Course Code: 16CE135

R16

SIDDHARTH GROUP OF INSTITUTIONS:: PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code: FEM IN CIVIL ENGINEERING (16CE135)

Course & Branch: B.Tech - CE

Year & Sem: IV-B.Tech & I-Sem

Regulation: R16

UNIT –I
INTRODUCTION & PRINCIPLE OF ELASTICITY

1	What are the basic steps involved in FEM. Discuss merits and demerits of FEM.	[L1][CO1]	**[12M]**
2	Determine the deflection at center of the simply supported beam of span length 'l' subjected to a concentrated load at its mid-point use Rayleigh-Ritz method.	[L3][CO2]	**[12M]**
3	Determine the deflection at the center of simply supported beam of span length 'l' subjected to Uniformly distributed load throughout its length. Use Rayleigh-Ritz method.	[L3][CO2]	**[12M]**
4	Explain the concept of strain energy and principle of minimum potential energy	[L2][CO1]	**[12M]**
5	Derive the equation of equilibrium in case of three dimensional stress system.	[L2][CO2]	**[12M]**
6	Derive strain -displacement relationship in matrix form.	[L2][CO2]	**[12M]**
7	a) Explain in detail step by step procedure of FEM.	[L2][CO1]	**[6M]**
	b) Write down Merits and Demerits of FEM.	[L1][CO1]	**[6M]**
8	Determine the deflection by trigonometric form at center of simply supported beam of span length 'l' subjected to a concentrated load at its mid-point. Use Rayleigh-Ritz method.	[L3][CO1]	**[12M]**
9	Explain the plane stress condition. write the constitutive relations for the plane stress condition.	[L2][CO2]	**[12M]**
10	Explain the plane strain condition and Axi-symmetric condition. Write the constitutive relations for plane stress condition.	[L2][CO2]	**[12M]**

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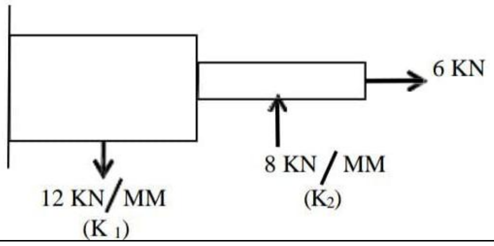
UNIT –II
ELEMENT PROPERTIES

1	Explain different types of elements in FEM.	[L2][CO2]	**[12M]**
2	A Rod of diameter 10 mm; length 200 mm has nodal displacement due to axial loads as 1.2 mm and 2.8 mm the position of the rod is shown in figure. Calculate a) Displacement at point 'Q' on the rod b) Strain c) Stress d) Strain energy for the rod  	[L3][CO2]	**[12M]**
3	Derive the stiffness matrix for one dimensional bar element	[L2][CO2]	**[12M]**
4	Calculate the nodal displacement and forces for the bar loaded as shown in figure  	[L3][CO3]	**[12M]**
5	(a)Explain the Displacement models	[L2][CO1]	**[6M]**
	(b)Explain the relation between nodal degree of freedom and generalized co-ordinate.	[L2][CO1]	**[6M]**
6	(a)Explain the Geometric invariance	[L2][CO1]	**[6M]**
	(b)Explain the Co-ordinate system.	[L2][CO1]	**[6M]**
7	Define shape function. Write the shape function and properties for one dimensional bar element.	[L1][CO1]	**[12M]**
8	(a)Explain about Elasticity equation	[L2][CO2]	**[6M]**
	(b)Explain the relation between stresses and strains	[L2][CO2]	**[6M]**
9	(a)Explain the Iso parametric element ,sub -parametric element and super parametric element	[L2][CO1]	**[6M]**
	(b)Explain the Geometric invariance	[L2][CO1]	**[6M]**
10	(a)Explain about Properties of stiffness matrix	[L2][CO1]	**[6M]**
	(b) Explain the Displacement models	[L2][CO1]	**[6M]**

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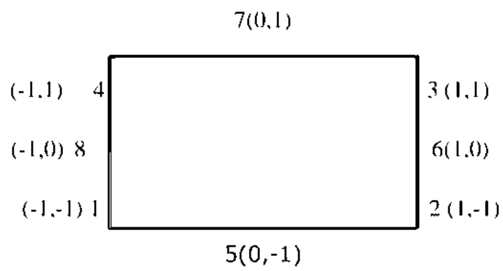
UNIT –III
SHAPE FUNCTIONS

