

B.E. DEGREE EXAMINATIONS: NOV / DEC 2010

Sixth Semester

MECHANICAL ENGINEERING

U07ME603: Finite Element Analysis

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. A small unit having definite shape of geometry and node is called.....
A) joint B) boundary condition C) truss element D) finite element
2. FEA software is
A) NASTRAN B) AUTO CAD C) CATIA D) PRO-E
3. Distributed force acting on every element volume of the body is
A) Traction force B) Point load C) Body force D) Reaction force
4. A structure made up of several bars, riveted or welded together is called.....
A) member B) body C) frame D) truss
5. are defined by three or more nodes in a two dimensional plane (x,y plane).
A) Horizontal planes B) Vertical planes C) Normal planes D) Two dimensional elements
6. is defined to be a state of strain in which the strain normal to the xy plane and the shear strains are assumed to be zero.
A) Plane stress B) Plane strain C) Plain stress D) Plain strain
7. Geometry is symmetric about axis is called
A) Axisymmetric B) Equality C) Partiality D) symmetric
8. One dimension is too small when compared to other two dimensions.
A) Plane strain B) Plane stress C) Plain strain D) Plain stress
9. If the number of nodes used for defining the geometry is same as number of nodes used for defining the displacements, then it is known as
A) Super parametric element B) sub parametric element
C) Isoparametric Element D) metric element
10. One of the types of non linearity is.....
A) Geometric non linearity B) Progressive non linearity
C) normal non linearity D) Axis non linearity

PART B (10 x 2 = 20 Marks)

11. What is meant by finite element analysis?
12. What is the difference between static and dynamic analysis?
13. What are the characteristics of shape function?
14. State the assumptions are made while finding the forces in a truss.
15. Write down the stiffness matrix equation for two dimensional CST element.
16. Write down the expression of shape function N and temperature function, T for one dimensional heat conduction element.
17. What are the conditions for a problem to be axisymmetric?
18. Give the stiffness matrix equation for an axisymmetric triangular element.
19. What is the purpose of Isoparametric elements?
20. What are the types of non-linearity?

PART C (5 x 14 = 70 Marks)

21. a) The differential equation of a physical phenomenon is given by, $[d^2y / dx^2] + 500 x^2 = 0$,
 $0 \leq x \leq 1$

Trial function, $y = a_1 (x - x^4)$

Boundary conditions are, $y(0) = 0$

$y(1) = 0$

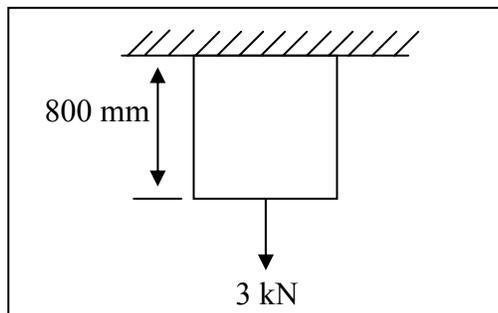
Calculate the value of the parameter a_1 by the following methods

- (i) Point collocation (ii) Least squares (iii) Galerkin

(OR)

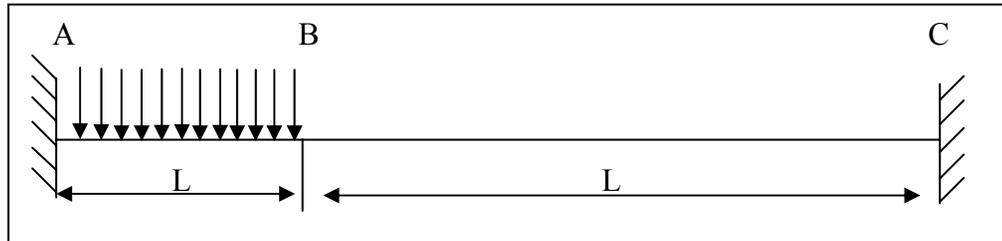
- b) What are the advantages of finite element methods? And explain its applications.

- 22 a) A steel bar of length 800mm is subjected to an axial load of 3 kN as shown in fig. find the elongation of the bar, neglecting the self weight. Take $E = 2 \times 10^5 \text{ N / mm}^2$, $A = 300 \text{ mm}^2$.

