

# SWARNANDHRA

## COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

Accredited by National Board of Accreditation, AICTE, New Delhi, Accredited by  
NAAC with "A" Grade – 3.32 CGPA, Recognized under 2(f) & 12(B) of UGC Act 1956,  
Approved by AICTE, New Delhi, Permanent Affiliation to JNTUK, Kakinada  
Seetharampuram, W.G.DT., Narsapur-534280, (Andhra Pradesh)

### DEPARTMENT OF MECHANICAL ENGINEERING

### TEACHING PLAN

Course Code	Course Title	Semester	Branches	Contact Periods /Week	Academic Year	Date of commencement of Semester
16ME7T01	FINITE ELEMENT METHOD	VII	Mechanical Engineering	6	2021-22	04.10.2021

#### COURSE OUTCOMES

CO1	Explain the fundamentals of finite element analysis, stress-equilibrium, strain-Displacement and stress –strain relationships and concept of potential energy. (K2)
CO2	Solve the One dimensional problems by using different methods.(K2)
CO3	Solve structural applications using truss and beam elements (K3)
CO4	Solve two dimensional problems using CST and higher order elements and apply Numerical integration for Higher order element analysis.(K3)
CO5	Apply finite element analysis to solve Heat transfer problems (K3)
CO6	Solve the element matrices, Lumped and consistent mass matrices evaluation of Eigen values and Eigen vectors (K3)

UNIT	Outcomes / Bloom's Level	Topic s No.	Topics/Activity	Text Book / Reference	Contact Hour	Delivery Method
------	--------------------------	-------------	-----------------	-----------------------	--------------	-----------------

#### INTRODUCTION TO FINITE ELEMENT METHOD

<b>I</b>	Explain the fundamentals of finite element analysis, stress-equilibrium, strain - displacement and stress-strain relationships . [K2]	1.1	Introduction to finite element method	T1, T2, R4	2	Chalk & Talk PPT, Classroom
		1.2	stress and equilibrium, Boundary conditions strain – displacement relations	T1, T2, R4	2	
		1.3	stress – strain relations,	T1, T2, R4	1	
		1.4	Special cases- one dimensional, Two dimensional plane stress and plane strain condition	T1, T2, R4	1	
		1.5	Potential energy and equilibrium; the Rayleigh-Ritz method	T1, T2, R4	2	
		1.6	Galerkin's Method	T1, T2, R4	1	
		1.7	Problems	T1, T2, R4	2	
<b>CBS</b>			Saint Venant's Principle	T1, T2, R4	1	



# SWARNANDHRA COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

Accredited by National Board of Accreditation, AICTE, New Delhi, Accredited by  
NAAC with 'A' Grade - 3.32 CGPA, Recognized under 2(f) & 12(B) of UGC Act 1956,  
Approved by AICTE, New Delhi, Permanent Affiliation to JNTUK, Kakinada  
Seetharamapuram, W.G. DT., Narsapur-534280, (Andhra Pradesh)

	CBS		Saint Venant's Principle	T1, T2, R4	1	
<b>TOTAL</b>					<b>12</b>	
<b>DIMENSIONAL PROBLEMS</b>						
<b>II</b>	Concept of potential energy and solve 1-D problems [K2]	2.1.	Finite element Modeling, Element Division, Numbering scheme.	T1, T2, R4	1	Chalk & Talk PPT, Animation, Videos
		2.2	Coordinates and shape functions	T1, T2, R4	1	
		2.3	Total Potential energy Approach- Element Stiffness Matrix Force terms. Assembly of the Global Stiffness matrix and load vectors. Properties of 'K'	T1, T2, R4	1	
		2.4	Band width, node numbering, mesh Generation	T1, T2, R4	1	
		2.5	The finite element equations; treatment of boundary conditions 1. Elimination approach 2. Penalty approach	T1, T2, R4	1	
		2.6	1-D Problems both approaches	T1, T2, R4	5	
		2.7	Temperature effects	T1, T2, R4	1	
<b>TOTAL</b>					<b>11</b>	
<b>ANALYSIS AND TRUSSES OF BEAMS</b>						
<b>III</b>	Solve structural applications using truss and beam elements [K3]	3.1	Analysis of Trusses Plane Trusses Local and global coordinate systems, Formulas for Calculating 'l' and 'm'	T1, R4	2	Chalk & Talk, PPT, Project Based Learning
		3.2	Stiffness Matrix- Assembly of global stiffness matrix and load vector, finite element equations,	T1, R4	1	
		3.3	Treatment of boundary conditions, stress, and strain and support reaction calculations.	T1, R4	1	
		3.4	Problems	T1, R4	4	
		3.5	Analysis of Beams: Potential - Energy approach, Finite element formulation and load vector, Shear force and Bending moment. Beam on elastic support.	T1, R4	1	

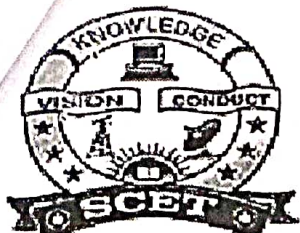


# SWARNANDHRA

## COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

Accredited by National Board of Accreditation, AICTE, New Delhi, Accredited by NAAC with "A" Grade – 3.32 CGPA, Recognized under 2(f) & 12(B) of UGC Act 1956, Approved by AICTE, New Delhi, Permanent Affiliation to JNTUK, Kakinada Seetharampuram, W.G.DT., Narsapur-534280, (Andhra Pradesh)

