ANNA UNIVERSITY, CHENNAI

NON- AUTONOMOUS COLLEGES

AFFILIATED TO ANNA UNIVERSITY

M.E., COMPUTER AIDED DESIGN

REGULATIONS 2025

PROGRAMME OUTCOMES (POs):

PO	Programme Outcomes
PO1	An ability to independently carry out research /investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO	Programme Specific Outcomes
PSO1	Apply advanced CAD, optimization, and manufacturing techniques to design efficient and innovative products.
PSO2	Integrate interdisciplinary engineering knowledge for effective product development and industry problem-solving.

ANNA UNIVERSITY, CHENNAI

UNDERGRADUATE CURRICULUM(NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: M.E. Computer Aided Design **Regulations:** 2025

Abbreviations:

BS – Basic Science (Mathematics, Physics, Chemistry)

ES – Engineering Science (General (**G**), Programme Core (**PC**), Programme Elective (**PE**)

SD – Skill Development

OE – Open Elective

L –Laboratory Course

T – Theory

LIT –Laboratory IntegratedT heory

PW – Project Work

TCP –Total Contact Period(s)

SEMESTER I

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.	MA25C06	Applied Mathematical and Statistical Modelling	LIT	3	1	0	4	4	BS
2.	ED25C02	Advanced Mechanics of Materials	T	3	0	0	3	3	ES (PC)
3.	CD25C01	Computer Graphics	T	3	0	2	5	4	ES (PC)
4.	ED25C01	Topology Optimization and Generative Design	T	3	0	0	3	3	ES (PC)
5.	ED25C06	Integrated Product Design and Development	T	3	0	0	3	3	ES (PC)
6.	ED25C04	Design Practice with CAD Tools Laboratory	L	0	0	4	4	2	ES (PC)
7.	CD25101	Technical Seminar	---	0	0	2	2	1	SD
						Total Credits	**24**	**20**	

Semester II

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.		Finite Element Methods	LIT	2	0	4	6	4	ES (PC)
2.		Solid Freeform Manufacturing	T	3	0	0	3	3	ES (PC)
3.		Product Life-cycle Management	T	3	0	0	3	3	ES (PC)
4.		Programme Elective I	T	3	0	0	3	3	ES (PE)
5.		Programme Elective II	T	3	0	0	3	3	ES (PE)
6.		Programme Elective III	T	3	0	0	3	3	ES (PE)
7.		Product Design Studio	L	0	0	4	2	2	ES (PC)
8.		Research Article Replication Practice	L	0	0	2	2	1	ES (PC)
9.		Industry-Oriented Course I	--	1	0	0	1	1	SD
10.		Self-Learning Course	--	-	-	-	-	1	-
						Total Credits	**26**	**24**	

Semester III

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.		Programme Elective IV	T	3	0	0	3	3	ES (PE)
2.		Programme Elective V	T	3	0	0	3	3	ES (PE)
3.		Programme Elective VI	T	3	0	0	3	3	ES (PE)
4.		Industry-Oriented Course II	--	1	0	0	1	1	SD
5.		Open Elective	T	3	0	0	3	3	-
6.		Project Work I	PW	0	0	12	12	6	SD
						Total Credits	**25**	**19**	

Semester IV

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P			
1.		Project Work II	PW	0	0	24	24	12	SD
						Total Credits	**24**	**12**	

PROGRAMME ELECTIVE COURSES (PE)

S. No.	Course Code	Course Title	Periods per week			Total Contact Periods	Credits
			L	T	P		
1.		Reverse Engineering	3	0	0	3	3
2.		Design for Sustainability	3	0	0	3	3
3.		Composite Materials and Mechanics	3	0	0	3	3
4.		Quality Concepts in Design	3	0	0	3	3
5.		Automated Product Manufacturing Systems	3	0	0	3	3
6.		Design of Hydraulic and Pneumatic Systems	3	0	0	3	3
7.		Mechanical Measurements and Analysis	3	0	0	3	3
8.		Surface Engineering	3	0	0	3	3
9.		Vehicle Dynamics	3	0	0	3	3
10.		Human Factors Engineering in Product Design	3	0	0	3	3
11.		Advanced Machine Tool Design	3	0	0	3	3
12.		Material Handling Systems and Design	3	0	0	3	3
13.		Creativity and Innovation Management	3	0	0	3	3
14.		Computational Fluid Dynamics	3	0	0	3	3
15.		Vibration, Fracture, and Failure Analysis	3	0	0	3	3
16.		Design and Analysis of Advanced Mechanisms	3	0	0	3	3
17.		Optimization Techniques in Design	3	0	0	3	3

