(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0421 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2010-11

FINITE ELEMENTS METHOD

Time : 3 Hours *Total Marks : 100*

Note :—(1) Attempt **all** questions.

(2) Assume any missing data suitably.

(3) Be precise in your answer.

1. Attempt any **two** parts of the following :— **(10×2=20)**

(a) Define the following stages of finite element method :—

(1) Preprocessing

(2) Solution

(3) Postprocessing.

(b) Consider an axial rod loaded at one end with a force P. If the rod has a uniform cross section, develop the direct FEM formulation of the problem.

(c) What is a functional ? What is meant by extremization of a functional ? How does it achieved ?

2. Attempt any **two** parts of the following :— **(10×2=20)**

(a) Using suitable examples discuss the different types of elements used in FEM analysis.

(b) What are natural coordinate ? Discuss the formulation of a two noded element using natural coordinates.

(c) Using the generalized coordinate approach, find shape function for two noded bar/truss element.

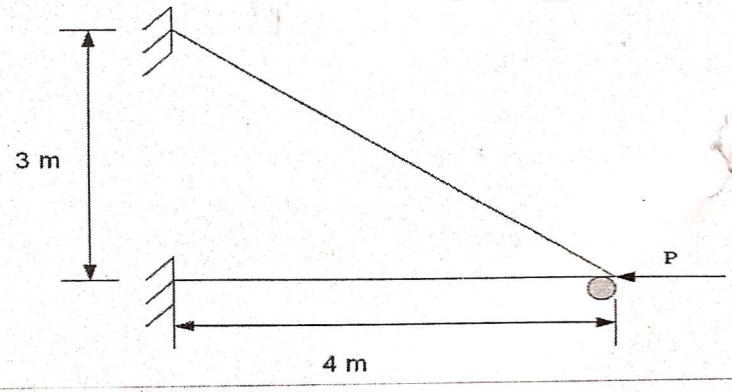
Attempt any **one** part of the following :— **(20×1=20)**

(a) A 10 m long beam fixed at one end and supported by a roller at the end, has a 20 kN concentrated load applied at the center of the span. Taking two elements, calculate the deflection under the load, shear force and bending moments in each element. Assume Young's modulus as 20×10^6 N/cm^2 and area moment of inertia as 2500 cm^4.

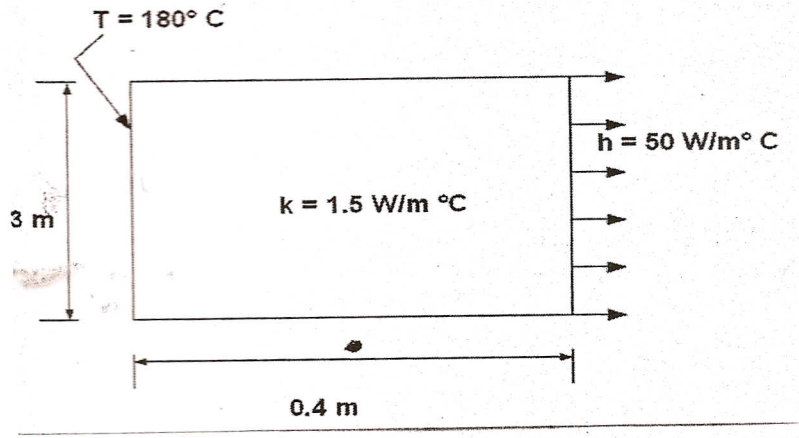
(b) Determine the temperature distribution in a one dimensional fin. The fin has a rectangular cross section and is 80 mm long, 40 mm wide and 10 mm thick. One end of the fin is maintained at 100 °C. Assume that the convection heat loss occurs from the end of the fin. Take h = 3 W/cm^{2}C and ambient temperature is 20 °C.

Attempt any **one** part of the following :— **(20×1=20)**

(a) For the two bar truss shown in the figure determine the nodal displacements, element stresses and support reactions. The force P is 1000 N, E = 210 Gpa and cross section area for each member is 600 mm^2.

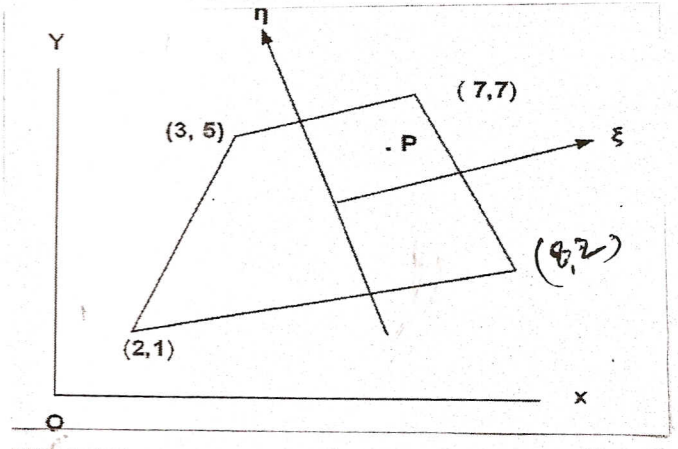


(b) For the dimensional body shown in the Figure determine the temperature distribution. The edges on the top and bottom of the body are insulated. Use two triangular elements to model and assume uniform thermal conductivity. Ambient temperature is 25 °C.



ttempt any two parts of the following :— **(10×2=20)**

i) Determine the Cartisian coordinates of the point P($\xi = 0.5$, $\eta = 0.6$) as shown in Figure.



(b) Explain the isoparametric concept in finite element analysis. State and explain three basic laws on which isoparametric concept is developed.

(c) Derive stiffness matrix for a constant strain triangular element by direct approach.