		3.6	Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.	T1,R4	1	
		3.7	Problems	T1,R4	4	
	<b>CBS</b>	3.8	Beams on elastic supports	T1,R4	1	
<b>TOTAL</b>					<b>15</b>	
<b>TWO DIMENSIONSL ELEMENTS</b>						
<b>IV</b>	Solve two dimensional problems using CST and higher order elements and apply Numerical integration for Higher order element analysis [K3]	4.1	Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions	T1, R4	2	Chalk & Talk, PPT, Virtual Class
		4.2	Two dimensional four noded isoparametric elements and numerical integration,	T1, R4	2	
		4.3	Problems	T1, R4	8	
		<b>CBS</b>	4.4	Orthotropic materials	T1,R4	
<b>TOTAL</b>					<b>13</b>	
<b>STEADY STATE HEAT TRANSFER ANALYSIS</b>						
<b>V</b>	Apply finite element analysis to solve Heat transfer.. [K3]	5.1	Steady state heat transfer analysis :one dimensional analysis of a fin and two dimensional analysis of thin plate.,	T1	2	Chalk & Talk, PPT, Active Based Learning
		5.2	Analysis of a uniform shaft subjected to torsion.	T1	1	
		5.3	Problems	T1	7	
		<b>CBS</b>	5.4	Electric and magnetic field problems	T1	
<b>TOTAL</b>					<b>11</b>	
<b>DYNAMIC ANALYSIS</b>						
<b>VI</b>	Solve the element	6.1	Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices,	T1	1	Chalk & Talk,

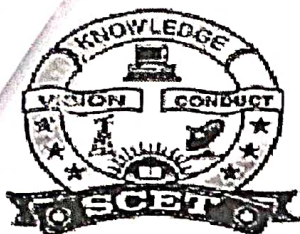


# SWARNANDHRA COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

Accredited by National Board of Accreditation, AICTE, New Delhi, Accredited by NAAC with "A" Grade – 3.32 CGPA, Recognized under 2(f) & 12(B) of UGC Act 1956, Approved by AICTE, New Delhi, Permanent Affiliation to JNTUK, Kakinada Seetharampuram, W.G.DT., Narsapur-534280, (Andhra Pradesh)

	matrices, Lumped and consistent mass matrices evaluation of Eigen values and Eigen vectors .. [K3]	6.2	Evaluation of eigen values and eigen vectors.	T1	2	PPT, Animation, Videos
		6.3	Problems.	T1	7	
	CBS		Guyan reduction method	T1	1	
<b>TOTAL</b>					<b>11</b>	
<b>NOTE: CBS - CONTENT BEYOND SYLLABUS</b>						
<b>CUMULATIVE PROPOSED PERIODS</b>					<b>73</b>	
<b>Text Books:</b>						
<b>S.No.</b>	<b>AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION</b>					
T1	Chandraputla, Ashok and Belegundu, Introduction to Finite Elements in Engineering , 4 <sup>th</sup> Edition, Eight Impression, Pearson publications, 2018.					
T2	SS Rao , The Finite Element Methods in Engineering , Elsevier india Private Limited, 5 <sup>th</sup> edition 2011.					
<b>Reference Books:</b>						
<b>S.No.</b>	<b>AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION</b>					
R1	YM Desai, Eldho&Shah , Finite Element Method with applications in Engineering Pearson publishers,2011					
R2	JN Reddy , An introduction to Finite Element Method , McGrawHill..2009					
R3	Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom, The Finite Element Method for Engineers, John Wiley & Sons (ASIA) Pte Ltd., 2001					
R4	S.S.Bhavikatti, Finite Element Analysis, New age International Publishers, 2012 reprint					
<b>Web Details</b>						
	<a href="https://nptel.ac.in/courses/112/104/112104116/#">https://nptel.ac.in/courses/112/104/112104116/#</a>					
	<a href="https://nptel.ac.in/courses/112/104/112104193/">https://nptel.ac.in/courses/112/104/112104193/</a>					
	<a href="https://nptel.ac.in/courses/112/106/112106135/">https://nptel.ac.in/courses/112/106/112106135/</a>					
	<a href="https://nptel.ac.in/courses/112/104/112104115/">https://nptel.ac.in/courses/112/104/112104115/</a>					

		Name	Signature with Date
i.	Faculty	Dr.A Gopichand	
ii.	Faculty II (for common Course)	B Mahesh Krishna	
iii.	Faculty III (for common Course)	John Bunyan V	



# SWARNANDHRA COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

Accredited by National Board of Accreditation, AICTE, New Delhi, Accredited by  
NAAC with "A" Grade – 3.32 CGPA, Recognized under 2(f) & 12(B) of UGC Act 1956,  
Approved by AICTE, New Delhi, Permanent Affiliation to JNTUK, Kakinada  
Seetharampuram, W.G.DT., Narsapur-534280, (Andhra Pradesh)

iv.	Course Coordinator	Dr.A Gopichand	A-Gopichand
v.	Module Coordinator	Dr.A Gopichand	A-Gopichand
vi.	Programme Coordinator	Dr.A Gopichand	A-Gopichand

  
Principal