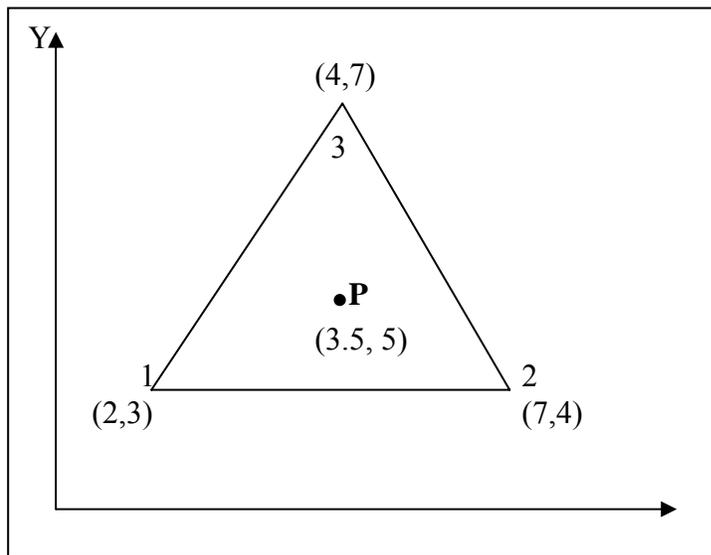


(OR)

- b) A fixed beam of length $2L$ m carries a uniformly distributed load of w (N/m) which runs over a length of L m from the fixed end, as shown in fig. calculate the rotation at point B.

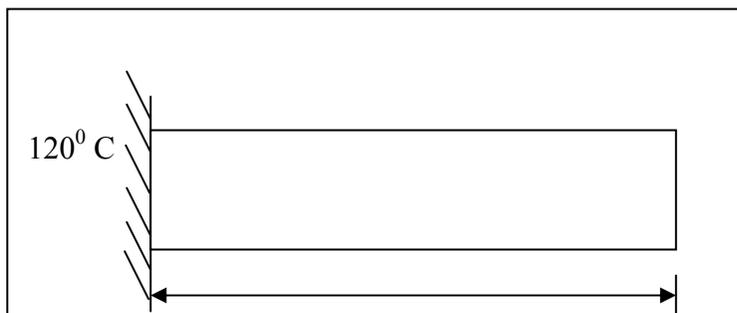


23. a) Determine the shape functions N_1 , N_2 and N_3 at the interior point P for the triangular element shown in fig.



(OR)

- b) Calculate the temperature distribution in a one dimension fin with physical properties given in fig. The fin is rectangular in shape and is 120 mm long, 40 mm wide and 10 mm thick. Assume that convection heat loss occurs from the end of the fin. Use two elements. Take $k = 0.3 \text{ W / mm}^0 \text{ C}$; $h = 1 \times 10^{-3} \text{ W / mm}^0 \text{ C}$, $T_\infty = 20^0 \text{ C}$.



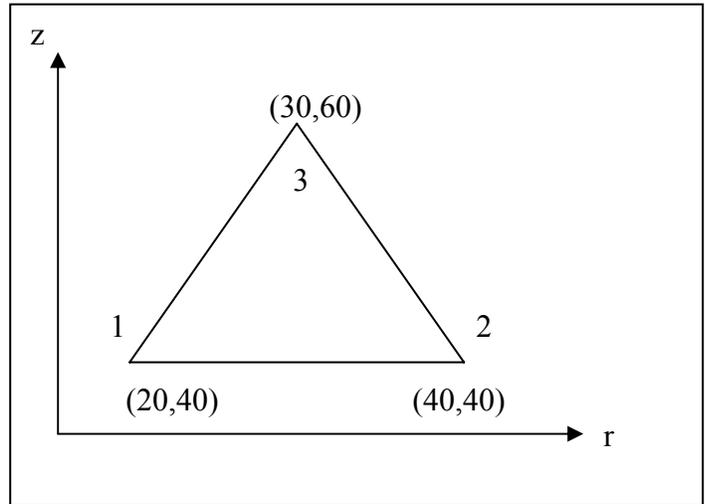
24. a) The nodal Co ordinates for an axisymmetric triangular element are given below.

$$r_1 = 20 \text{ mm}; \quad z_1 = 40 \text{ mm}$$

$$r_2 = 40 \text{ mm}; \quad z_2 = 40 \text{ mm}$$

$$r_3 = 30 \text{ mm}; \quad z_3 = 60 \text{ mm}$$

Evaluate [B] matrix for that element.



(OR)

b) Write the strain displacement Matrix [B] for Axisymmetric Triangular Element.

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25. a) Evaluate $\int_{-1}^1 (x^4 + x^2) dx$ by applying 3 point Gaussian quadrature.

-1

(OR)

b) Evaluate the Cartesian co-ordinate of the point P which has local co-ordinates $\xi = 0.6$ and $\eta = 0.8$ as shown in fig.

