Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2023

Subject Code:3171920 Date:06-12-2023

Subject Name: Finite Element Methods

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.**

Q.1	**(a)**	Differentiate between Plane stress and plane strain.	**03**
	(b)	What do you understand by Discretization? What are the factors to be considered for discrediting the domain?	**04**
	(c)	Explain general steps of the Finite element method in detail	**07**
Q.2	**(a)**	State various application of FEM in different field of Engineering.	**03**
	(b)	What are the convergence requirements?	**04**
	(c)	Give the derivation of the stiffness matrix for a bar element in local coordinate.	**07**
		OR	
	(c)	Explain the Galerkin's residual method and its use to derive the one dimensional bar element equations.	**07**
Q.3	**(a)**	Explain Different types of elements used in FEA.	**03**
	(b)	Explain in brief: CST & LST	**04**
	(c)	Classify the different boundary condition & explain it in detail.	**07**
		OR	
Q.3	**(a)**	Explain symmetric banded matrices and skyline matrices.	**03**
	(b)	Explain the properties of stiffness matrices.	**04**
	(c)	Illustrate the Plane Frames element with neat sketch indicating degree of freedoms. How it is differed from beam element. Write element stiffness matrix K ,transformation matrix L and load vector F.	**07**
Q.4	**(a)**	Enlist three examples of practical application of axisymmetric element.	**03**
	(b)	What are the conditions necessary to be followed for considering a problem as axisymmetric?	**04**
	(c)	Give potential energy approach to derive beam element equation	**07**
		OR	
Q.4	**(a)**	What are the ways through which 3D problems can be reduced to a 2D approach?	**03**
	(b)	A constant stain triangular element is defined by three nodes 1(1.5,2),2(7,3.5) and 3(4,7).Evaluate the shape functions N1,N2, and N3 at the interior point P (3.85,4.8).	**04**
	(c)	Give the derivation of the linear strain triangular element stiffness matrix and equation.	**07**
Q.5	**(a)**	Explain the different types of nonlinearity.	**03**
	(b)	Define Isoparametric element.	**04**
	(c)	Establish the shape functions and derive the strain displacement matrix for axisymmetric triangular element.	**07**

OR

Q.5	**(a)**	Differentiate between Spring, Bar and beam elements from general and application point of view.	**03**
	(b)	Explain Evaluation of eigenvalues in dynamic consideration.	**04**
	(c)	Write short note on FEM convergence requirements.	**07**

****