Printed Pages : 4

EME-061/EPL-061

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

PAPER ID : 140857

Roll No.

B. Tech.

(SEM. VIII) THEORY EXAMINATION, 2014-15

FINITE ELEMENT METHOD

Time : **3** Hours] [Total Marks : **100**

Notes : (i) Attempt all questions.
(ii) Assume any missing data suitably. Be precise in your answer.

1 Attempt any four parts of the following : **5x4=20**

(a) Briefly discuss the stages in finite element formulation of a physical problem.

(b) Explain the variational approach of finite element formulation. What are its limitations?

(c) Discuss the steps in Rayleigh Ritz method.

(d) Write the advantages and limitations of finite element method.

(e) Derive the stiffness matrix for a spring element by direct method.

(f) Explain Galerkin method with its advantages over other methods?

2 Attempt any two parts of the following : 10x2=20

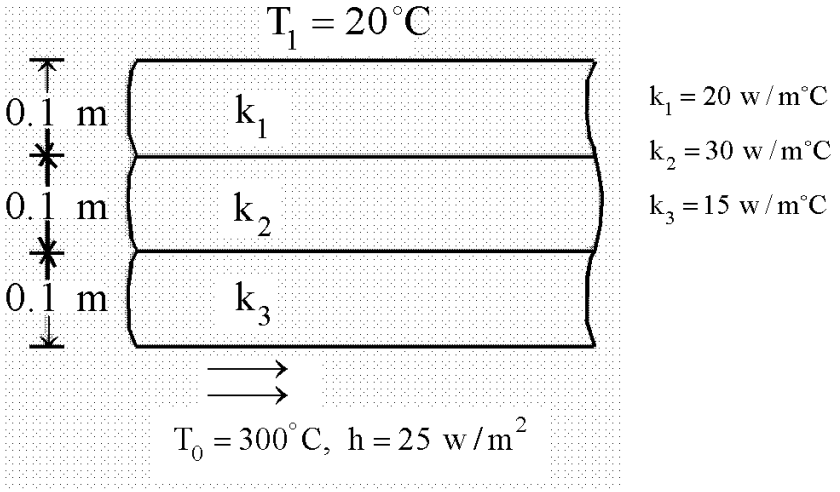
(a) What is the difference between Lagrange element & Serendipity Element? Explain with help of an example.

(b) Use Lagrange functions to find and draw the shape functions of a three node triangular element.

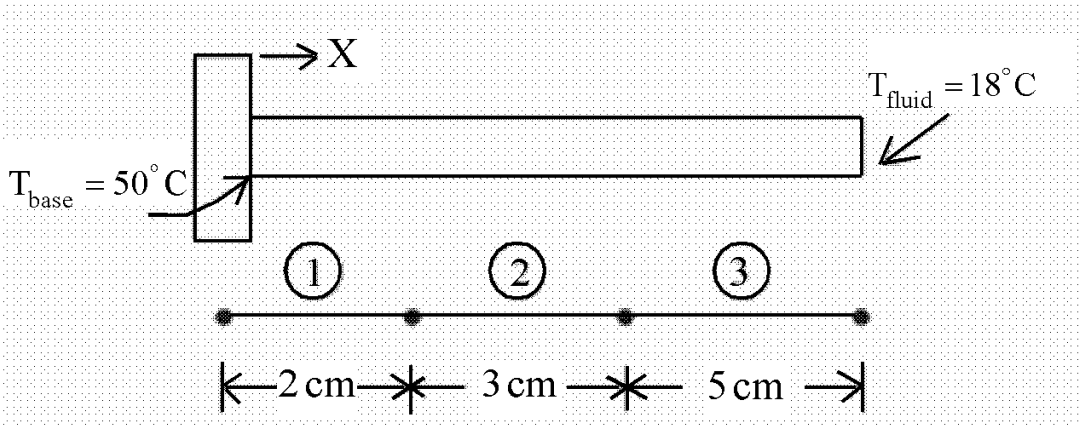
(c) Develop the stiffness matrix for a beam element.

