

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII(OLD) • EXAMINATION – WINTER 2016

Subject Code: 170605**Date: 18/11/2016****Subject Name: Advanced Structural Analysis (Department Elective-I)****Time: 10:30 AM to 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.
4. Assume the values for all the members of bending as $b=200$, $d=300$, $E=2 \times 10^7 \text{ kN/m}^2$, $G=7 \times 10^6 \text{ kN/m}^2$ and $J=3 \times 10^9 \text{ mm}^4$ where necessary.
5. Solve all the questions by member stiffness matrix method.

- Q.1** (a) A two span continuous beam ABC has $AB = 6\text{m}$ and $BC = 5\text{m}$. Span AB is loaded by an udl of 15 kN/m and span BC is loaded by center point load of 100kN . The support A is fixed while support B and C are roller support. Analyze the beam and draw final bending moment diagram. **07**
- (b) Derive the rotational transformation matrix for the element in the plane grid in XZ axes.
- Q.2** (a) State the various loading options available in the software you have learnt. Discuss any one of them in detail. **07**
- (b) 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**
- OR**
- (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.3** Analyze the portal frame as shown in figure.1 by stiffness matrix method and draw the bending moment diagram. (Neglect axial deformations). **14**
- OR**
- Q.3** (a) A three span continuous beam ABCD has $AB=4\text{m}$, $BC=6\text{m}$ and $CD=4\text{m}$. AB and $b=BC$ are loaded by a udl of 30kN/m while CD is loaded by a centre point load of 100kN . The support A and D are fixed while supports B and C are rollers. The beam is analyzed and the rotations at B and C found to be $-39.375/EI$ (clockwise) radian and $46.875/EI$ respectively. Calculate the member end forces and hence draw bending moment diagram. **07**
- (b) Explain the term elastic supports. Beam AB of span 5m and loaded by a udl of 60 kN/m and has support A as fixed and point B is supported by spring of stiffness $0.1EI\text{kN/m}$. Analyze the beam and draw bending moment and shear force diagram. **07**
- Q.4** Analyze the truss as shown in the figure.2 only for temperature load and tabulate the forces in the members. The centre member is heated by 80°C only. Assume the value of $\alpha=1.2 \times 10^{-6}/^\circ\text{C/m}$, $E=2 \times 10^8 \text{ kN/m}^2$ and $A=1000\text{mm}^2$. **14**
- OR**
- Q.4** Analyze the truss as shown in the figure.2 only for prestained forces and tabulate the forces in the members. The central member is too short by 2mm . Assume the value of $E=2 \times 10^8 \text{ kN/m}^2$ and $A=1000\text{mm}^2$. **14**

- Q.5 (a)** Explain the term non linearity. Explain how the problem of non linearity can be solved. **07**
- (b)** Briefly explain the steps involved in finite element analysis. Discuss the assembly process in detail. **07**

OR

- Q.5** A four span continuous beam ABCDE has $AB = BC = CD = DE = 6\text{m}$. Spans AB and DE are loaded by udl of 30kN/m while BC and CD are loaded by centre point load of 150kN . The support A and E are hinged while supports B, C and D are roller. Analyze the beam and draw bending moment and shear force diagrams. (Use of symmetry is permissible) **14**

