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JAYA GROUP OF INSTITUTION-THIRUNINRAVUR

6^{th} SEM – B.E. / B.Tech

INTERNAL ASSESSMENT-3(MODEL EXAM-3)

M-3 43

Sub. Name: FINITE ELEMENT METHOD — Date: 11/4/2015

Sub. Code: AE 2351 — Branch: Aeronautical

Duration: 180 minutes — Max.Marks: 100

PART-A (10 x 2 =20)

1. Define stiffness and flexibility matrices.
2. What do you mean by convergence?
3. Write the shape functions of a one dimensional line element.
4. Sketch a typical truss element showing local global transformation.
5. Explain plane strain problem with an explain.
6. Give examples of axisymmetric problems.
7. Write down the shape functions of a four node quadrilateral isoparametric element.
8. What is the signficiance of jacobian of transformation?
9. Write down the governing differential equation of one dimensional heat transfer.
10. What are the applications of finite element method in fluid flow problems?

PART-B (5 x 16 =80)

11.a. A simply supported beam subjected to uniformly distributed load over entire span and it is subjected to a point load at the centre of the span. Calculate the bending moment and deflection at midspan by using Rayleigh-Ritz method and compare with exact solution. As shown in fig 1.

(or)

b. The differential equtions of a physical phenomenon is given by $d^2y/dx^2+500x^2=0$, $0<x<1$, by using the trial function, $y= a_1(x-x^3)+ a_2(x-x^5)$, calculate the values of the parameters a_1 and a_2 by the following methods : (1) point collocation, (2) subdomain collocation, (3) least squares, (4) galerkin.the boundary conditions are : $y(0)=0$, $y(1)=0$.as shown in fig 2.

12.a. For the plane truss shown in fig 3, determine the horizontal and vertical displacements of nodal and the stress in each element.all elements have E=201Gpa and $A=4x10^{-4}\ m^2$.

(or)

b. For the three-bar truss shown in fig 4, determine the displacements of node 1 and the stress in element 3.

13.a. Determine the nodal displacements of nodes 1 and 2 and the element stresses for the two dimensional loaded plate as shown in fig 5. Assume plane stress condition. Take , $v=0.25$, $E=2x10^5$ N/mm^2, thickness=15 mm.

(or)

b.i) For the plane stress element shown in fig 6, the nodal displacements are u1= 2.0 mm, u2= 0.5mm, u3=3.0mm. v1=1.0mm, v2= 0.0mm, v3= 1.0mm. determine the element stresses and the principal angle , let E=210 GPa, v=0.25 and t=10mm. all co-ordinates are in millimetres

ii) Calculate the element stresses and the principal angle for the element shown in fig 7. The nodal displacements are: $u_1 = 2$mm, $u_2 = 0.5$mm, $u_3 = 3$mm, $v_1 = 1$mm, $v_2 = 0$mm, $v_3 = 1$mm. take $E = 2.1 \times 10^5$ N/mm^2 and $\nu = 0.25$. assume plane stress condition.

14.a. Afour noded rectangular element is shown in fig 8. Determine the following 1. Jacobian matric, 2. Strain displacement matric, 3. Element stress. Take $E = 2 \times 10^5$N/mm^2; $\nu = 0.25$; $u = [0, 0, 0.003, 0.004, 0.006, 0.004, 0, 0]^T$; $\varepsilon = 0$; $\eta = 0$.

(Or)

b. i) Evaluate integral e^{-x} dx by applying 3 point guassian quadrature.

ii) Evaluate the integral cos x / 1- x^2 dx byapplying 3 point guassian quadrature.

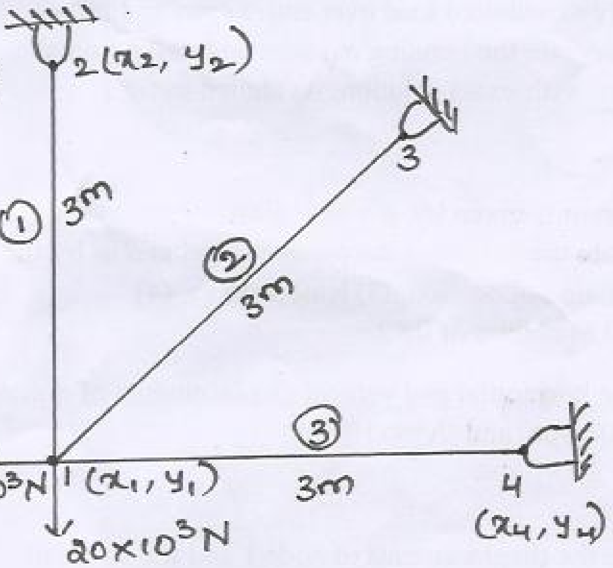
iii) Evaluate the I = [$3e^x + x^2 + 1/(x+2)$] dx using one point and two point guass quadrature . compare with exact solution.

