COURSE TITLE	**COMPUTER AIDED MANUFACTURING**
COURSE CODE	**01CA1201**
COURSE CREDITS	**3**

Objective:

1 The manufacturing field has witnessed the development of major automation alternatives recently. CNC machines play a big role in manufacturing field. An attempt has been made to focus on CNC machine tools, related programming and their advanced features.

Course Outcomes: After completion of this course, student will be able to:

1 Setup and operate various Computer Numerical Control (CNC) machine tools for given manufacturing tasks.

2 Prepare part programs for CNC turning and milling operations.

3 Analyse feature-based modelling approaches to evaluate their integration with design-for-manufacture strategies.

4 Apply CAD/CAM software to generate, simulate, and optimise CNC programs for complex component geometries.

Pre-requisite of course: Manufacturing processes – 1, Production Technology

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	**CNC Machine Tools** Concept of CNC and development of its technology, advantages, applications, classification of CNC Machine, Axis designations, interpolators- linear, circular and helical interpolators, CNC Machine building, structural details, CNC block diagram, guide ways, friction and antifriction, recirculating ball screws, planetary roller screw, recirculating roller screws, Types of indexing with numerical Problems, Automatic tool changer (ATCs), automatic pallet changer (APCs), timing gear belt design, types of control, CNC networking topologies and their products, concepts of DNC	9
2	**System drives and control system** DC shunt motor, 3 phase AC induction motor & their comparison, Stepper motor, servo principle, DC & AC servo motors with numerical problems, Types of encoders, absolute and incremental optical encoders, synchro, synchro-resolver, gratings, moire fringe gratings, induction, laser interferometer.	5

Contents : Unit	Topics	Contact Hours
3	**Manual Part Programming for CNC** Fundamentals of CNC Turning, Familiarization of control panel, Axis designation, Work offset & tool offset measurement, Work piece setting methods, Introduction to Various types of tools, Fundamentals of CNC programming, Part programming techniques with Simulation, Part program preparation by absolute & incremental programming, Subroutine, Macro Programming, Stock Removal Cycle, Turning Cycles (Stock Removal, Groove, Undercut, Thread-OD, Cut off), Drilling (Centering, Drilling, Deep Hole Drilling, Boring), Contour Turning (Contour, Stock Removal, Grooving, Plunge Turning), Fundamentals of CNC milling, Familiarization of control panel, Axis designation, Work offset & tool offset measurement, Introduction to Various types of tools, Fundamentals of CNC programming, Part programming techniques with Simulation, Part program preparation by absolute & incremental programming, Sub Programming, Milling (Face Milling, Pocket, slot, Engraving), Drilling (Centering, Drilling/Reaming, Deep Hole Drilling, Boring, Thread), Contour (Contour, Path Milling, Rough Drill, Pocket, Spigot)	12
4	**Feature Based Manufacturing** Deficiencies of Geometric Models, Definition of Features, Types and Attributes of Features, Properties of Features and composite features; Taxonomies, Validation and Mapping of Features; Feature Creation, Automatic Feature recognition, Design by Features, Comparison of Feature Creation Techniques and Their Unification; Feature Based Part Creation, Feature Identification, Design by Feature, Tolerance Specification; Manufacturing Features, Level abstraction and Specification, Dimensionality, Completeness of Feature Model, Feature Relationships, Temporal, Ordering, Product Families, Interactive Feature Identification	12
5	**Automated Part Programming** Computer Assisted Part Programming, Automatic NC, program generation from CAD models, Parametric Programming	4
Total Hours		**42**

Textbook :

1 Numerical Control and Computer Aided Manufacturing, T.K. Kundra, P.N.Rao, N.K. Tewari, Tata McGraw Hill Publishing Company Ltd., 2015

2 CNC Machining and Programming: An Introduction, David Gibbs and Thomas Crandall, Industrial Press Inc.,U.S., 2003

References:

1 Parametric and feature based CAD/CAM , Parametric and feature based CAD/CAM , Shah J.J., Mäntylä M , John Wiley Sons Inc. , 1995

2 Mechatronics , Mechatronics , HMT, McGraw Hill , 2000

References:

3 Introduction to Computer Numerical Control , Introduction to Computer Numerical Control , James V. Valentino and Joseph Goldenberg , Englewood Cliff, New Jersey , 2012

4 Computer control of Manufacturing Systems , Computer control of Manufacturing Systems , Yoram Koren , McGraw Hill , 2006

5 Computer Aided Manufacturing, Computer Aided Manufacturing, C. Elanchezhian, Laxmi publication , 2007

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	20.00	20.00	20.00	20.00	10.00

Instructional Method:

1 Presentation, Demonstration, Simulation, Practical

Supplementary Resources:

1 https://nptel.ac.in/courses/112102102