introduction, objectives of an ideal FMS, applications, classification, functional components, hardware components, FMC, pallets and fixtures, elements of an FMS- NC/CNC machines, three coordinate measuring machines, robots, conveyors, AGVs, ASRS and computers and their functions, FMS layouts, specifications, benefits, limitations, quantitative analysis, FMS planning and implementation issues.

5. Computer Integrated Manufacturing:-

Introduction, CIM concepts-IBM, Siemens, Digital Equipment Corporation, E-Spirit-CIM-OSA model, NIST, AMRF, CIM hardware CIM software, development of CIM, specifications, CIM database and database management system.

6. Robots:-

Components, classifications, various types of physical configurations, specifications, basic motions, robot control, methods of programming the robot, economic considerations which can be used as a competitive weapon and selection and industrial applications of robots.

7. CAD/CAM integration:-

Introduction, activities involved in CAD/CAM integration such as 3D modelling, analysis and optimization, 2D drafting and drawing, database management, process planning, tool design, NC programming and inspection, case studies, brief description of commonly used software packages and their use in area of CAD/CAM/CAE.

D. Lesson planning

SR.NO	DATE/WEEK	UNIT NO	%WEIGHTAGE	TOPIC NO
1	1^{ST} , 2^{ND} , 3^{RD}	1, 2	20	1, 2
2	4^{TH} ,5^{TH} , 6^{TH}	3	20	3
3	7^{TH} ,8^{TH} , 9^{TH}	4, 5	20	4, 5
4	10^{TH} ,11^{TH} , 12^{TH}	6	20	6
5	13^{TH} ,14^{TH} , 15^{TH}	7	20	7

E. Instructional Method & Pedagogy

1. At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2. Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
3. Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4. One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5. Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6. Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.

7. The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
8. **Practical / Oral:** Term work shall be carried out to fulfill the practical credits related to course contents.

F. Students Learning Outcomes

- The student can identify different areas of Computer Integrated Manufacturing.
- Can find the applications of all the areas in day to day life.

G. Recommended Study Materials

1. Numerical Control & Computer Aided Manufacturing-T. K. Kundra & P.N. Rao
2. CAD,CAM,CIM- P. Radhakrishnan & S.Subranarayan- New Age International
3. CAD, CAM, CIM- Mikell P. Groover & EN. Zimmers- Prentic Hall
4. Computer Aided Manufacturing-Chang and Wysk
5. Computer Aided Manufacturing S. Vishal-S. K. Kataria & Sons-Delhi
6. Computer Aided Production Management-P.B. Mahapatra
7. Computer Numerical Control Machines- P. Radhakrishnan-New Age International
8. Production & Operation Management-R. Paneerselvam- Prentic Hall