Semester I

MA25C06	Applied Mathematical and Statistical Modelling	L	T	P	C
		3	1	0	4

Course Objectives:

- To equip students with advanced mathematical techniques, specifically Fourier Transforms, for formulating and solving partial differential equations that model fundamental mechanical engineering phenomena such as heat transfer, vibrations, and fluid flow.
- To provide a strong foundation in statistical inference, enabling students to estimate population parameters (like material properties and process capabilities) from experimental data and assess the quality and reliability of these estimators.
- To enable students to design efficient, structured experiments and apply appropriate statistical tests to make valid, data-driven decisions for comparing processes, optimizing designs, and solving complex engineering problems.

Fourier Transform: Definitions, Properties, Transform of elementary functions, Dirac delta function, Convolution theorem, Parseval's identity, Solutions to partial differential equations: Heat equation, Wave equation, Laplace and Poison's equations.

Estimation Theory: Unbiasedness, Consistency, Efficiency and sufficiency, Maximum likelihood estimation, Method of moments.

Testing of Hypothesis: Sampling distributions, Small and large samples, Tests based on Normal, t, Chi square, and F distributions for testing of means, variance and proportions, Analysis of r x c tables, Goodness of fit, independent of attributes.

Design of Experiments: Analysis of variance, One way and two-way classifications, Completely randomized design, Randomized block design, Latin square design, 2^2 Factorial design.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.

References:

1. Andrews, L. C., & Shivamoggi, B. K. (2003). Integral transforms for engineers. Prentice Hall of India.
2. Devore, J. L. (2014). Probability and statistics for engineering and the sciences, Cengage Learning.
3. Johnson, R. A., Miller, I., & Freund, J. (2015). Miller and Freund's probability and statistics for engineers, Pearson Education Asia.

E-resources:

1. https://www.edx.org/learn/probability-and-statistics/massachusetts-institute-of-technology-probability-the-science-of-uncertainty-and-data
2. https://www.itl.nist.gov/div898/handbook/
3. https://ocw.mit.edu/courses/2-830j-control-of-manufacturing-processes-sma-6303-spring-2008

ED25C02	Advanced Mechanics of Materials	L	T	P	C
		3	0	0	3

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the theory of elasticity and advanced stress analysis techniques essential for the design and evaluation of mechanical and structural components. The course emphasizes the formulation and solution of stress-strain relations, equilibrium equations, and compatibility conditions in various coordinate systems. It covers the analysis of flat plates, curved beams, torsional members, and rotating bodies, along with the evaluation of contact stresses and deflections. Students will develop the ability to apply analytical and energy methods to solve complex solid mechanics problems encountered in real-world engineering applications.

Elasticity: Stress-Strain relations and general equations of elasticity in Cartesian, Polar and curvilinear coordinates, theories of failure, differential equations of equilibrium, compatibility, boundary conditions-representation of three-dimensional stress of a tension generalized hook's law, St. Venant's principle, plane stress, Airy's stress function. Energy methods

Activities: Use MATLAB/ANSYS to visualize 3D stress states and Airy’s stress function solutions, Apply failure theories to real-life engineering components (e.g., pressure vessel, shaft).

Stresses In Flat Plates and Curved Members: Circumference and radial stresses, deflections, curved beam with restrained ends, closed ring subjected to concentrated load and uniform load, chain links and crane hooks. Solution of rectangular plates, pure bending of plates, deflection, uniformly distributed load, various end conditions.

Activities: Analyze deflection of a rectangular plate under UDL using ANSYS, Compare analytical vs FEM solutions for curved beams, Write a technical note on applications of plate theory in aerospace or civil structures.

