



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Machine Design

Course / Subject Code : ME01000481

Course / Subject Name : Computer Aided Design

w. e. f. Academic Year:	2024-25
Semester:	1 st Semester
Category of the Course:	PCC

Prerequisite:	Nil
Rationale:	The course is intended to provide exposure of modelling techniques for curves, surfaces and solids. It also includes topics on feature based modelling, mass property calculations and assembly modelling. Topic on CAD data formats and exchange standards is also included

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Students will understand fundamentals of computer graphics and geometrical modelling.	A
2	Students will learn various techniques for surface and solid modelling.	N
3	Students will learn various techniques for surface and solid modelling.	N
4	Students will learn assembly modelling and CAD data exchange.	E

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction: Conventional and Computer aided design processes, Product Life	2	05



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	Cycle and Role of CAD, Applications of CAD.		
2.	Principles of Computer Graphics: Introduction, graphic primitives, Plotting of analytical Curves, Coordinate systems, Half-Spaces and Homogeneous Coordinates, 2D (Translations, Rotation, Scaling and Shear) and 3D transformation (Translations, Rotation, Scaling, Shear, Orthographic and Perspective Projections), Windows to View port transformation, Clipping	8	15
3.	Curves: Introduction to curves, parametric continuity condition, geometric continuity condition, Conics, Spline representation, Hermite Curves (Algebraic and Geometric Forms, Basis Functions, Matrix Form, Tangent Vectors, Truncating and Sub-dividing, 3-point and 4-point interpolation), Bézier Curves (Bézier basis functions, control points, truncating and subdividing, composite Bézier curve, characteristics of Bézier curve), B-Spline Curves (Uniform and Non-uniform B-Spline basis function, Quadratic and Cubic B-Spline basis function, Closed B-Spline Curve, Continuity, NURBS, Representation of conics with NURBS)	09	25
4.	Surfaces: Introduction, Implicit and explicit function of surfaces, types of surfaces, Surface Representation, Surface Analysis (Tangent, Normal, Twist, Distance Calculation, Curvature, Tangent Plane), Plane Surface, Ruled Surface, Surfaces of Revolution, Tabulated Surfaces, Hermite Bi-cubic surface, Bézier Surface, Coons Surface,	07	20
5.	Solids: Introduction, Solid Representation, Properties of Solid model, Regularized Boolean set operations, Primitive instancing, Sweep representations, Comparison of representations	05	10
6.	Advanced Topics: Feature Based Modelling: Features and primitives, Feature entities, 3D sketching, Feature representation, creating features, Parametrics, Relations and constraints, Feature manipulations Geometric and Mass Properties: Geometric Properties, Calculate length of contours and curves, Calculate areas, Calculate centroids, Calculate inertia properties, Mass Properties, Properties Evaluation. Assembly Modelling: Differences between part and assembly modelling, Mating conditions, Bottom-up assembly modelling approach, Top-down assembly modelling approach, WCS and mate methods to assemble parts, Managing assemblies, Working with subassemblies, Assembly	11	20



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	analysis.		
7.	CAD Database: Evaluation of data exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF.	03	05
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	20	30	30	10	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Mastering CAD / CAM Ibrahim Zeid McGraw-Hill
2. Geometric Modelling M Mortenson Industrial Press.
3. CAD / CAM: Theory and Practice Ibrahim Zeid McGraw-Hill
4. Mathematical Elements of Computer Graphics David F Roger McGraw Hill
5. Computer Graphics: C Version Hearn and Baker Pretice Hall of India
6. Curves and Surfaces for CAGD: A Practical Guide 5/e, Gerald Farin Morgan Kaufmann
7. Computer Graphics and Geometric Modelling David Salomon Springer.
8. Computer Aided Engineering Design Anupam Saxena and Birendra Sahay Springer
9. Mechanical Assemblies: Their Design, Manufacture, and Role in Product Development D E Whitney Oxford Press

(b) Open-source software and website:

1. <https://nptel.ac.in/courses/112102101>
2. <https://www.coursera.org/learn/introduction-cad-cam-practical-cnc-machining>

Suggested Course Practical List:

1. Programming Exercises for Point, Line, and Circle Plotting
2. Programming Exercises for Curves
3. Programming Exercises for Transformations



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4. Introduction to CAD Tools and Hardware
5. Surface Modelling
6. Solid Modelling
7. Programming Exercises for estimating surface and mass properties of model.
8. Assembly

List of Laboratory/Learning Resources Required:

1. 3D modelling software
2. Software for Analysis of components/assembly

Suggested Project List:

1. Create 3D solid model of any mechanical components
2. Create assembly of any mechanical device/machine using modeling software

Suggested Activities for Students:

1. Structural/Thermal analysis of any real world mechanical component

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