15.a. An aluminium alloy fin of 7mm thick and 50mm long protrudes from a wall, which is maintained at 120 *c .The ambient air temperature is 22*c. The heat transfer coefficient and thermal conductivity of the fin material are 140W/m^{2}K and 55W/mK respectively. Determine the temperature distribution of fin.fig in 9

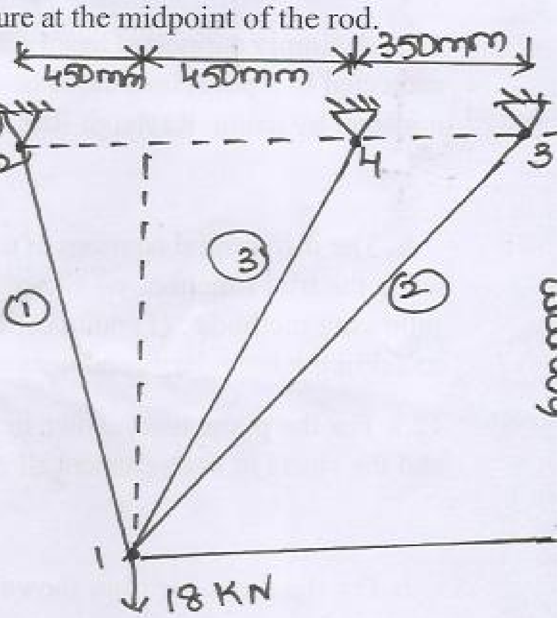
(or)

b. A steel rod of diameter=2cm, length L=5cm and thermal conductivity K=50 W/m*c is exposed at one end to a constant temperature 320*c . The other end is in ambient air temperature 20*c with a convection coefficient of h= 100 W/m^2 *c. Determine the temperature at the midpoint of the rod.

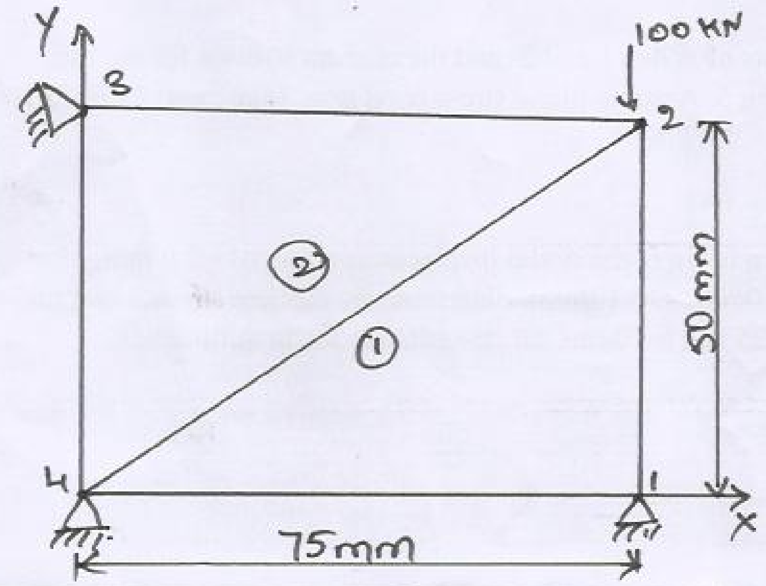
12 (a)



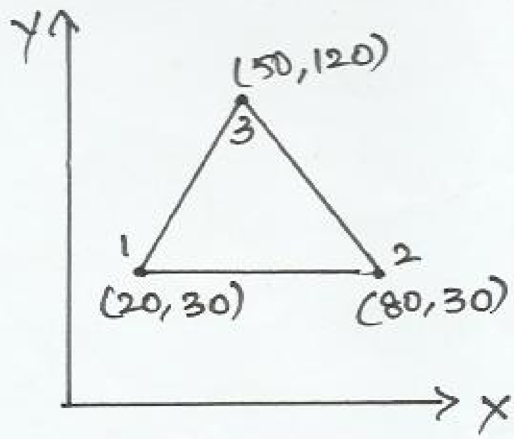
12 (b)



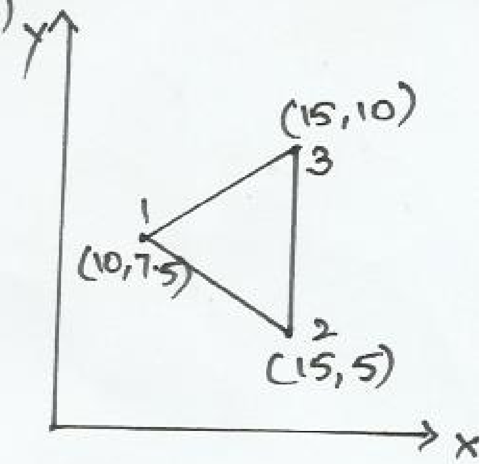
13 (a)



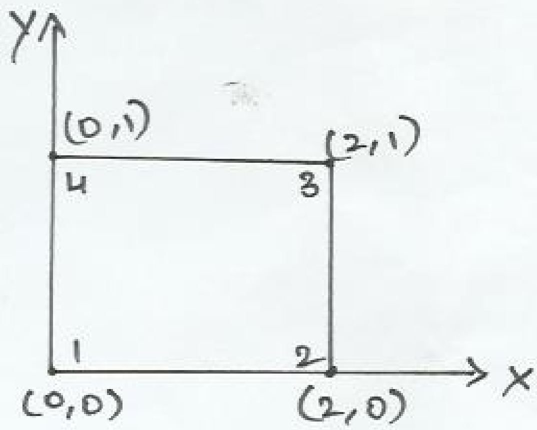
13 (b)(i)



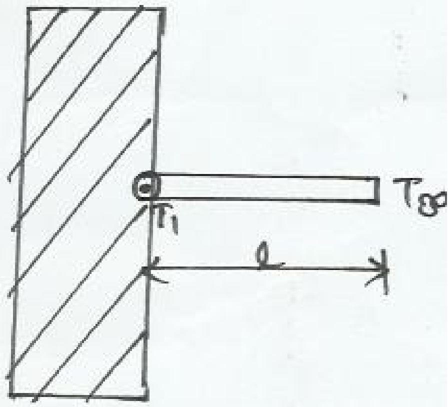
13 (b)(ii)



(14) (a)



(15) (a)



(15) (b)