Shear and Torsion: Location of shear centre for various thin sections, shear flows. Stresses and Deflections in beams subjected to unsymmetrical loading-kern of a section, General Torsional equation, Torsion of rectangular cross section, St.Venants theory, elastic membrane analogy, Prandtl’s stress function, torsional stress in hollow thin walled tubes and multi-walled sections

Activities: Find the shear center for an open thin-walled section experimentally (e.g., channel section), Use FEM to analyze torsional stresses in rectangular and hollow thin-walled tubes, Students design a beam subjected to unsymmetrical bending and justify choice of section.

Stresses in Rotating Members and Contact Stresses: Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness allowable speeds. Methods of computing contact stress-deflection of bodies in point and line contact applications

Activities: Calculate allowable speeds for rotating discs (e.g., turbine blade roots, flywheels), Use ANSYS/ABAQUS to simulate stress in rotating discs with varying thickness, Mini project on predicting failure in machine components under contact stresses.
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%
Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)
References: 1. Boresi, A. P., & Schmidt, R. J. (2009). *Advanced mechanics of materials*. Wiley India Pvt. Ltd. 2. Hibbeler, R. C. (2011). *Mechanics of materials*. Prentice Hall. 3. Cook, R. D., & Young, W. C. (1999). *Advanced mechanics of materials*. Prentice Hall. 4. Chandramouli, P. N. (2017). *Theory of elasticity*. Yes Dee Publishing. 5. Srinath, L. S. (2010). *Advanced mechanics of solids*. Tata McGraw-Hill. 6. Timoshenko, S., & Goodier, J. N. (2010). *Theory of elasticity*. Tata McGraw-Hill.

	Description of CO	PO	PSO1	PSO2
CO1	Understand and apply fundamental concepts of elasticity, stress-strain relations, and equilibrium equations to analyze mechanical components under various loading conditions.	--	--	--
CO2	Analyze stresses and deflections in flat plates, curved beams, and torsional members using analytical and energy methods.	PO3 (3)	2	3
CO3	Evaluate stresses in rotating members and contact stresses in mechanical components for design and failure analysis.	PO1 (3), PO3 (2)	3	2
CO4	Develop problem-solving skills to formulate and solve complex solid mechanics problems encountered in real-world engineering applications.	PO1 (3), PO2 (2)	2	3

CD25C01	Computer Graphics	L	T	P	C
		3	0	2	4

Course Objectives:

The primary objective of this course is to equip students with a comprehensive understanding of computer graphics principles, algorithms, and modeling techniques essential for engineering applications. The course aims to build foundational knowledge in 2D and 3D graphics, scan-conversion algorithms, and geometric transformations. It develops the ability to model curves, surfaces, and solids using analytical and synthetic methods, including advanced tools such as NURBS. Students will gain proficiency in visibility determination and rendering techniques to simulate realistic graphics. Additionally, the course introduces concepts of assembly modeling, tolerance analysis, and product lifecycle management to integrate design, simulation, and visualization skills relevant to modern computer-aided design environments.

Fundamentals of Computer Graphics and Scan Conversion: Introduction to Computer Graphics, Scan-conversion of Lines: Digital Differential Analyzer (DDA) Algorithm, Bresenham's Line Drawing Algorithm, Scan-conversion of Circles and Ellipses: Bresenham's Circle Drawing Method, Midpoint Circle Algorithm, Drawing Ellipses and Other Conics

Activities: Manual Implementation of Bresenham's Line and Circle Algorithms: Plot pixels on graph paper and replicate the same using code; observe the difference in pixel placement and accuracy.

2D and 3D Transformations and Clipping: Introduction to 2D and 3D Transformations, Transformation Matrix, 2D Transformations: Identity, Scaling, Rotation, Translation, Reflection, Shear, Rotation about Arbitrary Point, Combined Transformations. Clipping Techniques: 2D Clipping: Point, Line, Polygon Clipping, 3D Viewing and Clipping, Text Clipping

Activities: Hands-on 2D Transformations Using Paper Cutouts: Physically perform translation, rotation, scaling, reflection, and clipping on shape cutouts to understand transformation matrices.

