3PE05: COMPUTER AIDED MANUFACTURING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:
With an increase in the need for quality manufacturing along with the factors of short lead time & short product lives and increasing consumer awareness regarding the quality of the product, it is becoming increasingly important for the manufacturer to initiate steps to achieve all these. With the advent of microelectronics, the students of manufacturing discipline must take advantage of the availability of low-cost & more powerful computers operating machines in industries for manufacturing, planning, control & other functions.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Computer Aided Manufacturing:** Computers in industrial manufacturing, Product cycle & CAD/CAM, Automation & CAD/CAM, Benefits & limitations of using CAM technology, Applications of CAM in industries.	04
2	**Introduction to NC/CNC Machine Tools:** Introduction, Difference between NC & conventional machine tools, Advantages of CNC over NC, Advantages of NC/ CNC over conventional machine tools, Limitations of NC/CNC machine tools, Specifications of typical CNC machine tools. Basics of NC/CNC machine tools, Axes designation, Coordinate system, Reference points- Grid system, Machine origin, Part origin & Tool reference point. Classifications NC/CNC machine tools on the basis of number of axes, control systems (P, L & C type controls), power supply used, Automatic tool changer (ATC) & Automatic pallet changer (APC). CNC machine tools – Structure including Spindle, Bearings, Guideways, Transmission system, Recirculating ballscrews, Roller screw, Drives including Stepper motor, AC/DC Rotary servo motor, Linear motor, Open loop & Closed loop control systems, Tool presetters.	09
3	**Part Programming:** Basics of programming, Coding systems, Types of codes, G- & M-codes, Absolute & Incremental programming, Diameter & Radius programming, Programming functions, Spindle speed control, Tool & tool offset, Tool compensations, Programming on Turning center & Machining center for turning, threading, drilling, tapping & profile milling operations, Use of	16

Unit No.	Topics	Teaching Hours
	Canned cycles &Subprogramming features.	
4	**Computer Aided Process Planning (CAPP):** Introduction, approaches to CAPP- Retrieval/variant system & Generative system, Implementation techniques – decision tables, expert system technique (AI), Concepts of Material Requirement Planning (MRP-I) & Manufacturing Resource Planning (MRP-II), Concept of Finite Requirement Planning (FRP).	05
5	**Introduction to Robotics:** Introduction & definition, Characteristics of a true robot, Laws of robotics, Robot anatomy & Manipulator, Types of joints, degree of freedom of robot, Work envelope – work volume, Robot configurations, Comparison of configurations, Basic robot elements – controller, manipulator, end effectors, sensors & actuators, Performance specifications of robot.	06
6	**Computer Integrated Manufacturing:** Concept of Computer Integrated Manufacturing (CIM), Modules of CIM, CIM wheel to understand basic functions, Benefits of CIM.	02
	Total	**42**

List of References:

1. Mikell P Groover, *"Automation, Production Systems and Computer Integrated Manufacturing"*, Pearson Education Inc.
2. Mikell P Groover & E. W. Zimmer, *"CAD/CAM, Computer Aided Design & Manufacturing"*, Pearson Education Inc.
3. P M Agrawal & V J Patel, *"CNC Fundamentals and Programming"*, Charotar Publishing House Pvt. Ltd., 2nd Revised Edition, 2014.
4. P N Rao *"CAD/CAM***:** *Principles and Applications"*, Tata McGraw Hill Education Pvt. Ltd., Delhi, 2010.
5. P. N. Rao, N. K. Tewari& T. K. Kundra, *"Computer Aided Manufacturing",* Tata McGraw Hill Education Pvt. Ltd., Delhi, 2010.
6. Tien Chien Chang, Richard A. Wysk & Hsu-Pin Wang, "*Computer Aided Manufacturing*", Pearson Education Inc.
7. Ibrahim Zeid, *"CAD/CAM Introduction",* Tata McGraw Hill Education Pvt. Ltd., Delhi, 2007.
8. Er. J S Narang, Er. Sanjeev Walia & Er. V. D. S. Narang, *"Computer Aided Manufacturing (CNC & Robotics)",*Dhanpat Rai & Co. (P) Ltd., 2010.
9. S K Saha, "Introduction to Robotics", Tata McGraw Hill Education Pvt. Ltd., 4th Ed. 2011.
10. P. Radhakrishnan, *"CAD/CAM/CIM",* New Age International Publication.
11. Manua Singh, *"System Approach to Computer Integrated Manufacturing"*, Wiley and Sons Inc, 1996.
12. S R Deb & S Deb, *"Robotics Technology and Flexible Automation"*, McGraw Hill Education Pvt. Ltd.
13. Y. Koren, *"Robotics for Engineer"*, McGraw Hill Education Pvt. Ltd.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand the various spheres of manufacturing activities where computers are used, the meaning of product cycle with difference between conventional & computer-based manufacturing and identify various computer-based applications in manufacturing.
2. Understand the principle of NC and CNC technologies, their components, advantages & disadvantages along with the hardware requirements & control systems for NC/CNC machine tools.

3. Create & simulate sample part programs using fundamentals of part programming for CNC turning & machining centers using word address format, canned cycles & sub-programming involving use of G- & M-codes for turning, threading, drilling, tapping & profile milling operations.
4. Understand importance & needs of computer aided process planning (CAPP), different approaches used in CAPP, and learn about the concepts of material requirement planning (MRP-I), manufacturing resource planning (MRP-II) & finite requirement planning (FRP).
5. Learn & understand concept of robotic, impact on society, use of robots including their components (grippers, sensors, actuators) & various robot-configurations as well as robot performance specifications required for applications.
6. Understand concept of computer integrated manufacturing with modules, functions of each module & benefits of CIM.