(DME 413)

B.Tech. DEGREE EXAMINATION, MAY - 2015

(Examination at the end of Final Year)

MECHANICAL ENGINEERING

Paper - III : Finite Element Analysis

Time : 3 Hours **Maximum Marks : 75**

Answer question No.1 compulsory ***(15)***

Answer ONE question from each unit ***(4 × 15 = 60)***

1) a) Define potential energy and equilibrium. **[2]**

b) Write about Rayleigh-Ritz method. **[2]**

c) Define shape function. **[2]**

d) What do you mean by trusses. **[2]**

e) Von-mises stress. **[2]**

f) Discuss about boundary conditions of scalar field problem. **[3]**

g) Local and global co-ordinates with an example. **[2]**

UNIT - I

2) a) Derive an expression for principle stress calculation. **[7]**

b) Discuss in detail about the concepts of FEM formulations. Discuss in detail about the application of finite element method. **[8]**

OR

3) Explain the following methods used for the formulation of element characteristics and load matrices. **[15]**

a) Variational approach.

b) Weighted residual approach.

UNIT - II

4) a) Differentiate between BAR and TRUSS elements in FEM formulation using an example. **[8]**

b) Derive the stiffness of axial bar? **[7]**

OR

5) Consider a bar as shown in figure 1 an axial load of 200 kN is applied at point P. Take area of element 1 $A_1 = 2400$ mm^2 and $A_2 = 600$ mm^2. Young's modulus for element (1) & (2) $E_1 = 70 \times 10^9$ N/m^2 and $E_2 = 200 \times 10^9$ N/m^2 respectively.

Calculate the following :

a) Nodal displacement at point P **[8]**

b) Stress in each material **[4]**

c) Reaction force **[3]**

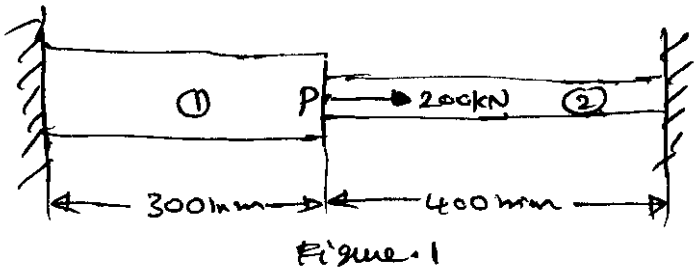

Figure. 1

UNIT - III

6) Determine the shape functions N_1 , N_2 and N_3 at the interior point P for the triangular element shown in figure 2. **[15]**

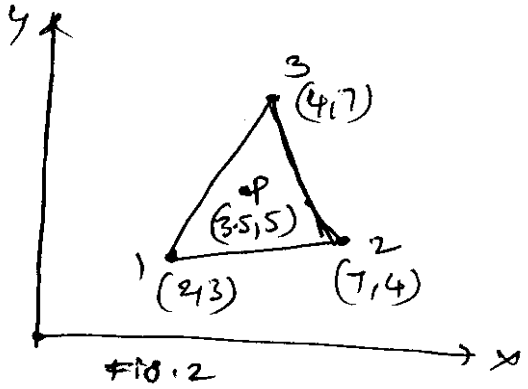

Fig. 2

OR

7) For a beam of length 2 meters fixed at both ends, estimate the deflection at the centre of beam, vertical load acting is10 kN. Divide the beam in to two elements. Compare the solution with theoretical values. Young's modulus $E = 2 \times 10^{11}$ N/m^2 moment of inertia $I = 250$ mm^4. **[15]**

UNIT - IV

8) a) Derive one dimensional steady state neat conduction equation. **[7]**

b) A metallic fin, with thermal conductivity K = 200 w/m^{o}C of 1 mm diameter 50 mm long is used to enhance heat transfer from a wall maintained at 270^{o}C, the ambient conditions are h = 15 w/m^{o}C T_{α} = 25^{o}C. Compare the temperature distribution with two and three elements compare with exact solution. **[8]**

OR

9) An axisymmetric triangular element is subjected to the loading as shown in figure the load is distributed throughout the circumference and normal to the boundary. Derive all the necessary equations and derive the nodal point loads. **[15]**

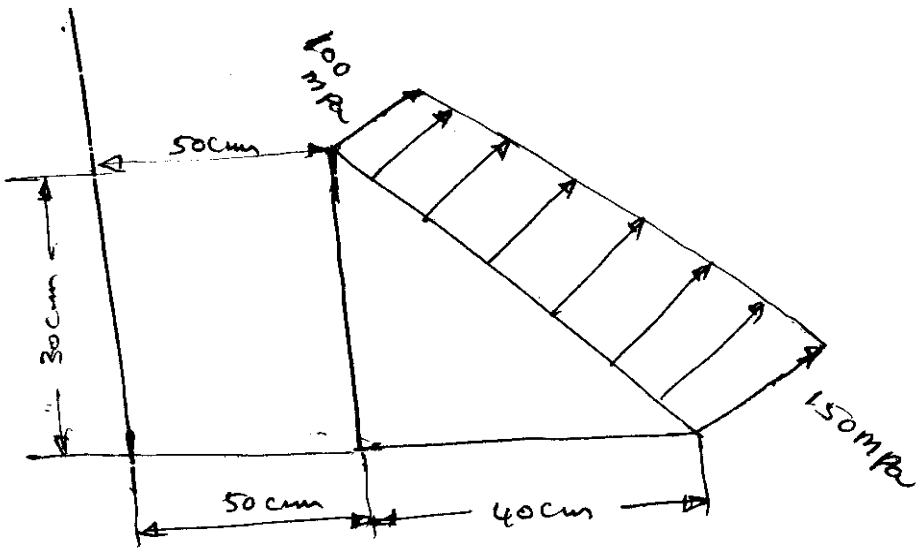

Fig. 3

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