Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2022

Subject Code:3171920 Date:08/06/2022

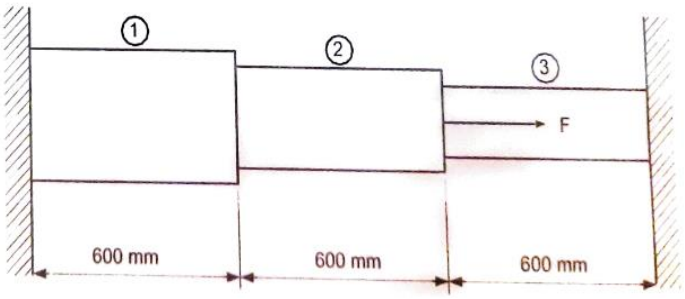
Subject Name:Finite Element Methods

Time:02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

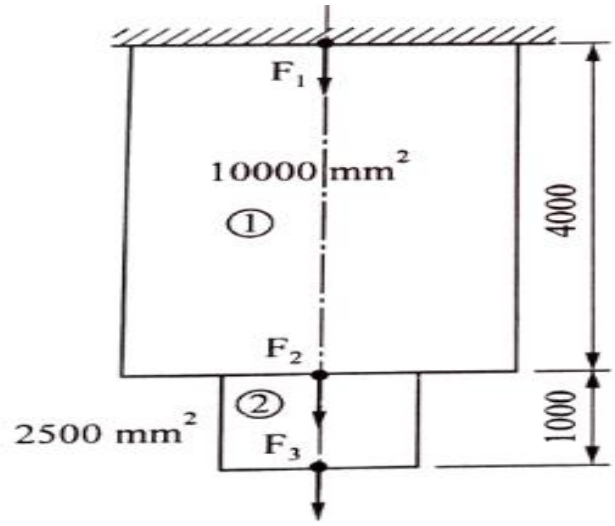
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Explain the types of boundary conditions identified in Finite element analysis	**03**
	(b)	Explain shape function ?	**04**
	(c)	Explain step by step procedure for finite element method in detail.	**07**
Q.2	**(a)**	What is element connectivity?	**03**
	(b)	Discuss the applications of Finite Element Method.	**04**
	(c)	A stepped shaft is shown in figure. Determine stresses and the deflections in each of the sections. Take E=90GPa and axial force F =50KN.	**07**



OR

	(c)	Discuss the different types of elements used in FEA with its application	**07**
Q.3	**(a)**	Source of error in FEA.	**03**
	(b)	Higher number of elements leads to getting a solution closer to the exact solution? Justify	**04**
	(c)	A rectangular section steel bar is suspended vertically from top edge as shown in figure. Evaluate extension of bar under self weight. Assume modulus of elasticity as 210 Gpa and specific gravity of steel as 8.	**07**

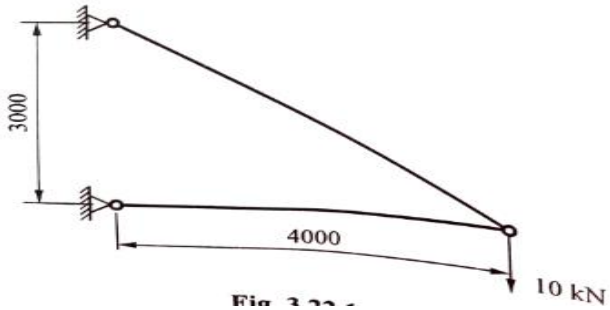


OR

Q.3 **(a)** Differentiate between plane stress and plane strain analysis giving asuitable example. **03**

(b) Differentiate between spring, bar and beam elements from general and application point of view. **04**

(c) A two member truss is as below.The cross sectional area of each member is 200 mm^2 and the modulus of elasticity is 200 GPa.Determine the deflections and stresses in each of members. **07**



Q.4 **(a)** Discuss the conditions necessary for solving a problem using Axisymmetric element. **03**

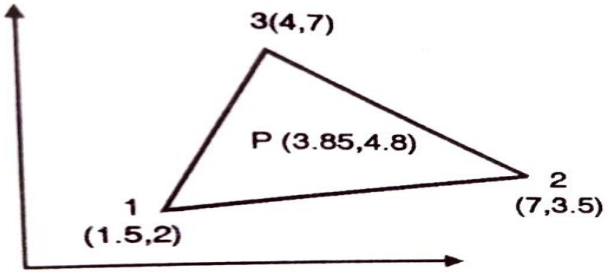
(b) Explain Isoparametric element. **04**

(c) Give Potential Energy Approach to Derive Beam Element Equations. **07**

OR

Q.4 **(a)** Explain CST and LST elements. **03**

(b) Evaluate the shape function N_1, N_2, N_3. **04**



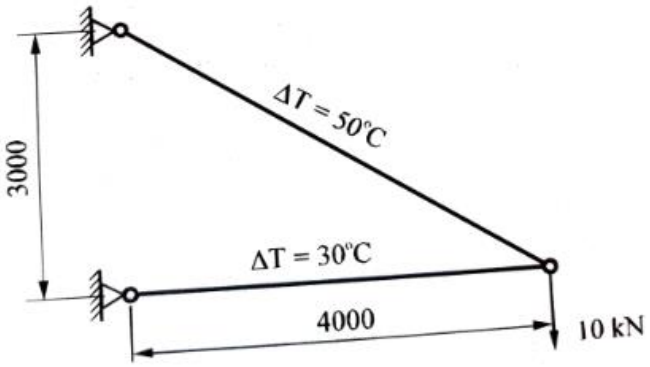
(c) Differentiate Plane Frames element with beam element. Write element stiffness matrix K ,transformation matrix L and load vector F. **07**

Q.5 **(a)** Define axissymmetric elements. **03**

(b) Give the practical application of axisymmetric elements. **04**

(c) Determine the global stiffness matrix and global load vector in the truss shown in figure. The cross-sectional area of each member is 200 **07**

mm^2 and modulus of elasticity is 200 GPa. Assume $\alpha = 12 * 10^{-6}$ per °C.



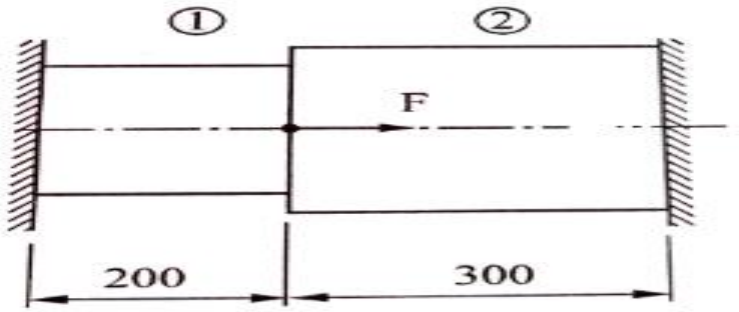
OR

Q.5 **(a)** How 3D problems can be reduced to a 2D approach in finite element method ? **03**

(b) How are the thermal effects considered in the analysis of 1 d linear elements. **04**

(c) An axial load of F=400KN is applied at 20°C to the rod as shown in figure.The temperature is then raised to 50°C.The properties of elements are as shown in table. **07**
Determine nodal displacements.

Component	Element -1	Element -2
MATERIAL	ALUMINIUM	STEEL
CROSS SECTIONAL AREA	900 mm^2	1200 mm^2
coefficient of thermal expansion	$2.3 * 10^{-6}$ per °C.	$11.7 * 10^{-6}$ per °C.
Young's Modulus (Gpa)	70	200



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