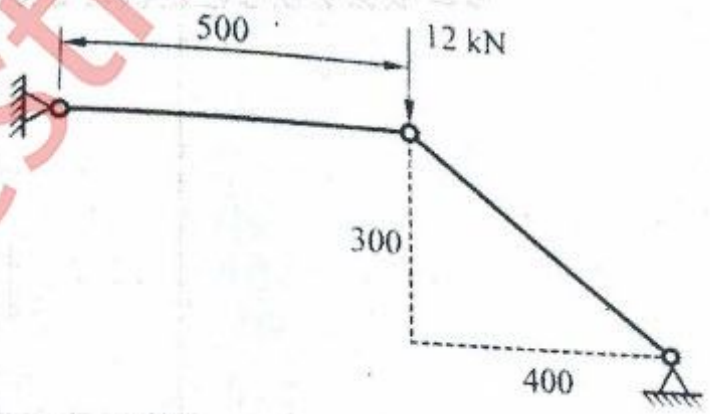
Q. P. Code: 24911

(3 Hours) Max. Marks: 80

Note:

1. Question 1 is Compulsory
2. Solve any three from remaining five
3. Figures to right indicate full marks
4. Assume suitable data if necessary

Question No.			Max. Marks
Q.1	a)	Write short note on Advantages and limitations of Finite Element Method	20
	b)	Derive shape function for 1D quadratic element in natural co-ordinates.	
	c)	Explain plane stress and plane strain conditions with figure.	
	d)	Elaborate convergence with example.	
Q.2	a)	The governing differential equation for the steady state one dimensional conduction heat transfer with internal heat generation is given by $$\frac{d}{dx}\left[k\frac{dT}{dx}\right] = q \text{ for } 0 \le x \le L$$ were k= coefficient of thermal conductivity of the material, q= internal heat generation Develop the finite element formulation for linear element. Use Rayleigh Ritz method, mapped over general element.	10
	b)	For the two bar truss as shown in fig, determine the nodal displacements and stress in each member. Take E = 70 GPa and area for both members = 200 mm^2. 	10
Q.3	a)	Solve following differential equation by Galerkin method. $$\frac{d^2u}{dx^2} + u = x^2, 0 \le x \le 1$$ Given Boundary Conditions are: u = 0 at x = 0, $\frac{du}{dx} = 1$ at x = 1 Find values for u (0.3) & u(0.6)	10

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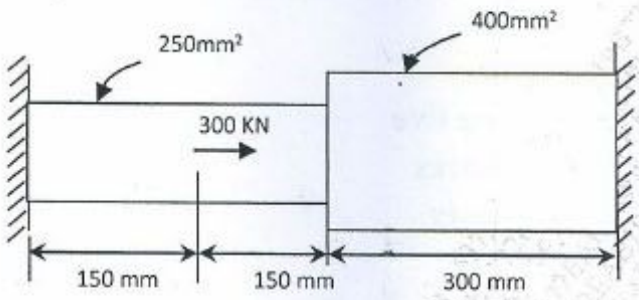
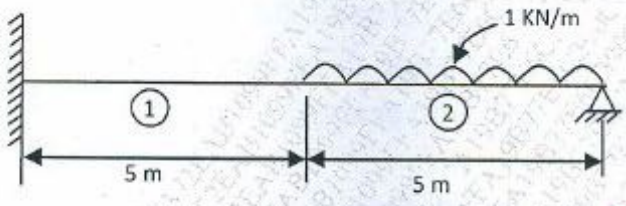
b) Find the displacement, stresses and strain in the elements of stepped bar as shown in figure. Take E = 200GPa. 10

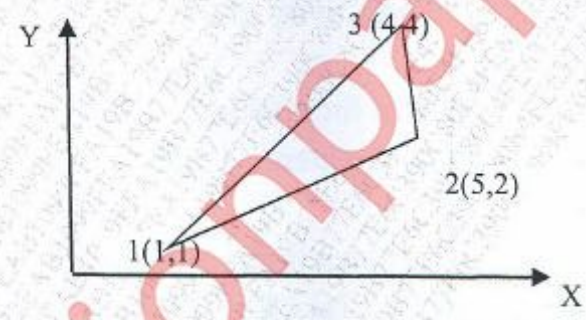


Q.4 a) Find the deflection and slopes at nodes and reactions at supports for the beam as shown in figure. Take E = 200 GPa, $I_1 = 2 \times 10^7$ mm^4 and $I_2 = 1 \times 10^7$ mm^4. 12



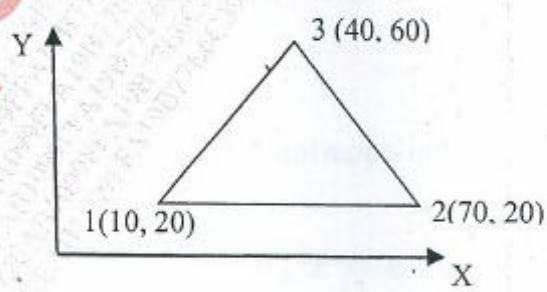
a) Derive shape function in natural coordinate system for eight nodded quadrilateral element. 08

Q.5 a) A linear interpolation functions for a triangular element as shown in figure. 10



b) Find the two natural frequencies of transverse vibrations of a beam fixed at both ends. Use Lumped mass matrix. Assume length of beam as 1unit, $EI = 10^6$ units, $\rho A = 10^6$ units. 10

Q.6 a) Evaluate the stiffness matrix for the CST element shown below. Coordinates are given in mm. Assume plane stress condition. Thickness = 10mm, E = 200 GPa and $\gamma = 0.3$. 10



b) Explain significance of Jacobian matrix. Derive for CST element. 10

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