

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(θ_b) and C(θ_c) 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 discretizations 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