Curve and Surface Modeling: Introduction to Curves: Analytical Curves: Line, Circle, Conics, Synthetic Curves: Hermite Cubic Spline, Bézier Curve, B-Spline Curve, Curve Manipulations, Introduction to Surfaces: Analytical Surfaces: Plane, Ruled, Revolution, Tabulated Cylinder, Synthetic Surfaces: Hermite Bicubic, Bézier, B-Spline, Surface Manipulations

Activities: Sketching and Interpreting Bézier Curves: Manually construct Bézier curves using control points and then compare results with simulation using MATLAB or Python.

Nurbs and Solid Modeling Techniques: NURBS Basics: Curves, Lines, Arcs, Circle, Bilinear Surface, Solid Modeling Techniques: Regularized Boolean Set Operations, Primitive Instancing, Sweep Representations, Boundary

Representations, Constructive Solid Geometry (CSG) Comparison of Solid Representations, User Interface for Solid Modeling

Activities: Solid Modeling Using Free CAD Tools: Design simple components by applying Boolean operations and sweep features to reinforce constructive solid geometry concepts.

Visibility, Rendering, and Shading Techniques: Visible and Hidden Surface Removal: Coherence, Bounding Volumes, Back Face Culling, Painter's Algorithm, Z-Buffer, Floating Horizon, Roberts Algorithm, Object Rendering: Lighting and Illumination Models, Shading Techniques: Flat, Gouraud, Phong, Polygon Mesh Shading, Advanced Effects: Transparency, Shadows, Texture Ray Tracing, Ray Casting, Radiosity, Color Models

Activities: Shadow and Visibility Demonstration Using 3D Block Models: Use a torchlight on physical models to simulate surface visibility, shading, and hidden surface removal principles.

Assembly Modeling and Product Lifecycle: Assembly of Parts: Design for Manufacture (DFM), Design for Assembly (DFA), Computer-Aided DFMA, Position & Orientation Inferences, Tolerance Analysis, Center of Gravity & Mass Property Calculation, Mechanism Simulation, Product Lifecycle Management (PLM): Product Development and Management, Models for New Product Development, Graphics & Computing Standards, Data Exchange Standards

Activities: CAD activity: Assemble 2–3 parts with constraints and generate exploded views**.**, Case study discussion: How PLM integrates design, manufacturing, and lifecycle management**.**

List of Experiments:

Cad Module

1. Sketching and Part modelling (Solid modelling, Surface modelling, Feature manipulation) of mechanical components using CAD software package.
2. Assembly (Constraints, Exploded Views, Interference check) and Drafting (Layouts, Geometric Dimensions &Tolerance Standards, Sectional Views, & Detailing) of mechanical components using CAD software package
3. Working with CAD Data Exchange formats: IGES, PDES, PARASOLID, DXF and STL.
4. Study and exercise on freeform modelling.
5. Reverse engineering the given product/component and convert the data into 3Dmodel.
6. Exercise on. STL file Preparation, Slicing, Support Structure Generation & Build setup Preparation.

List of items (hardware/software) required:

1. Computers 24 Nos. 2. CAD software Package 3. Open source CAD software for Additive Manufacturing 4. CAE Software package

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)

References:

1. Boothroyd, G. (1991). Assembly automation and product design. Marcel Dekker.
2. Chitale, A. K., & Gupta, R. C. (2023). Product design and manufacturing (7th ed.). PHI Learning Private Limited.
3. Rogers, D. F., & Adams, J. A. (2017). Mathematical elements for computer graphics (2nd ed.). Tata McGraw-Hill.
4. Hearn, D. D., & Baker, M. P. (1997). Computer graphics C version (2nd ed.). Prentice Hall.
5. Zeid, I. (2006). Mastering CAD/CAM (2nd ed.). McGraw Hill.
6. Newman, W. M., & Sproull, R. F. (2001). Principles of interactive computer graphics (1st ed.). McGraw Hill.

