Register Number……

B.E. DEGREE EXAMINATIONS: APRIL / MAY 2010

Sixth Semester

MECHANICAL ENGINEERING

U07ME603: Finite Element Analysis

Time: Three Hours **Maximum Marks: 100**

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. The number of elements to be selected for discretization depends on _____

   A. Accuracy desired B. Size of the elements

   C. Number of degrees of freedom involved D. All of the above

2. The Inverse of a non singular square matrix can be found by _____

   A. Gauss Jordan method B. Gauss Jacobi method C. Galerkins method D. Rayleigh Ritz method

3. The force acting on every elemental volume of the body is _____

   A. Body force B. Traction force C. Point load D. Drag force

4. The degrees of freedom for a space frame element is _____

   A.6 B.12 C.4 D.16

5. Dams and pipes subjected to loads that remain constant over their lengths can be solved using ___

   A. Plane strain analysis B. Plane stress analysis C. Transient analysis D. Stress strain analysis.

6. _____ elements are preferred for plane stress applications and relatively small number of nodes.

   A. LST B.CST C. Iso parametric D. Sub Parametric.

7. For an axisymmetric problem all boundary conditions must be symmetric about the _____

   A. axis of rotation B. axis of revolution C. Own axis D. axis of intersection

8. Elements with no internal nodes but nodes only on the boundaries are called _____

   A. Serendipity element B. Linear element C. Cubic element D. Quadratic element

9. If the number of nodes used for defining the geometry is same as number of nodes used for defining the displacement then it is called _____

   A. Iso parametric element B.CST element C. LST element D. Sub parametric element

10. Beam is an_____

A. Super parametric element B. Sub Parametric element

C. Isoparametric element D.LST element.

PART B (10 x 2 = 20 Marks)

11. Define 'Aspect ratio'.
12. What do you mean by 'constitutive law'?
13. Give the general expression for element stiffness matrix.
14. Compare essential boundary condition and natural boundary condition.
15. State the assumptions in the theory of pure torsion.
16. How thermal loads are input in finite element analysis?
17. What is LST element?
18. What are the ways in which a 3D problem can be reduced to a 2D approach?
19. List the types of non linearity.
20. What do you mean by isoparametric formulation?

PART C (5 x 14 = 70 Marks)

21. (a) Demonstrate the general procedure for FEA with the help of an example.

(OR)

(b) The following differential equation is available for a physical phenomenon $d^2 y / dx^2 + 50 = 0$, $0<x<10$; Trial function is $y = a_1 x (10 – x)$

Boundary conditions are $y (0) = 0$; $y (10) = 0$

Find the value of the parameter a_1 by the following methods

(a) Sub domain collocation method (b) Galerkins method.

22. (a) Derive the stiffness matrix for a stepped shaft subjected to an axial tensile load. Choose your own dimensions. Determine the displacement of the shaft at the free end. Assume one end of the shaft is fixed.

(OR)

(b)Why higher order elements are needed? Determine the shape functions of an eight node rectangular element.

23. (a) A metallic fin with thermal conductivity K=360 W/m °C, 0.1 m thick and 10 cm long extends from a Plane wall whose temperature is 235°C.Determine the temperature distribution and amount of heat transferred from the fin to the air at 20°C with h=9 W/m^2 ° C. Take the width of the fin to be 1m.

(OR)

(b) Derive the finite element equation for Torsional bar element.

24. (a) (i) The nodal co-ordinates for an axisymmetric triangular element are given below:

$r_1 = 20mm; z_1 = 40mm$

$r_2 = 40mm; z_2 = 40mm$

$r_3 = 30mm; z_3 = 60mm$

Evaluate [B] matrix for that element. (8)

(ii) Derive the stress strain relationship matrix for axisymmetric triangular element. (6)

(OR)

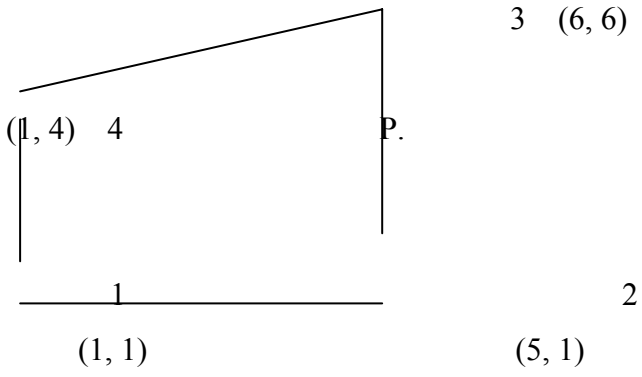
(b) (i) Briefly explain the plane stress and plane strain analysis. (6)

(ii) Derive the equations of equilibrium in case of three dimensional system. (8)

25. (a) (i) Integrate the function $f(r) = 1 + r + r^2 + r^3$ between the limits –1 and +1 using

(1) Exact method (2) Gauss Integration method and compare the two results. (7)

(ii) For the isoparametric four noded quadrilateral element shown, determine the Cartesian Co ordinates of point P which has local co-ordinates ε = 0.5 and η = 0.5 (7)



(OR)

(b) Derive the element stiffness matrix for a linear isoparametric quadrilateral element.

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