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)   **07**
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.

(b) Write a C/C++ program to read the geometrical and structural data for   **07**
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*.

Q.2 **(a)** Derive the relation for action or displacement vector on member axis and   **07**
structure axis for plane frame.

(b) For the plane frame shown in *fig.-3*, determine load vector for member BC   **07**
along structure axis using rotation transformation matrix.

OR

(b) List various methods for solution of linear simultaneous equations using   **07**
matrices. Give algorithm or C/C++ program for any of them.

Q.3 Analyse the plane truss shown in *fig.-2* and determine deflections and   **14**
reactions at the joints. Determine member end actions also and tabulate
them.

OR

Q.3 Analyse the plane frame shown in *fig.-3* using member stiffness approach,   **14**
neglecting axial deformation condition. Use of symmetry may be
permitted. Determine support reactions. Draw B.M diagram neatly. Take
I/A=100.

Q.4 Find the displacement of the composite structure shown in *fig.-4*. Beam AB   **14**
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.

OR

Q.4 A symmetrical plane grid shown in *fig.-5* is made up of steel pipes of 300   **14**
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.

Q.5 **(a)** List various steps involved in solution of problem using Finite Element   **05**
Method and explain descritizations in details.

(b) A steel tapered rod of 500 mm length, 40 mm diameter at top end and 20   **09**
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.

1

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

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

Figures

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

2