E-Resources:

1. Bhattacharya, S. (2025). Computer Graphics [NPTEL Online Course]. Indian Institute of Technology Guwahati. Retrieved from https://onlinecourses.nptel.ac.in/noc25_cs133
2. Indian Institute of Technology Delhi, Department of Computer Science & Engineering. (2023). Introduction to Computer Graphics [NPTEL Course No. 106102065]. National Programme on Technology Enhanced Learning (NPTEL). Retrieved from https://nptel.ac.in/courses/106/102/106102065
3. Das, S. (2008). Lecture Series on Computer Graphics [YouTube Video Lectures]. Indian Institute of Technology Madras. Retrieved from https://www.youtube.com/watch?v=_f_pHgRQPPE

	Description of CO	PO	PSO1	PSO2
CO1	Understand and implement fundamental computer graphics algorithms such as scan-conversion, 2D/3D transformations, and clipping techniques.	--	---	--
CO2	Model curves, surfaces, and solids using analytical and synthetic methods, including NURBS and solid modeling techniques.	PO3 (3)	3	2
CO3	Apply visibility determination, rendering, and shading techniques to generate realistic images and simulations.	PO3 (3)	3	2
CO4	Integrate CAD assembly modeling, tolerance analysis, and product lifecycle management concepts for effective product design and visualization.	PO1 (2), PO2 (2), PO3 (3)	3	3

ED25C01	Topology Optimization and Generative Design	L	T	P	C
		3	0	0	3

Course Objective:

This course aims to provide students with a comprehensive understanding of optimization techniques applied to mechanical engineering design, with a focus on topology optimization and generative design. It introduces mathematical formulations and programming methods such as linear, nonlinear, and integer optimization, along with sensitivity and gradient-based approaches. Students will explore topology optimization techniques including SIMP and level set methods for efficient material distribution, and learn generative design principles using rule-based and AI-driven systems integrated with additive manufacturing. The course also addresses advanced topics such as multi-objective optimization, robust and reliability-based design, and sustainability considerations. By the end of the course, students will be equipped to apply computational and algorithmic methods to develop optimized, innovative, and practical engineering solutions.

Fundamentals of Optimization in Mechanical Engineering: Introduction to Optimization Techniques, Importance of Optimization in Mechanical Design, Applications of Topology Optimization and Generative Design in Mechanical Systems. Mathematical Formulation of Optimization Problems, Mathematical Programming Methods: Linear, Nonlinear, and Integer Programming Sensitivity Analysis and Gradient-Based Methods

Activities: Manual Formulation of Optimization Problems: Students will identify a simple mechanical design problem (e.g., truss structure) and manually define its objective function, design variables, and constraints. This helps in understanding mathematical modeling of real-world problems.

Python Implementation of Gradient-Based Optimization: Implement a basic gradient-based method (like steepest descent) to minimize a simple function (e.g., weight minimization of a cantilever beam). Students analyze convergence behavior and parameter effects.

Principles of Topology Optimization: Introduction to Topology Optimization, Problem Formulation and Design Domain, Material Distribution Methods (SIMP, Level Set), Optimization Algorithms for Topology Optimization, Case Studies and Applications in Mechanical Components

Activities: Topology Optimization Using 2D SIMP Method: Use open-source tools or coding to perform 2D topology optimization of a bracket. Students modify boundary conditions and volume fraction to observe material distribution changes.

Generative Design and Computational Techniques: Overview of Generative Design Principles, Evolutionary Algorithms for Design Generation, Rule-Based and AI-Based Generative Systems, Integration with Additive Manufacturing, Generative Design Tools and Case Studies

Activities: Generative Design with CAD Software: Perform a generative design study using CAD Sofware for a component (e.g., bike stem or connecting rod). Analyze various generated design options based on load paths and constraints.

Advanced Concepts and Future Trends: Multi-Objective Optimization and Trade-Off Strategies, Optimization Under Uncertainty, Robust and Reliability-Based Design, Sustainability in Design Optimization, Future Challenges and Research Trends in Topology Optimization and Generative Design

Activities: Multi-Objective Trade-off Analysis using Pareto Fronts: Use Python or Excel to generate Pareto fronts for two conflicting objectives (e.g., stiffness vs. weight). Students interpret the trade-off and identify optimal design decisions.

