



SARVAJANIK UNIVERSITY
Sarvajani College of Engineering and Technology
Bachelor of Technology



Mechanical Engineering Department
B. Tech. Semester VI

Course Name: Software Simulation-1 **Course Code:** BTME19652
Type of course: Minors – Computer Aided Modeling and Simulation
Prerequisite: Strength of Materials, Solid modelling
Rational of course: This course will enable the students to apply knowledge of mathematics, science, and engineering to identify, formulate, and solve engineering problems by parametric design language analysis software tools.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	100
0	2	4	4	--	--	--	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

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	Introduction to Finite Element Analysis (FEA) Software: Introduction to CAD/CAM/CAE, introduction to FEM, FEA and CFD, history of FEA, types of engineering analysis, analytical and numerical FEA, necessity of FEA, system requirements, FEA software, GUI of simulation software tools, general procedure of conducting FEA, general steps of the Finite Element Method, Pre-processing, Solution, Post-processing, capabilities of simulation software tools.	2	5%
2.	Introduction to Finite Element Method (FEM): Finite Element Method concept, history of FEM, general steps of the Finite Element Method, 1D, 2D and 3D elements, basic requirements of FEM, FEM methods, advantages and limitation of FEM.	3	10%



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Sr. No.	Topics	Teaching Hrs.	Module Weightage
3.	Parametric Design Language Analysis Software Tools GUI: Geometry creation, geometry import in parametric design language analysis software tools, coordinate systems, element attributes, meshing, material properties, boundary conditions, solvers, post-processing.	6	20 %
4.	Meshing, Material Properties and Boundary Conditions Meshing: Free meshing, mapped meshing, hybrid meshing, setting element attributes, selecting element type, shape function, defining element types, real constants, defining section properties, assigning element attributes before meshing, mesh controls. Material Properties: Material library, specifying properties. Boundary Conditions: Types of loads, applying loads.	9	30 %
5.	Solvers and Post-Processing: Solvers: Types of solvers, solver setup, load step options, solving multiple load steps. Post-processing: Contour plot viewing, path operations, estimating solution error, time history postprocessor, report generator.	3	10 %
6.	Parametric Design Language Analysis: Static Structural Analysis, Modal Analysis, Thermal Analysis, Introduction to Non-Linear Analysis.	7	25%

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

Percentage Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	25	25	20	10	5

Legends: R: Remembrance, U: Understanding; A: Application, N: Analyze, E: Evaluate C: Create and above Levels

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 from above table.



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Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher	Publication Year	Publication Edition
1	ANSYS Mechanical APDL for Finite Element Analysis	Mary Kathryn Thompson, John M. Thompson	Butterworth-Heinemann	2017	1 st
2	Fundamentals of Finite Element Analysis	Hutton	McGraw Hill	2017	1 st
3	Finite Element Analysis in engineering	S.Md.Jalaludeen	Anuradha Publications	2016	2 nd
4	Advanced CAD Modeling: Explicit, Parametric, Free-Form CAD and Re-engineering	Nikola Vukasinovic , Joze Duhovnik	Springer	2019	1 st
5	ANSYS 2020: Structural Analysis Using the ANSYS Mechanical APDL	R B Choudary	Dreamtech Press (Willey)	2022	2 nd

Course Outcomes (CO):

CO. No.	CO Statements After learning this subject, students will be able to	Marks % weightage
CO-1	Explain the fundamental concepts of the theory of the Finite Element Analysis	5
CO-2	Apply finite element methods for engineering analysis	10
CO-3	Demonstrate capability to model and analyze engineering problems using parametric design language analysis software tools	20
CO-4	Capable of designing, optimizing and analyzing a component	30
CO-5	Extract, interpret and present results professionally.	10
CO-6	Apply the FE analysis for practical applications in static structural, modal and thermal analysis	25



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Mapping of (CO's) with Program Outcomes (PO'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
CO-1	3	2	2	1	2	1	1	1	1	1	1	1
CO-2	3	3	2	2	3	2	1	1	1	1	1	1
CO-3	2	3	3	2	3	2	2	1	2	2	2	1
CO-4	2	2	2	2	2	2	2	1	3	3	2	2
CO-5	2	3	3	2	3	2	2	1	2	2	2	1
CO-6	2	3	3	2	3	2	2	1	2	2	2	1
Rationale*	14	16	15	11	16	11	10	6	11	11	10	7

Rationale - Mapping of CO's with PO's:

This course will give basic understanding of engineering knowledge, problem analysis & design and development of solutions by using modern tool usage with real life problems.

This course highly maps with Program outcomes 1,2,3,5. it states that the course will develop engineering knowledge, problem analysis, design / development of solutions, modern tool usage.

List of Practical:

1. Analyze 1-D structural problems.
2. Exercise for FEA of Truss.
3. Exercise for FEA of Beam Element.
4. Solve the 1-D and 2-D thermal problems.
5. Analyze 1-D fluid problems.
6. Solve 2-D structural problems.
7. Preparation of report based on 1-D structural, thermal and fluid problems results.
8. Preparation of report based on 2-D structural, thermal and fluid problems results.

Major Equipment:

1. Computational facilities



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List of Open Source/learning website:

1. <https://nptel.ac.in/courses/105105041>
2. <https://nptel.ac.in/courses/112104193>
3. <https://nptel.ac.in/courses/112104205>
4. <https://courses.ansys.com/>
5. <https://www.ualberta.ca/index.html>
6. <https://www.mscsoftware.com/training-materials>
7. <http://expertfea.com/tutorials.html>
8. <https://altairuniversity.com/modeling/hypermesh-related/>
9. <https://discoveryforum.ansys.com/>

List of Software: Simulation Software