3 Attempt any one parts of the following: **20x1=20**

(a) A composite wall consists of three materials as shown in the figure. The inner temperature is T = 20°C and convective heat transfer takes place on the outer wall T_o = 300°C. Determine the temperature distribution in the wall.

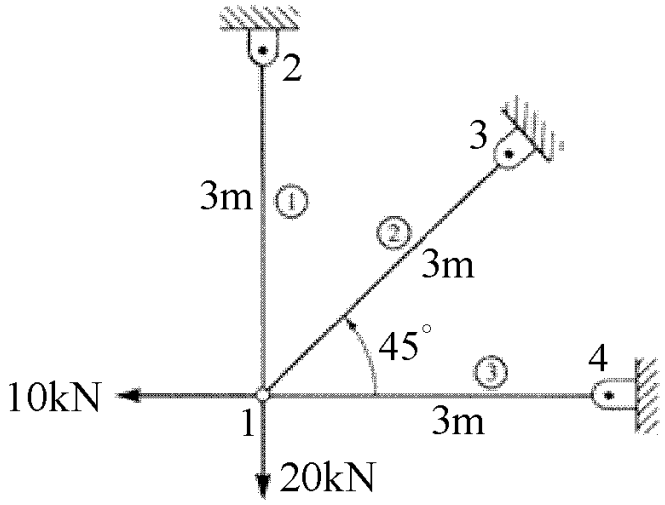


(b) Linear one-dimensional elements to approximate the temperature distribution along a fin. The nodal temperatures and their corresponding positions are shown in figure. What is the temperature at (a) X = 4 cm and (b) X = 8 cm.

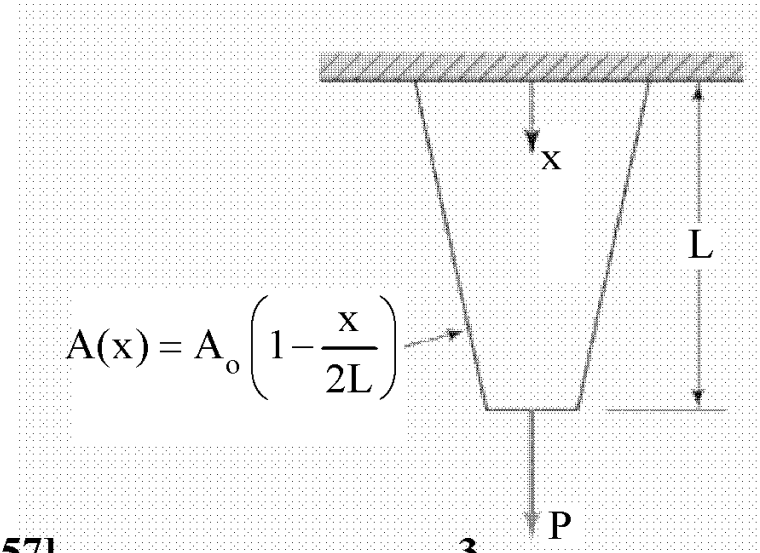


4 Attempt any one parts of the following: **20x1=20**

(a) For the plane trusses shown in Figures A and B, determine the horizontal and vertical displacements of node 1 and the stresses in each element. All elements have E = 210 GPa and A = $4x10^{-4}$ m^2.



(b) Figure depicts a tapered elastic bar subjected to an applied tensile load P at one end and attached to a fixed support at the other end. The cross-sectional area varies linearly from A_0 at the fixed support at x = 0 to A/2 at x = L. Calculate the displacement of the end of the bar (a) by modeling the bar as a single element having cross-sectional area equal to the area of the actual bar at its midpoint along the length, (b) using two bar elements of equal length and similarly evaluating the area at the midpoint of each.



5 Attempt any two parts of the following: **10x2=20**

(a) Write short notes on:

i. Gaussian quadrature integration technique

ii. Cholesky decomposition method

iii. Advantages of isoparametric elements

(b) Discuss the convergence criteria for isoparametric elements. Also explain the terms isoparametric, subparametric and superparametric elements.

(c) A steel rod subjected to compression is modeled by two bar elements, as shown in figure. Determine the nodal displacements and the axial stress in each element. What other concerns should be examined?