Reg. No. ________

Karunya University

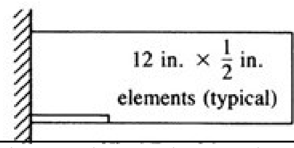
(Karunya Institute of Technology and Sciences)

(Declared as Deemed to be University under Sec.3 of the UGC Act, 1956)

End Semester Examination – Nov/Dec 2016

Subject Title: **FINITE ELEMENT ANALYSIS** **Time: 3 hours**
Subject Code: **12AE222** **Maximum Marks: 100**

Answer ALL questions
PART – A (10 x 1 = 10 MARKS)

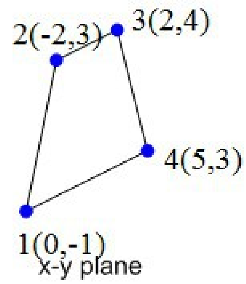
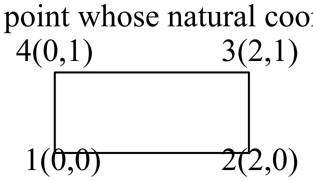
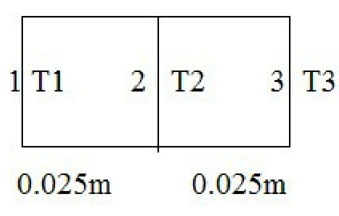
1.	Find the aspect ratio of the following element 	1
2.	Distinguish between interior and exterior nodes.	1
3.	Write down the equation of potential energy for beam of span L simply supported at ends, subjected to a concentrated load P at mid span. Assume EI= constant .	1
4.	Define a node.	1
5.	Write down the strain-displacement matrix for CST element.	1
6.	Write down the equation of lumped mass matrix for the bar element.	1
7.	Write down the shape function equation for 1D bar element.	1
8.	Specify the consistent mass matrix for a beam element.	1
9.	Write the shape functions for a 1D quadratic isoparametric element.	1
10.	Mention any one advantage of FEA.	1

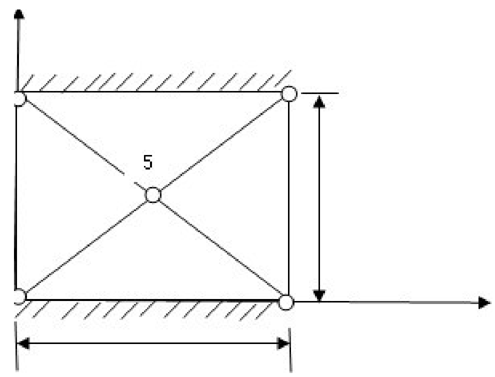
PART – B (5 x 3 = 15 MARKS)

11.	Define geometric isotropy.	3
12.	The nodal displacements of two noded truss element at points 1 and 2 are 5 mm and 8 mm respectively. Calculate displacement at x=l/4.	3
13.	List out the factors affecting discretization .	3
14.	What are the applications of eigen value problem?	3
15.	What are the types of non-linearity?	3

PART – C (5 x 15 = 75 MARKS)

16.	Solve the differential equation for a physical problem expressed as $d^2y/dx^2+100=0$, $0 \leq x \geq 10$, with boundary conditions as y(0)=0 and y(10)=0 using (i) Point collocation method (3) (ii) Subdomain method (4) (iii) Least square method (4) (iv) Galerkin method (4)	15
	(OR)	
17.	Solve the sytem of linear equations using Gauss elimination method x -3y+z=4; 0x-y+3z= -5 and 0x+0y-18z=36	15
18.	Find the deflection of a simply supported beam which has the point load at the mid span using Rayleigh Ritz method.	15
	(OR)	

19.	The Cartesian (global) co-ordinates of the corner nodes of a quadrilateral element are given by (0, 1),(-2, 3),(2, 4) and (5, 3). Find the Co-ordinate transformation between the global and natural co-ordinates. Using this determine Cartesian co-ordinates of the point defined by (r, s) = (0.5, 0.5) in the global co-ordinate system.  	15
20.	Determine the eigen values and natural frequencies of a system and mass matrices are given below. $[K] = (2AE/L) \begin{vmatrix} 3 & -1 \\ -1 & 1 \end{vmatrix}$, $m=\rho AL/12 \begin{vmatrix} 6 & 1 \\ 1 & 2 \end{vmatrix}$	15
	(OR)	
21.	Determine the element stress for the plane stress element whose co-ordinates are given by (100,100),(400100)and(200,400). The nodal displacements are u_1=2 mm,v_1=1mm, u_2=1 mm,v_2=1.5mm, u_3=2.5 mm,v_3=0.5mm. Assume young's modulus E==200GN/m^2 , poisson's ratio μ=0.3 and thickness t=10 mm.	15
22.	Find the jacobian transformation for four noded quadrilateral element with the (x,y) coordinates of the nodes are (0,0),(2,0),(2,1)and(0,1) at nodes, i,j,k,l.Also find the jacobian at point whose natural coordinates are (0,0).  	15
	(OR)	
23.	A shaft has rectangular cross-section with 8 cm×4cm sides which is discretized into four triangular elements. The material of the shaft has shear modulus 80×10^5 N/cm^2 . The shaft length is 100 cm and is fixed at one end. The other end of shaft is subjected to a torque T value of 10×10^3 N-cm. Determine the global stiffness matrix.	15
24.	Determine the temperature distribution along a circular fin of length 5 cm and radius 1 cm. The fin is attached to a boiler whose wall temperature 15˚C and the free end is open to the atmosphere. Assume T_∞= 40˚C,h= 10 W/cm^2 ˚C, k= 70 W/cm ˚C.  	15
	(OR)	

25.	For the two dimensional sandy soil region shown in Fig Determine the potential distribution and velocity gradient. The potential (fluid head) on the left side is a constant 10.0m, and that on the right side is o.om, The upper and lower edges are impermeable. The permeability are $K_x = K_y = 25 \times 10^{-5}$ m/s. Assume unit thickness. 	15