03ME7073

Reg. No:

Name:

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER M.TECH DEGREE EXAMINATION,DECEMBER 2019

MECHANICAL ENGINEERING

Specialization:THERMAL ENGINEERING

03ME7073 FINITE ELEMENT METHOD FOR THERMAL ENGINEERING

Time: 3 Hours   **Max.Marks:60**

PART A

Answer ALL questions

1.Define weighted residual method?

2.What is shape function and its properties?

3. What is meant by axisymmetric solid?

4. Differentiate CST and LST elements?

                                                        (4x5 Marks = 20 Marks)

PART B

5. An aluminum alloy fin of 7mm thick and 50mm long from a wall which is maintained at 120^0C. The ambient air temperature is 22^0C. Heat transfer coefficient and thermal conductivity of the fin material are 140 W/m^{2}K and 55 W/mK. Determine the temperature distribution of fin?

(10)

OR

6. Derive the one-dimensional heat transfer element equation for a plane wall with uniformly distributed heat source.

(10)

7. The nodal coordinates for an axisymmetric triangular element shown in figure are given below.
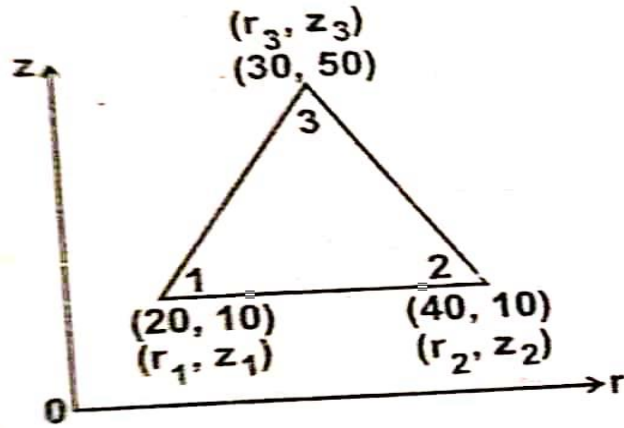
R1 = 20mm

Z1 = 10mm

R2 =40mm

Z2= 10mm

R3= 30mm

Z3 = 50mm

Determine the strain displacement matrix for that element. **(10)**

(r_3, z_3)
$(30, 50)$

$(20, 10)$
(r_1, z_1)

$(40, 10)$
(r_2, z_2)

OR

8. Evaluate the shape functions N1,N2,N3 at the interior point P for the triangular element sown in the figure using isoparametric representation.

$(5, 8)$

$P(4, 6)$

$(7, 4)$

$(3, 2)$
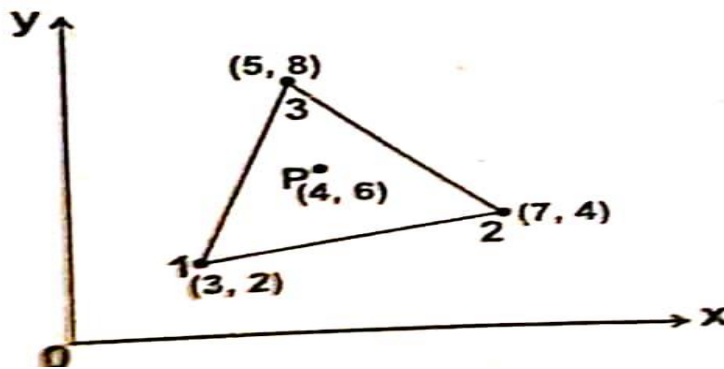
(10)

9. Solve the differential equation for a physical problem expressed as

$$\frac{d^2 y}{dx^2} + 100 = 0, \quad 0 \leq x \leq 10$$

With boundary conditions as $y(0) = 0$ and $y(10) = 0$ using Galerikin's method   **(10)**

OR

10. Derive the expression for stress-strain relationship matrix for axi-symmetric triangular element.   **(10)**

11.Briefly explain the properties of eigen vector pairs?   **(10)**

<div align="center">

OR

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12. Briefly explain the solutions of eigen value problems.   **(10)**