

# GUJARAT TECHNOLOGICAL UNIVERSITY

## MECHANICAL (CAD/CAM) (08)

CAD / CAM SYSTEMS

SUBJECT CODE: 2720822

SEMESTER: II

**Type of course:** Engineering Science

**Prerequisite:** Zeal to learn the subject

**Rationale:** Computer Aided Design systems are successful in manufacturing as they replace the specifications of numerical parameters, a task difficult for humans to perform reliably. Moreover, editing of visual realism is much more natural for humans to perform. The term CAD/CAM systems implies that any engineer can use both systems combined or individually for designing a product or controlling manufacturing processes.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2 <sup>#</sup>	2	5	70	30	20	10	10	10	150

**Contents:**

Sr. No	Topic	Lectures	Weightage %
<b>1</b>	<b>Introduction:</b> Introduction, Reasons for implementing a CAD system, Benefits, Features of CAD software, 2D and 3D Geometric transformations, homogeneous coordinates.	<b>7</b>	<b>15%</b>
<b>2</b>	<b>Curves and Surfaces:</b> Parametric representation of synthetic curves Hermit cubic splines Bezier curves, B-splines. Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.	<b>7</b>	<b>15%</b>
<b>3</b>	<b>Solid Modelling, Data Structures and Data Exchange:</b> Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG). Data structures for CAD Models, Graphics standards – Data exchange format, evolution- features of various interfaces GKS, IGES, DXF, PDES, STEP. Networking- networking techniques, LAN, components, wiring methods, network interface cards, network standards.	<b>8</b>	<b>20%</b>

4	<b>CNC Machine Tools:</b> Concept of CNC and development of its technology, advantages, applications, classification of CNC Machine, axis designations, interpolators- linear and circular interpolators. <b>Hardware:</b> CNC Machine building, structural details, CNC block diagram, guideways - friction and antifriction, recirculating ball screws, planetary roller screw, recirculating roller screw, types of indexing, automatic tool changers (ATC), automatic pallet changers (APC), timing gear belt, types of control, concept of DNC.	7	20%
2	<b>System drives and control system:</b> <b>Spindle drives</b> - DC shunt motor, 3 phase AC induction motor & their comparison. <b>Feed drives</b> - stepper motor, servo principle, DC & AC servomotors. <b>Control system-</b> Types of encoders, absolute and incremental optical encoders, synchro, synchro-resolver, gratings, moire fringe gratings, inductosyn, laser interferometer.	4	15%
3	<b>Manual Part Programming for CNC:</b> Various controllers for CNC, Structure of a part program, G & M Codes, Types of programming, different compensations, Manual part programming using FANUC controllers: Canned cycles for lathe: G70, G71, G72, G73, G75, G76, G81; Canned cycles for Milling: G81, G82, G83, G73, G84,G74, Mirroring.	9	15%

#### References Books:

1. Parametric and feature based CAD/CAM, Shah J.J., Mäntylä M., 1995, John Wiley Sons Inc.
2. Mechatronics, HMT, McGraw Hill Education
3. James V. Valentino and Joseph Goldenberg, Introduction to Computer Numerical Control, 5<sup>e</sup>, Prentice Hall, Englewood Cliff, New Jersey, 2012.
4. Yoram Koren, Computer control of Manufacturing Systems, McGraw Hill, 2006
5. T.K. Kundra, P.N.Rao, N.K. Tewari, Numerical Control and Computer Aided Manufacturing, Tata McGraw Hill Publishing Company Ltd.
6. David Gibbs and Thomas Crandall, CNC Machining and Programming: An Introduction, Industrial Press Inc., 2003.

#### Course Outcome:

After learning the course the students should be able to:

1. Understand Computer Aided Manufacturing technology, through programming, setup, and operations of various Computer Numerical Control (CNC) machine tools.
2. Prepare programmes various CNC machine tools.
3. To use feature based modelling for design for manufacture and manufacturing as well.

#### List of Experiments

1. Drafting and Solid Modelling exegesis.
2. CNC machines hardware and their axis designations.
3. Manual part programming for CNC lathe without canned cycles
4. Manual part programming for CNC lathe for multipass turning and facing
5. Manual part programming for CNC lathe for undercutting, multi-pass threading and grooving
6. Manual part programming for profile milling with cutter radius compensation
7. Manual part programming for pocket milling with repeat count

**Design based Problems (DP)/Open Ended Problem:**

1. Develop a programme to generate a CNC programme from given CAD model. The program should be able to recognize features in the model and use appropriate techniques.

**Major Equipment:**

1. CAD Software.
2. CNC Turning Centre
3. CNC Milling Centre
4. Manual Part programming software.
5. Computational facility.

**List of Open Source Software/learning website:**

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website