



## FACULTY OF ENGINEERING & TECHNOLOGY

### First Year Master of Technology

#### Semester II

**Course Code:** 102320202

**Course Title:** Computer Aided Manufacturing

**Type of Course:** Core Course IV

**Course Objectives:** Students will gain a basic understanding of computer numerical control (CNC) machining processes and programming for different operations along with recent trends in manufacturing.

#### Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	0	2	5	30/15	20/10	70/35	30/15	150/75

\* J: Jury; V: Viva; P: Practical

#### Detailed Syllabus:

Sr.	Contents	Hours
1	CAM - Concept and definition: NC (Numerical Control), CNC (Computerized Numerical Control) and DNC (Direct Numerical Control) - concept, features and differences. Advantages and limitations of CNC, Selection criteria for CNC machines	03
2	CNC machines: Types, classification, working and constructional features. Spindle drives and axes (feed) drives on CNC machines. Machine structure- Requirements and reasons. Elements of CNC machines - Types, working and importance of: Slide ways, Re-circulating ball screw, Feedback devices (transducers, encoders), Automatic tool changer (ATC), Automatic pallet changer (APC), CNC axes and motion nomenclature.	07
3	CNC Tooling: Tool pre-setting-concept and importance, Qualified tools-definition need and advantages, Tool holders- types and applications. CNC turning and Milling centers: Types, Features, Axes nomenclature, Specification, Work holding devices - types, working and applications, Tool holding and changing devices - types, working and applications.	07



4	CNC part programming: Definition and importance of various, positions like machine zero, home position, work piece zero and program zero, programming format and structure of part program. ISO G and M codes for turning and milling-meaning and applications of important codes. Simple and Complex part programming for turning and milling using ISO format having straight turning, taper turning (linear interpolation) and convex/concave turning (circular interpolation), ISO format milling. Importance, types, applications and format for: i. Canned cycles ii. Macro iii. Do loops iv. Subroutine CNC turning and milling part programming using canned cycles, Do loops and Subroutine, Need and importance of various compensations: i. Tool length compensation. ii. Tool radius compensation.	12
5	Recent Trends in CAM: Interfacing standards for CAD/CAM - Types and applications, Adaptive control- definition, meaning, block diagram, sources of variability and applications. Flexible Manufacturing System (FMS) - concept, evaluation, main elements and their functions, layout and its importance, applications, Computer Integrated Manufacturing (CIM) - Concept, definition, areas covered, benefits. Robotics- definition, terminology, classification and types, elements and applications. Rapid prototyping - Concept and application	09
6	Automated Part Programming: Computer Assisted Part Programming, Automatic NC program generation from CAD models, Parametric Programming.	01

### Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
20	25	20	15	10	10	

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	CNC Machines, Pabla B.S., Adithan M., New Age International.
2	Computer Numerical Control Turning and Machining centers, Quesada Robert, Prentice Hall.
3	CAD/CAM: computer aided design and manufacturing, Groover, M. P., Zimmer, W.E., Prentice Hall.
4	Parametric and feature based CAD/CAM, Shah J.J., Mäntylä M., John Wiley Sons Inc
5	Mechatronics, HMT, McGraw Hill Education
6	Introduction to Computer Numerical Control, James V. Valentino and Joseph Goldenberg, Prentice Hall, Englewood Cliff.
7	Computer control of Manufacturing Systems, Yoram Koren, McGraw Hill.
8	Numerical Control and Computer Aided Manufacturing, T.K. Kundra, P.N.Rao, N.K. Tewari, Tata McGraw Hill Publishing Company Ltd.
9	CNC Machining and Programming: An Introduction, David Gibbs and Thomas Crandall, Industrial Press Inc.
10	Computer Aided Manufacturing, Rao, P. N., Tiwari, N. K., Kundra, T., CBS Publication



## Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To demonstrate a basic understanding of machining fundamentals including speed and feed calculations, tooling systems, and work-holding systems for CNC milling and turning equipment.	25
CO-2	To demonstrate a basic and advanced understanding of numerical controlled (NC) programming strategies.	30
CO-3	To demonstrate an ability to set-up, program, and operate CNC milling and turning equipment.	20
CO-4	To demonstrate an ability to generate NC code using G-codes to machine parts to specifications.	25

## List of Practicals / Tutorials:

1	CNC machines hardware and their axis designations.
2	Manual part programming for CNC lathe without canned cycles.
3	Manual part programming for CNC lathe for multipass turning and facing.
4	Manual part programming for CNC lathe for undercutting, multi-pass threading and grooving.
5	Manual part programming for profile milling with cutter radius compensation.
6	Manual part programming for pocket milling with repeat count.
7	Manual part programming for mirroring using sub program.
8	Manual part program using macros.
9	Automatic part programming using high end CAD/CAM software's

## Supplementary learning Material:

### Curriculum Revision:

Version:	1
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22