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GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2181911 **Date:09/05/2019**

Subject Name:Finite Elements Method

Time:10:30 AM TO 01:00 PM **Total Marks: 70**

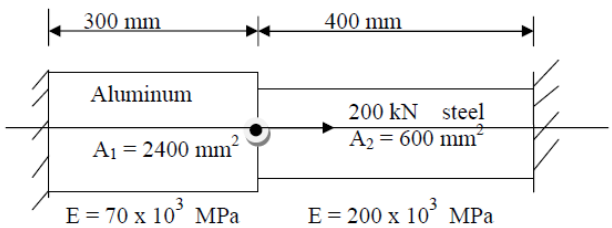
Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	What does discretization mean in the finite element method?	**03**
	(b)	Write advantages of the finite element method.	**04**
	(c)	List and describe the general steps of the Finite Element Method.	**07**
Q.2	**(a)**	Write strain-displacement equations.	**03**
	(b)	Derive elemental stiffness matrix for truss element.	**04**
	(c)	Explain Rayleigh Ritz method with example.	**07**

Finite Element Method **OR**

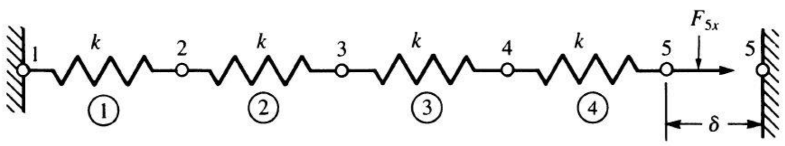
(c) Figure shows the compound section fixed at both ends. With the help of FEA estimate the reaction forces at the supports and the stresses in each material when a force of 200 KN is applied at the change of cross section. Solve using penalty approach. **07**



Q.3	**(a)**	What is dynamic analysis? Why is it required?	**03**
	(b)	Explain Consistent and Lumped mass matrices.	**04**
	(c)	Derive the element stiffness matrix and stress equation for plane truss.	**07**

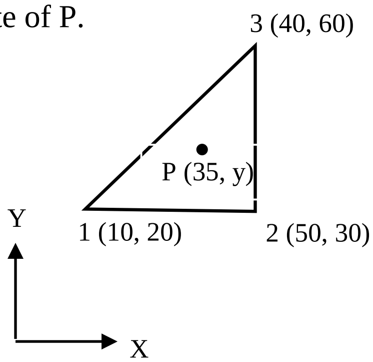
OR

Q.3	**(a)**	State properties of stiffness matrix.	**03**
	(b)	Define shape function and list its properties.	**04**
	(c)	For the spring assemblage shown in Figure, obtain (a) The global stiffness matrix, (b) The displacements of nodes 2–4, (c) The global nodal forces, and (d) The local element forces. Node 1 is fixed while node 5 is given a fixed, known displacement δ = 20:0 mm. The spring constants are all equal to *k* = 200 kN/m.	**07**



Q.4	**(a)**	Discuss the term CST & LST.	**03**
	(b)	Explain jacobian matrix of a 3 nodded CST element.	**04**

(c) The nodal coordinates of triangular elements are as shown in figure. The X coordinate of interior point P is 35 and N_1 = 0.3. Determine N_2, N_3 and Y co-ordinate of P. **07**

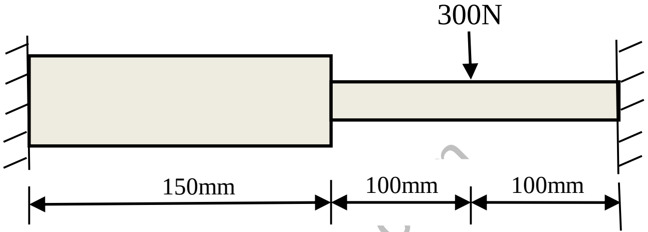


OR

Q.4 (a) Write difference between FEM and classical methods. **03**

(b) Explain Wilson's method. **04**

(c) Determine the displacement and slope at the load point for the stepped beam as shown in figure. Each elements has E = 200GPa. The area moment of inertia are given as $I_1 = 1.25\times10^5$ mm^4 and $I_2 = 4\times10^4$ mm^4. Determine the elemental stiffness matrices of each element, global stiffness matrix and application of boundary condition. **07**



Q.5 (a) Write different types of 2D elements. **03**

(b) Define plane stress and plane strain condition. **04**

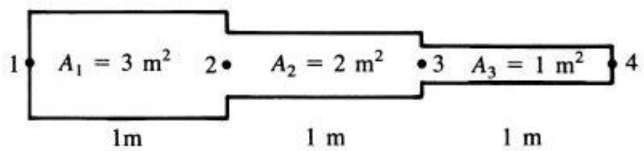
(c) Heat is generated in a large plate (K = 0.8W/m°C) at the rate of 4000 W/m^3. The plate is 25 cm thick and the outside surfaces of the plate are exposed to ambient air at 30°C with a convective heat transfer coefficient of 20 W/m^2 °C. Determine the temperature distribution in the wall. **07**

OR

Q.5 (a) Write application of FEM for fluid flow problems. **03**

(b) Define heat transfer, conduction, natural convection and radiation. **04**

(c) For the smooth pipe of variable cross section shown in Figure, determine the potential at the junctions, the velocities in each section of pipe and the volumetric flow rate. The potential at the left end is p_1 = 10 m^2/s and that at the right end is p_4 = 1 m^2/s. **07**



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