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	Topics No.	Topics/Activity	Text Book / Reference	Contact Hour	Delivery Method
INTRODUCTION TO FINITE ELEMENT METHOD						
I	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	
CBS			Saint Venant's Principle	T1, T2, R4	1	

CBS			Saint Venant's Principle	T1, T2, R4	1	
				TOTAL	12	
DIMENSIONAL PROBLEMS						
II	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	
CBS		2.7	Tempertrure effects	T1, T2, R4	1	
				TOTAL	11	
ANALYSIS AND TRUSSES OF BEAMS						
III	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	

		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	
CBS		3.8	Beams on elastic supports	T1,R4	1	
				TOTAL	15	
TWO DIMENSIONSL ELEMENTS						
IV	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 fournodedisoparametricel ementsand numerical integration,	T1, R4	2	
		4.3	Problems	T1, R4	8	
CBS		4.4	Orthotropic materials	T1,R4	1	
				TOTAL	13	
STEADY STATE HEAT TRANSFER ANALYSIS						
V	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 ofthinplate,.	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	
CBS		5.4	Electric and magnetic field problems	T1	1	
				TOTAL	11	
DYNAMIC ANALYSIS						
VI	Solve the element	6.1	Dynamic Analysis: Formulation of finite element model,element consistent and lumped mass matrices,	T1	1	Chalk & Talk,

	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	
				TOTAL	**11**	
NOTE: CBS - CONTENT BEYOND SYLLABUS						
				CUMULATIVE PROPOSED PERIODS	**73**	

Text Books:

S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
T1	Chandraputla, Ashok and Belegundu, Introduction to Finite Elements in Engineering , 4th Edition, Eight Impression, Pearson publications, 2018.
T2	SS Rao , The Finite Element Methods in Engineering , Elsevier india Private Limited, 5th edition 2011.

Reference Books:

S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
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

Web Details

	https://nptel.ac.in/courses/112/104/112104116/#
	https://nptel.ac.in/courses/112/104/112104193/
	https://nptel.ac.in/courses/112/106/112106135/
	https://nptel.ac.in/courses/112/104/112104115/

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

iv.	Course Coordinator	Dr.A Gopichand	
v.	Module Coordinator	Dr.A Gopichand	
vi.	ProgrammeCoordinator	Dr.A Gopichand	

Principal