

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**ME SEMESTER – I (NEW) EXAMINATION – SUMMER 2017**

**Subject Code:2712001****Date:09/05/2017****Subject Name: MATRIX METHODS OF STRUCTURAL ANALYSIS****Time:02:30 P.M. to 05:00 P.M.****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Solve all the questions by member stiffness matrix method or member flexibility matrix method. Assume the value of EI as 18000kN-m<sup>2</sup> whenever required.

- Q.1** (a) Explain sub-structure method of analysis giving examples. Also give advantages of the method. **07**
- (b) Discuss the importance of rotational transformation matrix used in stiffness matrix method. Also derive the rotational transformation matrix for the grid element. **07**
- Q.2** (a) Explain the concept of symmetry and anti-symmetry used in analysis of structures. Also give two applications for both the concepts. **07**
- (b) A two span beam ABC has hinged support at A while roller supports at B and C. Both the spans AB and BC are 5m. The span AB is loaded by a udl of 20kN/m over the entire span and span BC is loaded by a central point load of 80kN. Analyze the beam by flexibility matrix method by taking reaction at B as unknown. Assume flexural rigidity as EI for AB and 2EI for BC. **07**
- OR**
- (b) A propped cantilever beam AB has span of 8m and loaded by udl of 20kN/m over the half part of the beam from fixed support. Analyze the beam by flexibility matrix method and draw the bending moment diagram. Assume determinate beam as simple support beam. **07**
- Q.3** Analyze the portal frame as shown in the figure.1 by flexibility matrix method and draw bending moment diagram. Assume determinate structure as cantilever frame. **14**
- OR**
- Q.3** Analyze the portal frame as shown in the figure.2 by flexibility matrix method and draw bending moment diagram. The support at A is fixed while that at D is hinged. Assume determinate structure as cantilever frame. **14**
- Q.4** 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.4** Analyze the truss as shown in the figure.3 by stiffness matrix method. And tabulate forces in the member. All the supports at top are hinged supports. **14**
- Q.5** A continuous beam ABCD has AB = 5m, BC = 4m and CD = 5m. Both A and D are fixed supports while both B and C are roller supports. The beam is loaded by udl of 60kN/m over entire length ABCD. If both the fixed supports yield by 0.002 radians and both the roller supports settle by 0.01m, analyze the beam by stiffness matrix method and draw the bending moment and shear force diagram. Make use of symmetry of the structure. **14**

**OR**

**Q.5**

A two span continuous beam ABC has  $AB = BC = 6\text{m}$ . Support A is fixed, support B is spring support having stiffness of  $5000\text{kN/m}$  and support C is roller. The spans AB is loaded by udl of  $40\text{kN/m}$  and span BC is loaded by central point load of  $100\text{ kN}$ . Analyze the beam and hence draw bending moment and shear force diagram.

**14**

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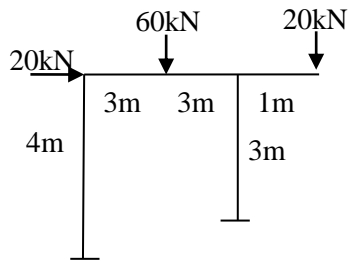


Figure.1

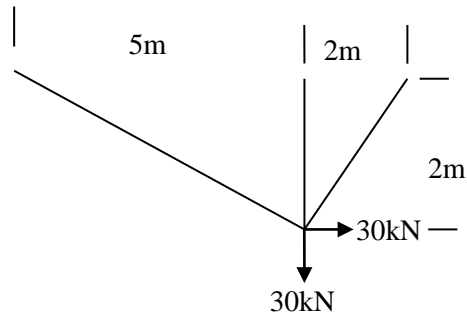


Figure.3

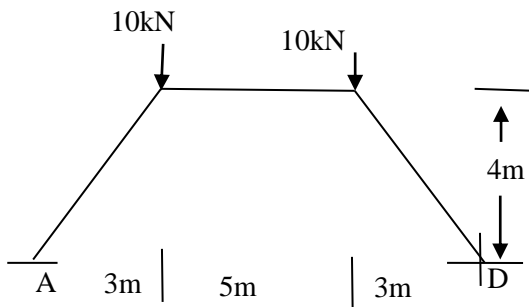


Figure.2