Case Study Presentation on Sustainable Generative Design;In groups, students research and present a real-world case (e.g., Airbus bracket or Nike Flyprint shoe) that uses generative design for sustainability. Focus on how design choices reduce material use or carbon footprint.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)

References:

1. Belegundu, A. D., and Chandrupatla, T. R., Optimization Concepts and Applications in Engineering, Cambridge University Press, 2011.
2. Chong, E. K. P., and Zak, S. H., Introduction to Optimization, Wiley, 2013.
3. Boyd, S., and Vandenberghe, L., Convex Optimization, Cambridge University Press, 2004.
4. Bohnacker, H., Gross, B., Laub, J., and Lazzeroni, C., Generative Design: Visualize, Program, and Create with Processing, Princeton Architectural Press, 2012.
5. Adeli, H., Advanced Structural Optimization, Chapman & Hall/CRC, 1994.

	Description of CO	**PO**	**PSO1**	**PSO2**
CO1	Apply optimization techniques (linear, nonlinear, integer programming) to solve mechanical design problems, focusing on material distribution and design efficiency.	PO1 (3), PO3 (2)	3	2
CO2	Implement gradient-based optimization methods for practical problems, such as minimizing weight in mechanical systems, and analyze convergence behavior.	PO1 (3), PO2 (2)	3	2
CO3	Perform topology optimization using SIMP and level set methods for efficient material distribution in mechanical components, and evaluate the optimization results.	PO1 (3), PO3 (3)	3	3
CO4	Use generative design principles, evolutionary algorithms, and AI-driven systems for design generation, with a focus on integrating with additive manufacturing.	PO2 (3), PO3 (3)	3	3

ED25C06	Integrated Product Design and Development	L	T	P	C
		3	0	0	3

Course Objective:

This course aims to provide a comprehensive understanding of the generic product development process, including product planning and customer need analysis. It enhances students' abilities to set product specifications and effectively generate, select, and test design concepts. Emphasis is placed on product architecture, industrial design, and Design for Manufacturing (DFM) principles. The course also introduces prototyping techniques, robust design through Design of Experiments (DoE), and the importance of patenting innovations. Additionally, it integrates economic principles and project management practices essential for successful new product development.

Introduction to Product Development: Overview of Product Development- Characteristics of Successful Products- Product Development Teams and Organizations- Challenges, Duration and Cost of Product Development- Product Development Process (Generic and Front-End)- Process Flows and Opportunity Identification.

Activities: Brainstorming Session: Identifying latent vs stated needs for a new product

Product Planning and Customer Needs: Product Planning Process- Identifying and Understanding Customer Needs- Importance of Latent Needs - Establishing Target and Final Specifications

Activities: Design Review Meeting: Present and defend a selected product concept

Concept Generation, Selection and Testing: Concept Generation Activities- Concept Selection: Screening and Scoring- Concept Testing Techniques and Caveats

Activities: Use mind maps to visually expand product features and functions

Product Architecture and Industrial Design: Product Architecture – Definition, Planning, and System-Level Design; Delayed Differentiation and Platform Planning; Industrial Design – Need, Process, Management, Quality Assessment.

Activities: Product Platform Case Study: Explore delayed differentiation in brands (e.g., Dell, Toyota)

Design for Manufacturing (DFM) Principles: DFM Process Overview- Integration of Design and Manufacturing Early in the Development Cycle- Cost and Complexity Considerations; Cross-functional Collaboration for Manufacturability.

Activities: Presentation: Pros and cons of different DFM strategies in a selected industry

Prototyping, Economics & Project Management: Prototyping: Principles, Planning, and Technologies- Product Development Economics – Cost Estimation and Analysis- Project Management: Task Representation, Planning, Execution-Postmortem Evaluation of Projects. **Activities:** Prototype Demo: Create and explain a low-fidelity prototype (paper or digital)
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%
Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)
References: 1. Ulrich, K. T., Eppinger, S. D., & Goyal, A. (2012). Product design and development, McGraw-Hill Education (India) Pvt. Ltd. 2. Crow, K. (n.d.). Concurrent engineering/integrated product development [Workshop book]. DRM Associates. 3. Otto, K. N., & Wood, K. L. (2016). Product design: Techniques in reverse engineering and new product development. Pearson Education, Inc. 4. Rosenthal, S. (1992). Effective product design and development. Business One Irwin. 5. Pugh, S. (1991). Total design: Integrated methods for successful product engineering. Addison Wesley Publishing..

