SIDDHARTH INSTITUTE OF ENGINEERING & TECHNNOLOGY :: PUTTUR

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QUESTION BANK (DESCRIPTIVE)

Subject With Code:	FEM IN STRUCTURAL ENGINEERING(20CE1005)	**Course & Branch:**	M.TECH-STRUCTURAL ENGINEERING
Regulation:	R20	**Year & Sem:**	I M.Tech & II SEM

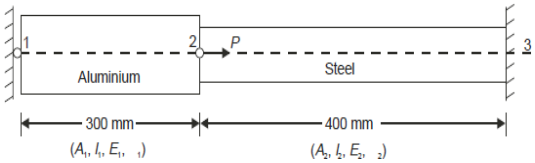
UNIT –I

INTRODUCTION AND PRINCIPLES OF ELASTICITY

1.		Explain the different steps involved in FEM	[L1][CO1]	**[6M]**
2.	a)	What are the merits, demerits and limitations of Finite Element Methods?	[L1][CO1]	**[6M]**
	b)	Explain in detail finite element method procedure with an example.	[L2][CO1]	**[6M]**
3.		What is potential energy? State and explain the principle of minimum potential energy	[L2][CO2]	**[6M]**
4.		Using Rayleigh – Ritz method determine the expression for maximum displacement, when The cantilever beam subjected to point W,KN at the free end. Also, compare it with the standard expression.	[L3][CO2]	**[12M]**
5.		Using Rayleigh-Ritz method determine the expression for deflection and B.M in a SSB Subjected to UDL over entire span. Find the deflection and moment at mid span and Compare with exact solution.	[L3][CO2]	**[12M]**
6.		Draw a typical three-dimensional element and indicate state of stress in their positive Sense and also derive the equations of equilibrium in case of a 3-D stress system.	[L2][CO2]	**[12 M]**
7.		A beam AB of span L simply supported at ends and carrying a concentrated load W at the Centre C .Determine the deflection At mid span by using Rayleigh-Ritz method and compare with exact solution.	[L2][CO2]	**[12 M]**
8.	a)	Explain plane stress problem and plane strain problems.	[L2][CO1]	**[6M]**
	b)	Explain axi-symmetric problem.	[L1][CO1]	**[6M]**
9.	a)	Explain discretization and classification of discretization.	[L2][CO1]	**[6M]**
	b)	Explain nodes at discontinuities.	[L1][CO1]	**[6M]**
10.		A bar of uniform cross section is clamped at one end and left free at other end and free at End is Subjected to a uniform axial load P. Calculate the displacement and stress in a bar by Using two terms polynomial and 3 terms polynomial. Compare with exact solution	[L3][CO2]	**[12 M]**

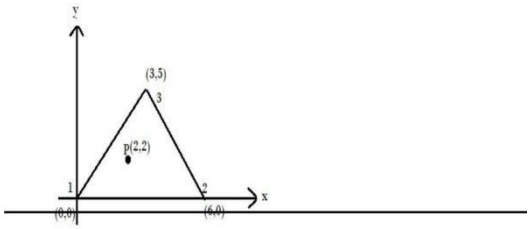
UNIT-II

ONE-DIMĒNSIONAL FEM

1.	Derive Stiffness matrix for 1D – two noded linear bar element.	[L2][CO3]	**[12M]**
2.	A 2 Noded truss element having the nodal displacement are u_1=5mm and u_2=8mm at the ends. Calculate the displacement at x=L/4,L/3 and L/2.	[L3][CO3]	**[12M]**
3.	Determine the nodal displacements at node 2, stresses in each material and element stiffness matrixfor each element as shown in Fig., due to applied force $P = 400 \times 10^3$N. $A_1 = 2400$ mm^2 & $A_2 = 1200$ mm^2 $L_1 = 300$ mm & $L_2 = 400$ mm $E_1 = 0.7 \times 10^5$ N/mm^2 & $E_2 = 2 \times 10^5$ N/mm^2 	[L3][CO3]	**[12M]**
4.	Briefly explain shape function and derive shape function for 1D – two noded line element.	[L2][CO3]	**[12M]**
5.	Briefly explain shape function and derive shape function for 1D – three noded line element.	[L2][CO3]	**[12M]**
6.	Derive of the displacement function(u) and shape function (N) for 1-D linear bar element based on global coordinate approach.	[L3][CO3]	**[12M]**
7.	Derive the shape function, strain displacement matrix element stiffness matrix for a two noded 1-D Element.	[L3][CO3]	**[12M]**
8.	A 1-D 3 noded bar element at X_1=20mm at first node, X=24mm at middle node and X_2=36mm.Calculate the following shape function N_1 and N_2 at the middle point P.if u_1=3mm and u_2=-5, calculate the displacement u at point P.	[L3][CO3]	**[12M]**
9.	A 2 Noded truss element having the nodal displacement are u_1=6mm and u_2=9mm at the ends. Calculate the displacement at x=L/4,L/3 and L/2.	[L3][CO3]	**[12M]**
10.	What is static condensation? Explain procedure of static condensation	[L2][CO3]	**[12M]**

