



Register Number: .....

**B.E DEGREE EXAMINATIONS: MAY 2015**

(Regulation 2009)

Fifth Semester

**AUTOMOBILE ENGINEERING**

AUE 111: Finite Element Analysis

**Time: Three Hours**

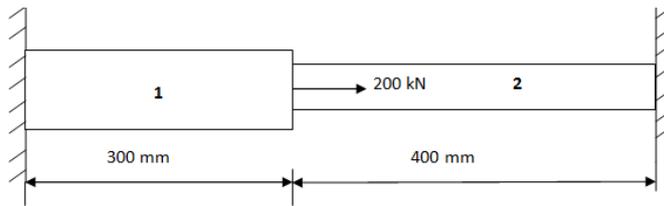
**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

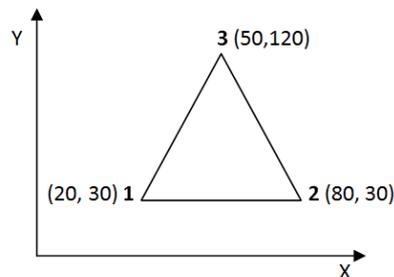
1. One of the general method associated with FEA is
  - a) Triangular method
  - b) Force method
  - c) Angular method
  - d) Collocation method
2. In FEA structural problems deals with \_\_\_\_\_
  - a) Temperature
  - b) Displacement
  - c) Fluid flow
  - d) Heat flow
3. If the solution of a problem do not vary with time then the type of analysis is called as \_\_\_\_\_
  - a) Dynamic
  - b) Transient
  - c) Time-dependant
  - d) Static
4. The stiffness matrix is Sum of elements in any column must be
  - a) zero
  - b) one
  - c) Positive value
  - d) Negative value
5. In 2D problems a Rectangular element will have \_\_\_\_\_ degrees of freedom.
  - a) 5
  - b) 8
  - c) 12
  - d) 6
6.  $\{e\}=[B] \{u\}$ , where  $\{u\}$  represents \_\_\_\_\_
  - a) Stiffness
  - b) Shape function
  - c) Nodal Displacement
  - d) Strain-Displacement
7. The stiffness matrix for a triangular element in a 2-D problem is often derived using
  - a) Surface co-ordinates
  - b) Area co-ordinates
  - c) Volume co-ordinates
  - d) All the above
8. A CST element has \_\_\_\_\_ DOF.
  - a) 6
  - b) 4





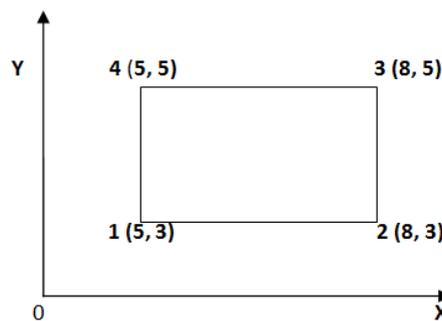
|                      | Bar 1                                | Bar 2                                 |
|----------------------|--------------------------------------|---------------------------------------|
| Material             | Aluminum                             | Steel                                 |
| Cross sectional Area | 2400 mm <sup>2</sup>                 | 600 mm <sup>2</sup>                   |
| Young's Modulus      | 70x10 <sup>3</sup> N/mm <sup>2</sup> | 200x10 <sup>3</sup> N/mm <sup>2</sup> |

23. a) For the plane stress element shown in figure. Evaluate the stiffness matrix. Assume  $E = 210 \times 10^3 \text{ N/mm}^2$ , Poisson's ratio  $\nu = 0.25$  and element thickness  $t = 10 \text{ mm}$ . The coordinates are given in millimeters.



(OR)

- b) For a 4-noded rectangular element shown in figure. Determine the temperature at the point (7, 4). The nodal values of the temperatures are  $T_1 = 42^\circ\text{C}$ ,  $T_2 = 54^\circ\text{C}$  and  $T_3 = 56^\circ\text{C}$  and  $T_4 = 46^\circ\text{C}$ . Also determine the three points on the  $50^\circ\text{C}$  contour line.



All Dimensions are in cm

24. a) Derive the shape functions for an axisymmetric triangular element

(OR)

- b) The nodal coordinates for an axisymmetric triangular element at its three nodes are  $(r_1, z_1) = (30, 10)$ ,  $(r_2, z_2) = (50, 10)$ , and  $(r_3, z_3) = (40, 60)$ .

Determine the strain displacement matrix for that element.

25. a) Derive the stiffness matrix for a linear isoparametric element.

(OR)

b) Evaluate the integral  $I = \int_{-1}^1 (3e^x + x^2 + \frac{1}{(x+2)}) dx$  using one point and two point Gauss-quadrature. Compare this with exact solution.

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