Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – WINTER 2015

Subject Code: 170605 **Date: 04/12/2015**

Subject Name: Advanced Structural Analysis

Time: 10:30am to 1:00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Assume the values for all the members of bending as b=200, d=300, E=2x10^{7}kN/m^2, G=7x10^{6}kN/m^2 and J=3x10^{9}mm^4.**

Q.1 **(a)** Write a subprogramme in C / C++ for the calculation of stiffness matrix for the portal frame analysis. The inputs are member properties like length, modulus of elasticity, area and moment of inertia. **07**

(b) Write a subprogramme in C / C++ for the solution of simultaneous equations by any method of solution. The inputs are structural stiffness matrix and structural load vector. **07**

Q.2 **(a)** Briefly explain the steps involved in finite element analysis. Discuss the assembly process in detail. **07**

(b) Derive the stiffness matrix for a three nodded column element having nodal coordinates at x=0, x=3 and x=8. **07**

OR

(b) Discuss plane stress problem and plane strain problems to be used in finite element analysis giving examples of it. **07**

Q.3 Analyze the portal frame as shown in figure.1 by member stiffness matrix approach and draw the final bending moment diagram. The over hang is 1m beyond the beam of 6m. (Neglect axial deformations). **14**

OR

Q.3 **(a)** A three span continuous beam ABCD has AB=4m, BC=6m and CD=6m. AB is loaded by a udl of 30kN/m and BC and CD are loaded by 40kN/m. The support A is fixed and D is roller. The beam is analyzed and the rotations at B, C and D are found to be -40/EI (clockwise) radians, -40/EI radians and 200/EI radians respectively. Calculate the member end forces and hence draw the final bending moment and shear force diagrams. **07**

(b) Derive the rotational transformation matrix for the element in the plane grid in XZ axes. **07**

Q.4 Analyze the truss as shown in the figure.2 by member stiffness matrix method only for temperature load (no external loads) and tabulate the forces in the member. The extreme members of two ends are heated by 80°C only. (Use of symmetry is allowed.) Assume the value of α=1.2x10^{-6}/°C/m, E=2x10^{8}kN/m^2 and A=1000mm^2. **14**

OR

Q.4 Analyze the truss as shown in the figure.2 by member stiffness matrix method and tabulate the forces in the member under external loads and loading due to shortness of middle member by 10 mm. (Use of symmetry is allowed.) Assume the value of E=2x10^{8}kN/m^2 and A=1000mm^2. **14**

Q.5 Analyze the grid structure as shown in figure.3 by member stiffness matrix and calculate the final member end actions for all the members. **14**

OR

Q.5 Analyze the gable frame as shown in the figure.4 by member stiffness mtrix method and draw the final bending moment diagram. Neglect the axial deformations. (Use of symmetry is allowed.) **14**

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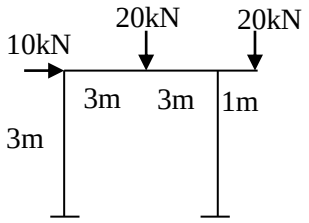

Figure.1

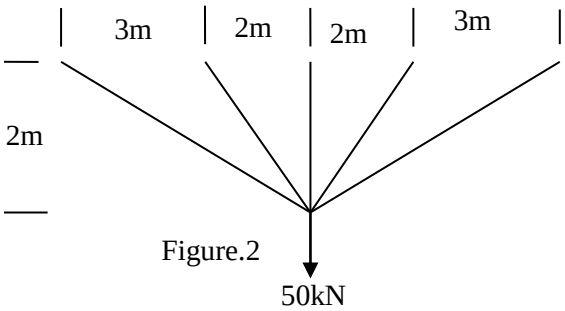

Figure.2

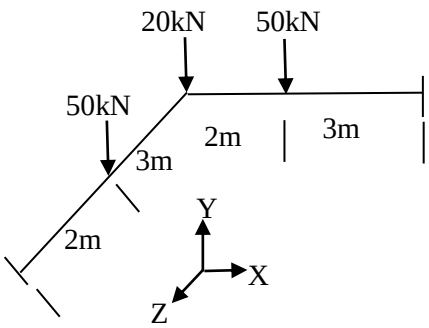

Figure.3

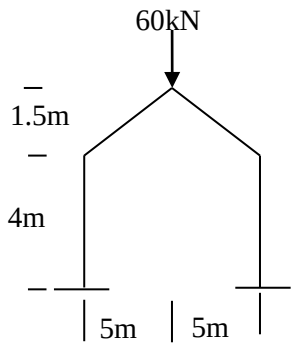

Figure.4