Subject Code: 01CA0103

Subject Name: Computer Aided Design

M.Tech. I Year – (Sem-1) CAD/CAM

Type of course: Program core

Prerequisite: Computer programming, Machine Design

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

Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Evaluation Scheme					Total Marks
				Theory Marks			Practical Marks		
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term Work (TW)	
4	---	2	5	50	30	20	25	25	150

Course Outcome

Students will be able to

1. Students will understand fundamentals of computer graphics and geometrical modeling.
2. Students will learn various techniques for surface and solid modeling.
3. Students will learn estimation of mass properties of model along with feature based modeling.
4. Students will learn assembly modeling and CAD data exchange.

| SR No	CONTENTS	TOTAL HOURS	WEIGHTAGE
1	**Introduction:** Conventional and computer aided design processes, Product Life Cycle and Role of CAD, Applications of CAD.	**02**	**5%**
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.	**08**	**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), Bezier Curves (Bezier basis functions, control points, truncating and subdividing, composite Bezier curve, characteristics of Bezier 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)	08	25%
4	**Surfaces:** Introduction, Implicit & 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, Bezier Surface, Coons Surface	06	20%
5	**Solids:** Introduction, Solid Representation, Properties of Solid model, Regularized Boolean set operations, Primitive instancing, Sweep representations, Boundary representations (B-rep), Constructive Solid Geometry (CSG), Comparison of representations.	05	10%
6	**Advanced Topics:** Feature Based Modeling: Features and primitives, Feature entities, 3D sketching, Feature representation, Creating features, Parametric, 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 Modeling: Differences between part and assembly modeling, Mating conditions, Bottom-up assembly modeling approach, Top-down assembly modeling approach, WCS and mate methods to assemble parts, Managing assemblies, Working with subassemblies, Assembly analysis	10	20%
7	**CAD Database:**	03	05%

Evaluation of data exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF				

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level
15	30	25	15	15

Legends: R: Remembrance**; U:** Understanding**; A:** Application, **N:** Analyze**, and E:** Evaluate
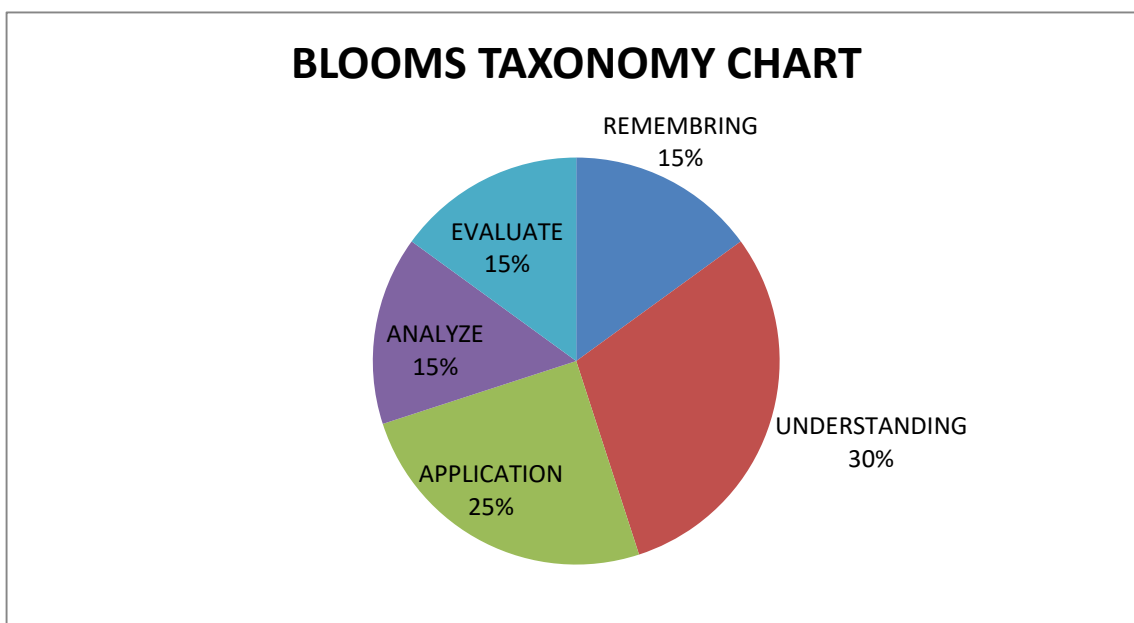
Reference Books:

1. Mastering CAD / CAM Ibrahim Zeid McGraw-Hill
2. Geometric Modeling 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 Prentice Hall of India
6. Curves and Surfaces for CAGD: A Practical Guide 5/e, Gerald Farin Morgan Kaufmann
7. Computer Graphics and Geometric Modeling 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

List of Experiments:

Laboratory sessions should be conducted to include followings. Apart from conventional laboratory sessions, students should be given topics from syllabus for which they should compile literature and present the same.

1. Exercises for Point, Line, Circle and Curves
2. Exercises for Synthetic Curves
3. Exercises for Transformations
5. Surface Modeling
6. Solid Modeling
7. Exercises for estimating surface and mass properties of model.
8. Assembly of Mechanical components.
9. Analysis of Mechanism.
10. Animation