Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

FEME 6301

Sixth Semester Regular Examination – 2014

FINITE ELEMENT METHOD

BRANCH : MECH

QUESTION CODE : F 282

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

Use standard notation as and when required.

1. Answer the following questions : 2×10

   (a) State the factors on which the number of elements to be selected depends upon ?

   (b) Describe the variational principle.

   (c) What are the characteristics of shape function ?

   (d) How frame structure is different from bars ?

   (e) What are global coordinates and local coordinates ?

   (f) What is axisymmetric element ?

   (g) What are Scalar field problems ?

   (h) What is the purpose of isoparametric elements ?

   (i) Write down the stiffness matix equation for one dimensional heat conduction element.

   (j) Why preprocessing is required in FEA.

2. Derive the shape functions and strain displacement matrix for a 2-noded one dimensional bar element. 10

P.T.O.

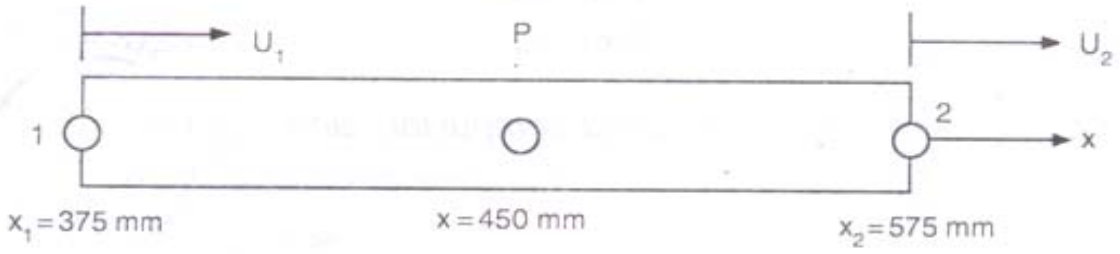
3. Consider a bar as shown in Figure below. The cross sectional area of the bar is 750 mm^2 and the Young's modulus is 200 GPa. If u_1=0.5 mm and u_2=0.625 mm, Calculate 10

(a) displacement of point P (x=450 mm).

(b) strain

(c) stress

(d) Element stiffness matrix.

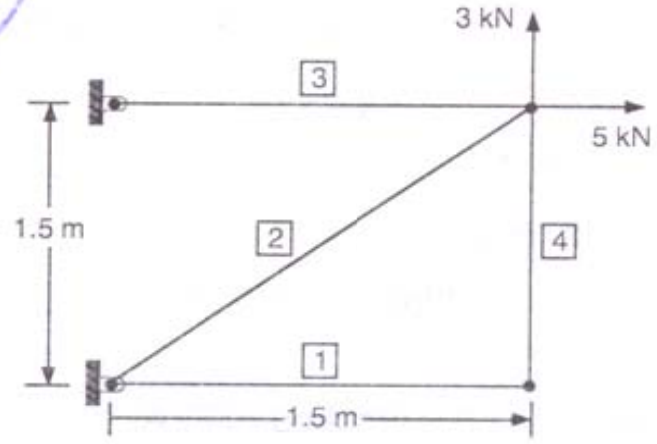


4. The plane truss shown in Figure below is composed of members having a square 15 mm x 15 mm cross section and modulus of elasticity E = 69 GPa.

(a) Assemble the global stiffness matrix.

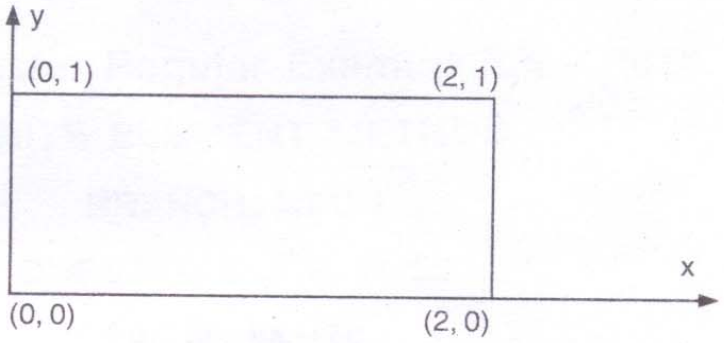
(b) Express the finite element equation for this.

(c) Compute the axial stress in each element. 10



5. From basics derive the shape functions and strain-displacement matrix for axisymmetric element with constant strain triangular elements. 10

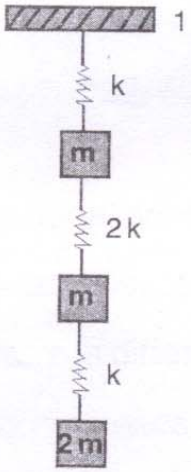
6. A four noded rectangular element as shown in figure below. Evaluate the shape function at a interior point P (1,0.5). Also determine the (i) Jacobian matrix and (ii) Strain displacement matrix for this element.



Take $E = 2 \times 10^5$ N/mm^2, poission ratio $\mu = 0.25$. Assume plane stress condition. 10

7. (a) Derive the stiffness matrix for one dimensional heat conduction element. 5

(b) Give the FE modeling for vibration of the system given in figure below. 5



8. Write short notes on any **two** : 5×2

(a) Advantages and disadvantages of FEM

(b) Transverse vibration formulation in FEM

(c) The basic steps involved in FEM

(d) Weighted residual method.