1	Explain the detail convergent and compatibility requirements in FEM .	[L2][CO1]	**[12M]**
2	Derive the shape functions for one dimensional bar element	[L2][CO2]	**[12M]**
3	Derive the shape functions for two dimensional Tri-angular element .	[L2][CO2]	**[12M]**
4	Derive the shape function by using A. Global co-ordinate system. B. Local co-ordinate system.	[L2][CO1] [L2][CO1]	**[6M]** **[6M]**
5	Derive the shape function by using matrix method.	[L2][CO2]	**[12M]**
6	Explain about shape functions using lagrange and serendipity.	[L2][CO2]	**[12M]**
7	Derive shape functions for 8- noded rectangular element by using natural co-ordinate system.  	[L2][CO2]	**[12M]**
8	Determine the shape functions N_1,N_2,N_3 at interior point ‘p’ for triangular element .The co-ordinate are P(3.5,5), (2,3),(7,4) and (4,7).	[L2][CO2]	**[12M]**
9	Differentiate between CST and LST elements.	[L4][CO2]	**[12M]**
10	Define shape function. write the properties of shape functions also ,write shape function in the form of global and local co-ordinate system.	[L1][CO2]	**[12M]**

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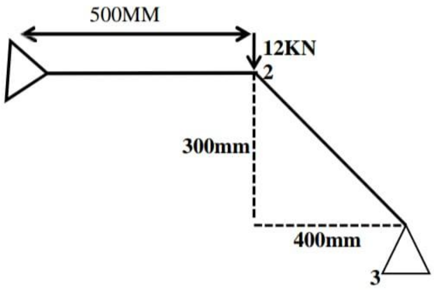
UNIT –IV

BAR AND TRUSSES & PLANE STRESS AND PLANESTRAIN ANALYSIS

1	Derive the stiffness matrix for stepped bar element.	[L2][CO2]	**[12M]**
2	For two bar truss as shown in figure .Determine the displacement at node 2 and stresses in both elements. E=70Gpa,A=200mm^2 	[L2][CO3]	**[12M]**
3	Derive stress - strain relationship in matrix formulation.	[L2][CO2]	**[12M]**
4	Explain about plane stress and plane strain analysis.	[L2][CO2]	**[12M]**
5	Derive the stiffness matrix for two dimensional elements	[L2][CO3]	**[12M]**
6	Calculate element stresses σx, σy, Txy, $\sigma 1$, $\sigma 2$, and principle angle θp for the CST element . The nodal displacement are $u1$=2.0 µm , $v1$=1.0 µm , $u2$=0.5 µm ,$v2$=1.5 µm ,$u3$=1.2µm ,$v3$=2.8µm . co-ordinates are (10,8) (15,5) , and (18,12). Take E=210 Gpa and poisson's ratio as 0.25. assume plane stress condition.	[L4][CO2]	**[12M]**
7	Evaluate strain displacement matrix and stress -strain matrix for the Tri-angular element under plane stress condition .The co-ordinate are (0,0) (6,0) and (3,5). Assume u=0.25, t=1mm , E=200 Gpa.	[L2][CO2]	**[12M]**
8	Derive strain -displacement relationship in matrix formulation.	[L2][CO2]	**[12M]**
9	Evaluate strain -displacement matrix and stress -strain matrix for the Tri-angular element under plane strain condition .The co-ordinates are (0,0) (0,6)and (3,5). Assume u=0.25,t=1mm, E=200Gpa.	[L2][CO2]	**[12M]**
10	Derive (A) Stress-Strain relationship matrix (B) Stress displacement relationship matrix.	[L2][CO2] [L2][CO2]	**[6M]** **[6M]**

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UNIT –V
ISOPARAMETRIC FORMULATION &AXI-SYMMETRIC ANALYSIS

1	Explain the following (A) Iso - parametric representation. (B) Formulation of CST element.	[L2][CO2] [L2][CO2]	**[6M]** **[6M]**
2	Derive the displacement matrix for four noded ISO -Parametric quadrilateral element.	[L2][CO2]	**[12M]**
3	Derive the shape functions for 8-noded Iso -parametric quadrilateral element.	[L2][CO2]	**[12M]**
4	Explain about lagrangian and serendipity elements.	[L2][CO1]	**[12M]**
5	Derive the shape functions for 4-noded Iso- parametric Axi- Symmetric element.	[L2][CO2]	**[12M]**
6	Determine the cartesian co-ordinates of the point 'p' which has local co-ordinates ε=0.8 and η=0.6. The Global co-ordinates are (3,4) (9,6) (8,12) and (5,10) . All dimensions are in mm.	[L2][CO2]	**[12M]**
7	Explain about plane stress and plane strain conditions for the formulation of CST element.	[L2][CO2]	**[12M]**
8	Compare general quadratic element and ISO -Parametric quadrilateral element in terms of displacement.	[L2][CO1]	**[12M]**
9	Explain about formulation of 4-noded Iso-parametric Axi - Symmetric element.	[L2][CO1]	**[12M]**
10	Determine the Cartesian co-ordinates of the point 'p' which has local co-ordinates ε=0.6 and η=0.3. The Global co-ordinates are (2,4) (3,6) (8,12) and(4,8). All dimensions are in mm.	[L2][CO2]	**[12M]**

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