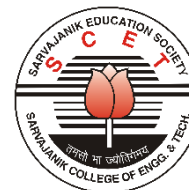




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Sarvajanik College of Engineering and Technology
Bachelor of Technology



Mechanical Engineering

B. Tech. Semester IV

Course Name: Computer Aided Design

Course Code: BTME19422

Type of course: HONOR – CAD/CAM

Prerequisite: None

Rationale of course: This course provides fundamental knowledge of computer-aided design connections to modeling and analysis tools. The course focuses on mathematical formulation and implementation of curves, surfaces, and solids in the design of mechanical components. This course will help enhance students' ability in using the different techniques used in the representation of mechanical parts.

Teaching and Examination Scheme:

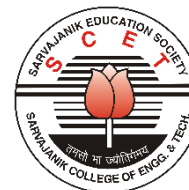
TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	200
3	0	4	5	60	25	15	60	40	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introduction to CAD: Fundamentals of CAD , Computers in industrial manufacturing, Design process , A typical product cycle, CAD tools for the design process of product cycle, Computer peripherals, Concept of coordinate systems: working coordinate system, model coordinate system, screen coordinate system , Benefits of computer aided design	4	9 %
2	Computer graphics: Graphics software and application software tools, graphic function in C languages, scan conversion of line and circle , developing algorithms/computer codes for transformations, DDA, Bresenham's algorithms , graphics exchange standards and database management systems	7	15 %
3	Curves, Surfaces & Solids: 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,	12	27 %



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Sr. No.	Topics	Teaching Hrs.	Module Weightage
	parabola and hyperbola, synthetic curves, various types of surfaces along with their typical applications. Geometry and topology, comparison of wireframe, surface and solid models, properties of solid model, properties of representation schemes, concept of half-spaces, boolean operations, B-rep, CSG, sweep representation, ASM, primitive instancing, cell decomposition and octree encoding.		
4	Transformations of geometry: Geometric and co-ordinate transformations, Two dimensional geometric transformations: Translation, scaling, reflection, rotation and shear; homogeneous coordinates, composite transformations, transformations in 3D, orthographic and perspective projections. window to view-port transformation	7	16 %
5	Finite Element Analysis: Introduction to FEA , finite element analysis steps, finite element modeling, Shape function and natural coordinates, displacement , strain and stress relationship, element stiffness matrix by potential energy approach, 1-D structural problems with elimination and penalty approach, 1-D thermal and fluid problems , analysis of trusses , plane stresses and plane strains, analysis software tools	12	27 %
6	Engineering optimization : Classical optimization, single variable optimization , multivariable optimization , optimum design procedure, mathematical formulation, Johnson’s method, optimized design of machine components	3	6 %

Percentage Distribution of Marks as per Bloom’s Taxonomy (Theory/Practical):

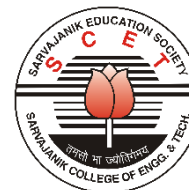
% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	10	25	15	15	25

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels (**Revised Bloom’s Taxonomy**)

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.



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Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher	Publication Year	Publication Edition
1	CAD / CAM: Theory and Practice	Ibrahim Zied	McGraw-Hill	2009	2 nd
2	Computer Aided Engineering Design	Anupam Saxena, Birendra Sahay	Springer	2005	5 th
3	Computer Graphics	Hearn E J and Baker M P	Pearson	2002	2 nd
4	Introduction to Finite Elements in Engineering	Chandrupatla T A and Belegundu A D	PHI	2012	4 th
5	CAD/CAM: Principles and Applications	P N Rao	McGraw Hill Education	2017	3 rd

Course Outcome (CO's):

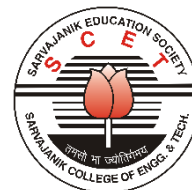
Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Describe the fundamental concepts of Computer Aided Design and its application in engineering field	9
CO-2	Develop algorithms and compute computer codes for transformations	15
CO-3	Create surface and solid models and apply it in engineering field	27
CO-4	Solve problem related to transformations of geometry	16
CO-5	Evaluate structural elements through FEA	27
CO-6	Identify and use of the optimization methodology for engineering field	6

Mapping of CO's with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	2	2	1	2	2	1	0	1	1	1	1	1	1	1
CO-2	3	3	2	2	3	1	1	0	2	2	0	0	1	3	1
CO-3	2	1	3	2	3	1	1	1	2	2	1	1	1	3	2
CO-4	2	2	2	1	2	1	0	0	1	1	0	0	0	2	1
CO-5	2	2	3	2	3	2	2	1	2	2	2	1	2	3	2
CO-6	2	2	2	2	1	0	0	0	0	0	0	1	1	2	1
Rationale*	14	12	14	10	14	7	5	2	8	8	4	4	6	14	8



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***Rationale of CO-PO-PSO Mapping:** This course highly maps with PO 1, 3, 5 and PSO 2. It states that the course will develop engineering knowledge, design / development of solutions, modern tool usage. This course also focuses on design and analyze different mechanical systems with the aid of current computing and analysis software.

List of Practical's:

- 1) To prepare a computer program of DDA line algorithm
- 2) To prepare a computer program of drawing a line by using Bresenham's algorithm
- 3) To understand concept and implementation of 2D transformation (translation and rotation)
- 4) To understand concept and implementation of 2D transformation (reflection and shearing)
- 5) To create a 2D drawings sheet using drawing as well as modifying commands
- 6) To create 3D Modelling of basic solid models
- 7) Exercise for Assembly modelling
- 8) Structural analysis of 2D truss system using FEA software tools
- 9) Structural Analysis of Cantilever beam using FEA software tools
- 10) Thermal analysis of 1D Element using FEA software tools

Major Equipment:

1. Computers
2. CAD Software
3. FEA Software

List of Open Source/learning website:

1. <http://help.autodesk.com/view/fusion360/ENU/>
2. <https://academy.autodesk.com/latest-manufacturing-courses>
3. <https://nptel.ac.in/courses/112102101>
4. <https://nptel.ac.in/courses/112102102>