C. U. SHAH UNIVERSITY
Wadhwan City

FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Mechanical Engineering
SEMESTER: - VI
CODE: - 4TE06CDE1
NAME – Computer Aided Design and Engineering

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
							Theory				Practical (Marks)			Total
		Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE06CDE1	Computer Aided Design and Engineering	4	0	2	6	5	30	1.5	70	3	---	20	30	**150**

Objectives: - The objective of this course is to provide foundation for application of computer in the area of generating models for engineering products, to visualize their assembly for final product, to analyze parts for various kinematic and dynamic conditions. To understand the need in Design for the Finite Element Method.

Prerequisites: -Basics of drawing and mechanical design, C programming, Computer soft skill, Basic understanding of Matrices.

Course Outline:-

Sr. No.	Course Content	Hours
1	**Fundamentals of CAD** Introduction, Reasons for implementing a CAD system, Computer Aided Process application, conventional design vs CAD. Benefits, Hardware, CAD softwares, Technical specification of CAD workstation, operating system	04
2	**Computer Graphics** Scan conversions, DDA and Breshnham's algorithm for generation of various figure, 2D and 3D transformations: Scaling, Translation, Rotation, Mirroring, Clipping, Homogeneous Transformation matrix.	08
3	**Geometrical Modeling** Types & mathematical representation of curves, wire frame models, entities, representations, parametric representations. Review of vector algebra, lines, circle, ellipse, parabolas, Parametric representation of synthetic curves, cubic curves, B - spline, Bezier spline, sweep curves, Bi – Parametric representation of surfaces, Surfaces & solids – model, entities, representations, fundamentals of surface and solid modeling, B-rep, constructive solid geometry (CSG), analytical modeling, sweep. Solid manipulation, visual realism. Computer aided design of Mechanical Elements & Mechanical Assembly with Rendering animation. Capabilities of various commercially available software in the area of CAD.	13

4	**CAD/CAM Data Exchange**: Evaluation of Data Exchange format**,** Standards for graphics programming, features of GKS, other graphics standards, PHIGS, IGES, PDES, STL, DXF. Standards in CAD.	05
5	**Computer aided design of machine components:** Development of programs in C++ design, drawing & plotting of Machine Elements shafts gears, pulleys, flywheel, connecting rods.	05
6	**Introduction to FEM:** basic concepts, historical back ground, application of FEM, general description, comparison of FEM with other methods, Variational approach, Galerkin's Methods. Co-ordinates, basic element shapes, interpolation function. Virtual energy principle, Rayleigh- Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain displacement relations	08
7	**1-D & 2-D Problem:** 1-D structural problems, axial bar element, stiffness matrix, load vector, temperature effects, Quadratic shape function. Analysis of Trusses, Plane Truss and Space Truss elements.1 - D Heat conduction,1- D fin element, 2 - D heat conduction problems.	10
8	**Optimization:** Introduction, design synthesis, Engineering vs Optimum Design, Objectives of Optimization, Classification of Optimization problems and their procedure, techniques of optimization, Optimized design of machine components, Optimization Software.	07

Learning Outcomes:-

At the end of the course

- To familiarize the basics of CAD.
- Writing interactive programs in C++ for mechanical design problems.
- Various aspects of data storage, manipulation & expanding its capability
- The student will be able to understand the numerical methods involved in Finite Element Theory.
- Students will able to derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts.

Teaching & Learning Methodology:

- Lecture method using standard teaching aids.
- Quiz/Seminar/Expert lectures.
- Performing and study the Experiments in fluid power lab.

Books Recommended:

1. CAD/CAM: Computer Aided design and Manufacturing by **Mikell Groover and Zimmer**, Pearson Education
2. CAD/CAM Theory & Practice by **Ibrahim Zeid**, Tata Mc Graw Hill
3. CAD/CAM and Automation by **Farazdak Haideri**, Nirali Prakashan
4. Mathematical Elements for Computer Graphics - **David F. Rogers & J. Alan Adams** McGraw Hill
5. Optimization Methods by **S.S. Rao**, New Age International Publications
6. Introduction to finite elements in engineering **Tirupathi K. Chandrupatla and Ashok D.Belegundu.**
7. An Introduction to Finite Element Methods **J. N. Reddy** – Mc Graw Hill.

8. The finite element methods in Engineering **S.S. Rao** - Pergamon, New York.
9. A Textbook of Finite Element Analysis **P. Seshu**
10. Computer Graphics & design by **P. Radhakrishnan, C.P. Kothanadaraman**, New age publication
11. Computer Aided Engineering & Design by **Jim Browne**, New Age International Publications,
12. Computer Aided Analysis and Design of Machine Elements by **Rao V. Dukkipati, M. Ananda Rao, Rama Bhat**, New Age International Publications
13. CAD / CAM - **Chris McMohan**, Jimmie Brown Addison – Wesley
14. CAD/CAM/CAE by **Chougule N K**, Scitech Publications Pvt. Ltd.
15. Technology of CAD / CAM - **Dr. Surendrakumar & Dr. A.K.Jha** - Dhanpat Rai Sons

E-Resources:

1. ASME Journal of Mechanical Design
2. IEEE Computer Graphics and Applications
3. IE Mechanical Engg.