

Seat No.:_____

Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- VII EXAMINATION-SUMMER 2023

Subject Code: 3172008

Date:26/06/2023

Subject Name: Finite Element Analysis

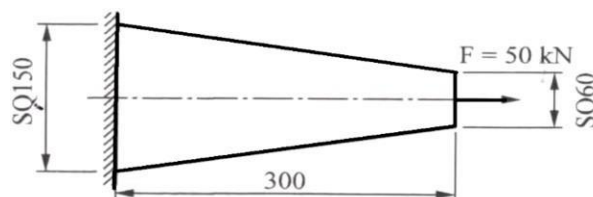
Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

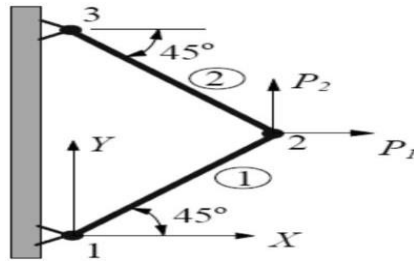
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Explain source of error in FEA.	03
	(b) Compare Finite Element Solution to the Exact Solution for a Beam.	04
	(c) Discuss the different types of elements used in FEA with its Application.	07
Q.2	(a) List various engineering application of FEA.	03
	(b) What do you mean by thermal effects of temperature? How it is included in calculation for 1-D elements?	04
	(c) Write general procedure for FEA.	07
	OR	
	(c) What is shape function? Derive linear shape functions for 1-dimensional bar element in terms of natural coordinate. Also plot variation of shape functions within this element.	07
Q.3	(a) Differentiate between spring, bar and beam elements from general and application point of view.	03
	(b) Draw a sketch of 2D and 3D elements used in FEA.	04
	(c) Model the tapered bar shown in following figure by considering it is made of 2 elements and determine deflection at both end and in middle of the bar. Assume modulus of elasticity as 200 GPa.	07

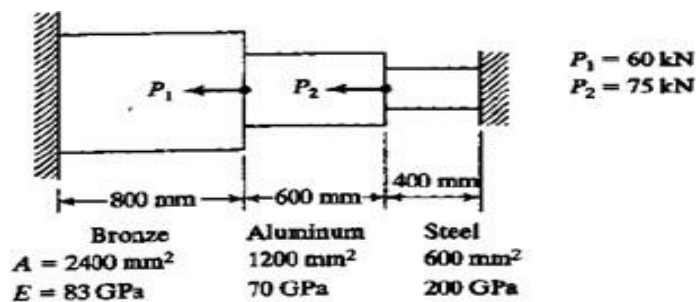


OR

Q.3	(a) What are the properties of the Stiffness matrix?	03
	(b) What do you mean by 'Discretization'? State precautions required during Discretization.	04
	(c) A simple plane truss is made of two identical bars (with E, A and L) and loaded as shown in figure 3. Find	07
	1) Displacement of node 2	
	2) Stress in each bar	

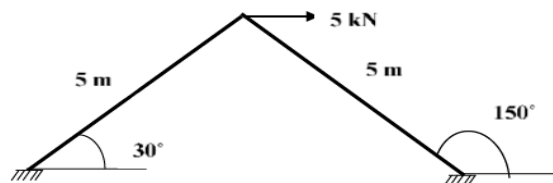


- Q.4 (a) How does axisymmetric differ from planer symmetry? 03
 (b) Explain penalty approach used to solve FEA problem. 04
 (c) A stepped is subjected to axial loads as shown in following fig. Determine the nodal displacement. 07

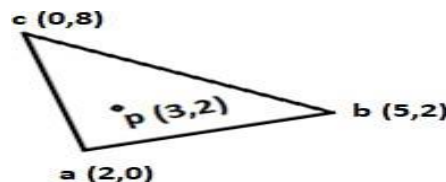


OR

- Q.4 (a) Define local and global coordinate system in trusses. 03
 (b) Explain in brief : CST & LST 04
 (c) Analyze the two-members truss shown in following Figure Assume EA to be constant for all members. The length of each member is 5m. Area $A=0.01 \text{ m}^2$ and $E=210 \text{ GPa}$. Compute nodal displacements and reactions forces. Determine stresses in each member. 07



- Q.5 (a) What are the ways which a 3D problems can be reduced to a 2D approach? 03
 (b) Differentiate between plane stress and plane strain analysis giving a suitable example. 04
 (c) Find the Jacobian matrices for triangle shown in following Fig. 07



OR

- Q.5 (a) What are the conditions necessary to be followed for considering a problem as axisymmetric? 03
 (b) Enlist steps to be followed for solution of Structural problems using FEA. 04
 (c) Derive stiffness matrix for an axial bar element using direct stiffness matrix. State the properties of global stiffness matrix. 07