UNIT III

TWO DIMENSIONAL FEM

1.		Derive matrix equation for 2-D element	[L3][CO4]	**[12M]**
2.	a)	Differentiate between CST and LST elements	[L2][CO4]	**[6M]**
	b)	Evaluate the shape functions N_1, N_2 and N_3 at the interior point P for the triangular element shown in the figure below. 	[L3][CO4]	**[6M]**
3.		Derive shape functions for four noded rectangular elements. Use natural co-ordinate system	[L3][CO4]	**[12M]**
4.		Write and briefly explain the different types of elements for plain stress and plain strain analysis.	[L1][CO4]	**[12M]**
5.		Derive the shape function for the Constant strain triangle element(CST) element.	[L3][CO4]	**[12M]**
6.		Derive the strain-displacement matrix for CST element.	[L1][CO4]	**[12M]**
7.		Explain about a) Geometric in variance b)Convergent and compatibility requirements	[L1][CO4]	**[12M]**
8.		Derive the shape function and strain-displacement for an rectangular 4-noded element.	[L3][CO4]	**[12M]**
9.		Write down the following? 1. Global coordinate system 2. Local coordinate system 3. Natural coordinate system 4. Discretization	[L1][CO4]	**[12M]**
10.		Derive the Shape functions for the 3-noded triangle element (or) L.D.T (or) C.S.T.	[L2][CO4]	**[12M]**

UNIT –IV
ISOPARAMETRIC FORMULATION & AXI-SYMMETRIC ANALYSIS

1.	Explain the isoparametric concept in finite element analysis.	[L1][CO6]	**[12M]**
2.	Explain the terms isoparametric, sub parametric and super parametric elements.	[L1][CO6]	**[12M]**
3.	Derive the Jaccobian matrix for 4-noded rectangular element.	[L2][CO6]	**[12M]**
4.	Explain the formulation of 4-noded 2-D isoparametric quadrilateral element. Derive the straindisplacement matrix and stiffness matrix.	[L3][CO6]	**[12M]**
5.	Derive the shape function for 4-Noded isoparametric quadrilateral element.	[L2][CO6]	**[12M]**
6.	Derive the strain-displacement matrix for 4-Noded isoparametric quadrilateral element.	[L2][CO6]	**[12M]**
7	Derive the shape function for 8-Noded isoparametric quadrilateral element.	[L2][CO6]	**[12M]**
8	Explain the lagrangian and serendipity elements.	[L1][CO6]	**[12M]**
9	Derive the shape function for Axisymmetric (Rectangular) element.	[L2][CO6]	**[12M]**
10.	Explain the axi symmetric analysis and axi-symmetrical formulation	[L2][CO6]	**[12M]**

UNIT V
THREE - DIMENSIONAL FEM

1.	Explain the basic theory of plate bending.	[L1][CO7]	**[12M]**
2.	Explain the basic relationships in plate bending theory.	[L2][CO7]	**[12M]**
3.	Explain about different types of 3-D solid elements.	[L1][CO7]	**[12M]**
4.	Explain about Hexahedral Isoparametric elements.	[L2][CO7]	**[12M]**
5.	What are the three dimensional stresses and strains explain the relation between them	[L1][CO7]	**[12M]**
6.	Write the stiffness matrix for a hexahedral element.	[L2][CO7]	**[12M]**
7.	Explain basic relations in thin plate theory.	[L1][CO7]	**[12M]**
8.	Briefly explain about Mindlin's approximations.	[L3][CO7]	**[12M]**
9.	Explain finite element formulation for 8-noded Isoparametric solid element	[L2][CO7]	**[12M]**
10.	Explain stress resultants in thin plates.	[L2][CO7]	**[12M]**

Prepared by

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