Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: 170605 **Date: 28/12/2012**

Subject Name: Advanced Structural Analysis (Department Elective – I)

Time: 10.30 am - 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Take Modulus of elasticity = 200 GPa & Poisson's ratio = 0.25, unless given.**

Q.1	**(a)**	For the beam shown in ***fig.-1***, if the displacement at joints B(θb) and C(θc) are 36.16/EI (anticlockwise) and -4.02/EI (clockwise) respectively due to the loading given on it. Determine member end actions and draw S.F. & B.M. diagrams.	**07**
	(b)	Write a C/C++ program to read the geometrical and structural data for plane truss structure and prepare member stiffness matrix along structural axis (i.e S_{MS} matrix) for each member. Read data from user defined input file and print appropriate results in user defined output file. Also prepare a sample input file for a structure shown in ***fig.-2***.	**07**
Q.2	**(a)**	Derive the relation for action or displacement vector on member axis and structure axis for plane frame.	**07**
	(b)	For the plane frame shown in ***fig.-3***, determine load vector for member BC along structure axis using rotation transformation matrix.	**07**
		OR	
	(b)	List various methods for solution of linear simultaneous equations using matrices. Give algorithm or C/C++ program for any of them.	**07**
Q.3		Analyse the plane truss shown in ***fig.-2*** and determine deflections and reactions at the joints. Determine member end actions also and tabulate them.	**14**
		OR	
Q.3		Analyse the plane frame shown in ***fig.-3*** using member stiffness approach, neglecting axial deformation condition. Use of symmetry may be permitted. Determine support reactions. Draw B.M diagram neatly. Take I/A=100.	**14**
Q.4		Find the displacement of the composite structure shown in ***fig.-4***. Beam AB is made up of concrete (E=20 GPa) with rectangular cross section of 150 mm x 200 mm, while cable CE is of steel (E=200 GPa) with 10 mm diameter.	**14**
		OR	
Q.4		A symmetrical plane grid shown in ***fig.-5*** is made up of steel pipes of 300 mm outer diameter and of 8 mm thickness. Determine displacement at joints and member end actions. Draw B.M, S.F and Torsional moment diagrams. Take G=80 GPa.	**14**
Q.5	**(a)**	List various steps involved in solution of problem using Finite Element Method and explain descritizations in details.	**05**
	(b)	A steel tapered rod of 500 mm length, 40 mm diameter at top end and 20 mm diameter at bottom is kept vertical with fixed at top. Determine stresses & strains in the rod due to its self weight and additional 20 kN load acts in downward direction at free end. Take minimum two elements of 2 noded for your calculations.	**09**

OR

Q.5 **(a)** Explain the use nonlinear analysis of structure. List various methods to be used in nonlinear analysis of structure and explain any one of them. **05**

(b) Determine the deformation at joints of a space truss shown in ***fig.-6*** using Member Stiffness Approach. Use of symmetry is permitted. **09**

Figures