Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER 2012

Subject code: 1724301 **Date: 29-12-2012**

Subject Name: Finite Element Method in Geo Technical Engineering

Time: 10.30 am – 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)**	Enumerate advantages & disadvantages of Finite Element Method.	**07**
	(b)	Derive the load vector for 2-noded bar element if it is loaded with i) Uniformly distributed load along length ii) Uniformly varying load along length	**07**
Q.2	**(a)**	Explain briefly Pascal's triangle and write displacement function for 4-noded quadrilateral element.	**07**
	(b)	For the one dimensional – Two noded seepage problem, specify the following. i) Constitutive relationship ii) Approximate function iii) Shape function iv) Strain displacement function	**07**
		OR	
	(b)	Derive shape functions and K matrix for two nodded bar element.	**07**
Q.3	**(a)**	Determine the fluid head distribution along the length of coarse gravelly medium as shown in Fig. 1. Fluid head at top is 20 cm & at bottom is 10 cm. Take Permeability Coefficient 1 cm/sec. and cross sectional area 4 cm^2.	**07**
	(b)	Analyse the beam shown in Fig.2, using finite element method and determine: i) End Reactions ii) Bending Moment at the midspan	**07**
		OR	
Q.3	**(a)**	A two noded torsion element is shown in Fig-3. Calculate angular rotations at node 2 & 3. Take GJ =160 GPa.	**07**
	(b)	Derive element stiffness matrix for beam element. Show sample calculation for K_{33}.	**07**
Q.4	**(a)**	Consider the bar shown in Fig.4. Determine the nodal displacements and stress each material. Take A_1 = 2000 mm^2, E_1 = 70 x 10^9 N/m^2 and A_2 = 500 mm^2, E_2 = 200 x 10^9 N/m^2.	**07**
	(b)	Derive K matrix for three nodded bar element.	**07**
		OR	
Q.4	**(a)**	Determine extension of tapered bar shown in Fig.5 at free end. Take thickness t=30 mm and E=200 Gpa.	**07**
	(b)	Derive K matrix for two nodded truss element.	**07**
Q.5	**(a)**	Give constitutive laws for three dimensional problems of i) Orthotropic materials ii) Isotropic materials	**07**
	(b)	Evaluate stiffness matrix for Fig.6. Assume plane stress condition. Take E=210 GPa ,ν = 0.25 and t=10 mm. Coordinates are in mm.	**07**
		OR	
Q.5	**(a)**	What do you understand by Jacobian matrix. Explain in detail.	**07**
	(b)	Sketch variation of shape function over CST element.	**07**

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