COURSE TITLE	**COMPUTER AIDED DESIGN**
COURSE CODE	**01CA1101**
COURSE CREDITS	**3**

Objective:

1 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 andassembly modelling. Topic on CAD data formats and exchange standards is also included

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

1 Apply fundamental concepts of computer graphics and geometrical modelling to construct basic graphical models.

2 Analyze and apply various techniques for surface and solid modeling in engineering design problems.

3 Apply methods to estimate mass properties of models and analyze feature-based modeling approaches for design optimization.

4 Apply assembly modeling techniques and analyze CAD data exchange methods for interoperability between systems.

Pre-requisite of course: Computer Programming, Machine Design

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	**Introduction** Conventional and computer aided design processes, Product Life Cycle and Role of CAD, Applications of CAD, Role of CAD in Additive manufacturing and part design.	2
2	**Principles of Computer Graphics** Introduction, graphic primitives, Plotting of analytical Curves, Coordinate systems, Half-Spaces and Homogeneous Coordinates, 2D transformation (Translations, Rotation, Scaling and Shear), 3D transformation (Translations, Rotation, Scaling, Shear, Orthographic and Perspective Projections), Windows to View port transformation, Clipping	8

Contents : Unit	Topics	Contact Hours
3	**Curves** Introduction to curves, parametric continuity condition, Geometric continuity condition, Conics, Spline representation, 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), Bezier Curves (composite Bezier curve, characteristics of Beziercurve), B-Spline Curves (Uniform and Non-uniform B-Spline basis function, Quadratic and Cubic B-Spline basis function), B-Spline Curves (Closed B-Spline Curve, Continuity, NURBS, Representation of conics with NURBS)	8
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, blending surface, surface manipulation.	6
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	5
6	**Advanced Topics** 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., 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
7	**CAD Database** Evaluation of data exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF, Communication standards LAN, WAN,MAN.	3
Total Hours		**42**

Textbook :

1 Geometric Modelling , M Mortenson , Industrial Press, 2006

2 CAD / CAM: Theory and Practice, Ibrahim Zeid , McGraw-Hill , 2009

References:

1 Mastering CAD / CAM, Mastering CAD / CAM, Ibrahim Zeid , McGraw-Hill , 2004

2 Mathematical Elements of Computer Graphics , Mathematical Elements of Computer Graphics , David F Roger , McGraw-Hill , 2017

3 Computer Graphics, C Version, Computer Graphics, C Version, Hearn and Baker , Pearson Education India, 2002

4 Curves and Surfaces for CAGD: A Practical Guide , Curves and Surfaces for CAGD: A Practical Guide , Gerald Farin, Morgan Kaufmann Publishers In, 2001

5 Computer Graphics and Geometric Modeling, Computer Graphics and Geometric Modeling, David Salomon, Springer, 2013

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 Lecture and Discussion

Supplementary Resources:

1 https://nptel.ac.in/courses/112/102/112102101/