	Description of CO	PO	PSO1	PSO2
CO1	Analyze customer needs and develop product specifications for successful product planning and development.	PO1 (3), PO3 (2)	2	3
CO2	Generate, select, and test design concepts using systematic methods including brainstorming and design reviews.	PO1 (3), PO3 (3)	3	2
CO3	Apply product architecture, industrial design, and Design for Manufacturing (DFM) principles in product development.	PO1 (2), PO3 (3)	3	3
CO4	Demonstrate prototyping techniques, economic analysis, and project management skills for integrated product development.	PO1 (2), PO3 (3)	2	3

ED25C04	Design Practice with CAD Tools Laboratory	L	T	P	C
		0	0	4	2

Course Objective:

The objective of this course is to equip students with the fundamental and practical knowledge of engineering drawing standards and CAD tools, enabling them to interpret and create accurate 2D and 3D representations of mechanical components and assemblies. The course aims to develop skills in applying BIS conventions, tolerancing, and geometric dimensioning, constructing orthographic projections, producing part and assembly drawings, and simulating basic kinematic mechanisms using CAD software for real-world mechanical applications.

Study exercise

1. Code of practice for Engineering Drawing, BIS/ASME specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.
2. Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of Geometric Dimensioning & Tolerancing.
3. Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed Drawing.

Sketching for solid modeling

4. Orthographic projection of mechanical parts: Hexagonal Nut, Sectioned Hollow stepped shaft, L – Bracket, Slotted Blocks, other similar parts.

Part Drawing, Assembly and Geometrical Properties

5. Bearings – Bush Bearing, Taper bearing
6. Valves – Safety and Non-return Valves.
7. Couplings – Flange, Oldham's, Muff, Gear couplings.
8. Joints – Universal, Knuckle, Gib & Cotter, Strap, Sleeve & Cotter joints.
9. Engine parts – Piston, Connecting Rod, Crosshead (vertical and horizontal), Stuffing box, Multi-plate clutch.
10. Machine Components – Screw Jack, Machine Vice, Lathe Tail Stock, Lathe Chuck, Plummer Block, Vane and Gear pumps.

Kinematics

11. Simulation of slider crank mechanism
12. Simulation of crank and rocker mechanism

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)

	Description of CO	PO	PSO1	PSO2
CO1	Apply engineering drawing standards, BIS/ASME specifications, and tolerancing principles for mechanical components.	PO1 (3), PO3 (2)	2	2
CO2	Create accurate 2D orthographic projections and detailed part drawings of mechanical components using CAD tools.	PO1 (3), PO3 (3)	3	2
CO3	Develop assembly drawings and interpret geometric properties of machine components and joints.	PO1 (2), PO3 (3)	3	2
CO4	Simulate basic kinematic mechanisms (slider crank, crank and rocker) using CAD software for mechanical applications.	PO1 (3), PO3 (3)	3	2

CD25101	Technical Seminar	L	T	P	C
		0	0	2	1

Course Objective:

The objective of this course is to develop the students' ability to research, organize, and deliver effective technical presentations on topics related to engineering design. It aims to enhance their communication skills, confidence, and ability to engage in technical discussions by encouraging peer interaction, critical questioning, and professional reporting.

The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to computer aided design topics and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

	Description of CO	PO	PSO1	PSO2
CO1	Conduct independent research on technical topics related to computer-aided design and engineering.	PO1 (3), PO3 (2)	2	2
CO2	Organize and deliver clear, effective technical presentations with confidence and professionalism.	PO2 (3), PO3 (2)	2	1
CO3	Prepare well-structured technical reports to document seminar topics accurately.	PO2 (3), PO3 (2)	2	1
CO4	Engage in technical discussions and respond to queries with clarity, demonstrating critical thinking.	PO1 (2), PO2 (2)	1	2