QP Code : 6470

| Revised Course | (3 Hours) | [Total Marks : 80 |

N.B
1. Question No. 1 is compulsory
2. Attempt any four questions from remaining FIVE.
3. Assume suitable data if required.
4. Figures to the right indicate full marks.

1. Attempt any four of following;
   a. Explain applications of FEA in various fields. — 5
   b. State different types of Boundary conditions. — 5
   c. Explain with sketches: types of elements. — 5
   d. Explain Shape function graphically for one dimensional Linear and quadratic element. — 5
   e. Explain Gauss Elimination Method using an example. — 5

2. a. Solve following differential equation — 12

   $$\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0; \qquad 0 \le x \le 1$$

   BCs: y (0) = 0 and y' (1) = 0.1; Find y(0.2) using variational method and Compare with exact solution

   b. Evaluate following integral $I = \int_{-1}^{1}(3^x - x)\,dx$ — 8

   Using (a) Newton Cotes Method using 3 sampling points.
   (b) Three points Gauss Quadrature

r	W_1	W_2	W_3	W_4
1	1			
2	1/2	1/2		
3	1/6	4/6	1/6	
4	1/8	3/8	3/8	1/8

| r	ξ_i	W_i
1	0.00	2.00
2	0.5773	1.00
3	0.00	0.8889
	0.7746	0.5556

3. a. Find the natural frequency of axial Vibrations of a bar of uniform cross section of 20 mm² and length 1 m. Take, E = 2 × 10⁵ N/mm² and ρ = 8000 kg/m³. Consider two linear elements. — 10

   b. Using Direct Stiffness method, determine the nodal displacements of stepped bar shown in figure. Take, G = 100 GPa. — 10


   2 kN-m   All lengths are in mm
   3 kN-m

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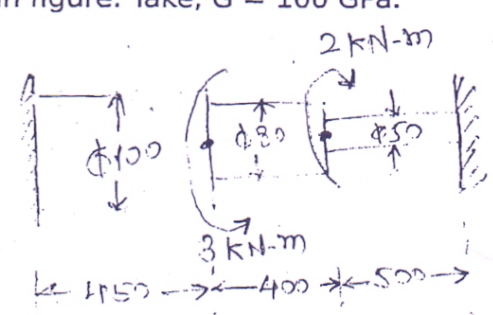
4. a. Explain Lumped and consistent mass matrix.   6

    b. Analysis the plane truss for nodal displacement, element stresses and srtains.   14
        Take , $P_1 = 5$ KN, $P_2 = 2$ KN, E = 180 Gpa, A = 6 cm2 for all elements.
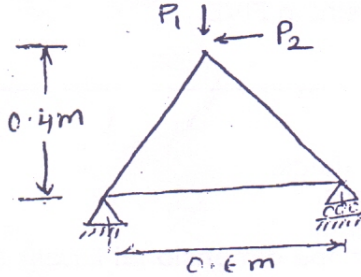
5. a.   12
        Solve following differential equation $\dfrac{d^2y}{dx^2} - 10x^2 = 5$; $0 \le x \le 1$

        BCs: y0) = y(1) = 0. Using Rayleigh-Ritz method, mapped over entire domain
        using one parameter method

    b. Find the shape function for two dimensional eight noded element.   8

6. a. Coordinates of nodes of a quadrilateral element are as shown in the figure.   10
        below. Temperature distribution at each node is computed as $T_1 = 100^0$ C, T_2
        $= 60^0$ C, $T_3 = 50^0$ C and $T_4 = 90^0$ C. compute temperature at point P (2.5, 2.5).
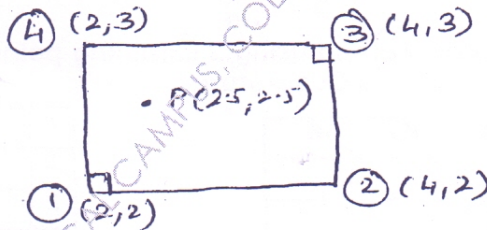
    b. What are the h and p versions of finite element method?   7
    c. Convergence requirement.   3

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