Course Syllabus
Gyanmanjari Institute of Technology
Semester- 2 (B.Tech.)

Subject : Computer Aided Design -BETME12301

Type of course: Undergraduate - Major

Prerequisite: Engineering Graphics & Design

Rationale:

Computers have become inevitable in today's era and find their application in various stages of product development. This course intends to introduce students to use of computers in the phases of product design viz. conceptualization, geometric modeling, graphical representation and finite element analysis. The students of the mechanical engineering programme are mainly involved in drafting, modeling, analysis, manufacturing, inspection and planning activities at industries. Hence for all such activities, reference document is the drawing of components/assemblies to be manufactured. In this context, it is a priority to prepare, read and interpret these drawings correctly for production of components and assemblies accurately and precisely.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	-	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course content	Hrs	% Weigh tage
1	**Introduction:** A typical product cycle, CAD tools for the design process of product cycle, CAD / CAM system evaluation criteria, Input / Output devices; Graphics Displays: Refresh display, DVST, Raster display, pixel value and lookup table, estimation of graphical memory, LCD, LED fundamentals. Concept of Coordinate Systems: Working Coordinate System, Model Coordinate System. Line and Curve generation algorithm: DDA, Bresenham's algorithms.	10	18%
2	**Curves and Surfaces:** Parametric representation of lines: Locating a point on a line, parallel lines, perpendicular lines, distance of a point, Intersection of lines. Parametric representation of circle, Ellipse, parabola. Synthetic Curves: Concept of continuity, Cubic Spline: equation, properties and blending. Bezier Curve: equations, properties; Properties and advantages of B-Splines. Various types of surfaces along with their typical applications	14	22%
3	**Mathematical representation of solids:** Geometry and Topology, Comparison of wireframe, surface and solid models, Properties of solid model, properties of representation schemes, Concept of Half-spaces, Boolean operations. Schemes: B-rep, CSG, Sweep representation.	8	16%
4	**Geometric Transformations:** Homogeneous representation; Translation, Scaling, Reflection, Rotation, Shearing in 2D and 3D; Orthographic and perspective projections. Window to View-port transformation.	8	16%
5	**Finite Element Analysis:** Review of stress-strain relation and generalized Hooke's Law, Plane stress and Plane strain conditions; Concept of Total Potential Energy; Basic procedure for solving a problem using Finite Element Analysis. 1-D Analysis: Concept of Shape function and natural coordinates, strain – displacement matrix, derivation of stiffness matrix for structural problems, properties of stiffness matrix. 1-D structural	20	28%

	problems with elimination and penalty approaches, 1-D thermal and fluid problems. Trusses and Beams: Formulation of stiffness matrix, simple truss problems to find displacement, reaction and stresses in truss members. Structural analysis using Euler-Bernoulli beam element.		

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Design** Design a structural machine component from a workshop using a design software method and upload it on a GMIU web portal.	10
2	**Assembly** Prepare a CAD model, assemble it and upload it on a GMIU web portal.	10
3	**Simulation** Perform FEA and compare results of conventional design and upload on a GMIU web portal	10
Total		30

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (**Revised Bloom's Taxonomy**)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	35%	30%	10%	0%	5%

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.

Course Outcome:

After learning the course the students should be able to:	
CO1	Understand and appreciate the use of computers in product development.
CO2	Understand the concept of parametric reorientation.
CO3	Apply algorithms of graphical entity generation.
CO4	Analyze mathematical aspects of geometrical modeling.
CO5	Design and use finite element methods for analysis of simple components.

List of Practical

Sr. No	Descriptions	Unit No	Hrs
1	Preparation of a programme for plotting lines and curves using algorithms learned.	1	2
2	Design for 3-D modeling.	3	2
3	Design for Assembly modeling.	3	4
4	Design for surface modeling.	2	2
5	Design for geometric transformation of curves and surfaces.	4	4
6	Introductory Design for finite element analysis.	5	2
7	Design for FEA of trusses and beams.	5	4
8	Design for FEA of 1-D thermal problems.	5	4
9	Design for FEA of 1-D fluid problems.	6	4
10	Design for FEA of 1-D structural problems.	7	4
	Total		30

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Ibrahim Zied, CAD / CAM: Theory and Practice, McGraw-Hill

[2] Hearn E J and Baker M P, Computer Graphics, Pearson.

[3] Chandrupatla T A and Belegundu A D, Introduction to Finite Elements in Engineering, PHI.

[4] Engineering Graphics, M.B.Shah, B.C.Rana, Pearson Education