

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V • EXAMINATION – WINTER • 2014

Subject Code: 150605

Date: 10-12-2014

Subject Name: Structural Analysis - III

Time: 10.30 am - 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. Draw neat and clean sketches, wherever required.

- Q.1** (a) Explain term “Plastic hinge”. State (i) Upper bound theorem and (ii) Lower bound theorems for collapse load in plastic analysis. **07**
- (b) Discuss the characteristics of stiffness matrix. Formulate Stiffness matrix [S] for a prismatic cantilever beam, of length ‘L’, also considering axial deformation with usual notations. Take $EI = \text{Constant}$. **07**
- Q.2** (a) Derive formula for meridional and hoop force in conical dome subjected to concentrated load ‘W’ at the vertex, with usual notations. **07**
- (b) Derive formulae of shear force, bending moment and torsional moment at any section, for the quarter circular cantilever beam curved in plan, subjected to uniformly distributed load w per unit run throughout its length, with usual notations. **07**
- OR**
- (b) Find Shape factor for the section shown in fig. (i) **07**
- Q.3** (a) Formulate the flexibility matrix [F] and vector {DQL} for the beam shown in fig. (ii). Assume fixed end moment at A and internal moment at support B as redundant Q_1 and Q_2 respectively. **07**
- (b) For the beam (given in Q.3(a) above), calculate values of all unknown reactions using flexibility method. Also draw SF and BM diagram. **07**
- OR**
- Q.3** (a) A circular beam curved in plan is symmetrically supported on six columns. The radius of beam is 6 m and is subjected to udl of 5 kN/m throughout its length. Determine the value of shear force, bending moment and torsional moment at $\phi = 0^\circ$, $\phi = 30^\circ$ and $\phi = 60^\circ$. (Mid span and Supports) **07**
- (b) Determine collapse load in terms of M_p for the portal frame loaded as shown in fig. (iii). **07**
- Q.4** (a) Formulate the stiffness matrix [S] and load vector {AD – ADL} for the beam shown in fig. (ii). **07**
- (b) For the beam (given in Q.4(a) above), calculate joint displacement and final end moments using stiffness method. **07**
- OR**
- Q.4** (a) A conical dome of 6 m diameter and central rise of 4 m supports total udl including self weight of 10 kN/m² over the entire surface. The thickness of dome is 100 mm. Calculate meridional stress and hoop stress at the base of the dome. **07**
- (b) Define term “collapse load”. Determine collapse load in terms of M_p , using static method for the beam fixed at both ends and subjected to udl ‘ w ’ kN/m throughout its length ‘L’ m as shown in fig. (iv). **07**

- Q.5 (a)** A spherical dome having 8 m span and 2 m rise, subjected to udl of 10 kN/m^2 including self weight. The thickness of the dome is 100 mm. Calculate meridional and hoop stresses at each $\theta = 10^\circ$ interval from crown to base of the dome. **07**
- (b)** A beam curved in plan is fixed at both the ends. The radius of the beam is 5 m and subtended angle is 75° . It is subjected to udl of 10 kN/m throughout its length. If the section of the beam is $230 \text{ mm} \times 600 \text{ mm}$, determine shear force, bending moment and torsional moment at mid span and end supports. Take $EI = 5.608GJt$. **07**
- OR**
- Q.5 (a)** Discuss various types of stresses in spherical domes with sketch. Using formula of hoop force prove that in a spherical dome, subjected to udl over entire surface, the hoop force changes its nature at an angle 51.83° from crown. **07**
- (b)** A semi-circular beam curved in plan is supported on three equally spaced supports, carries udl of w per unit run throughout its length. The radius of the beam is ' r '. Determine maximum value of bending and torsional moment. **07**

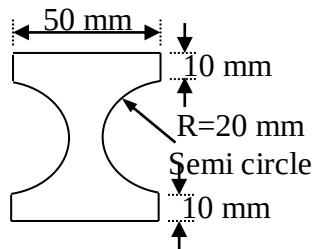
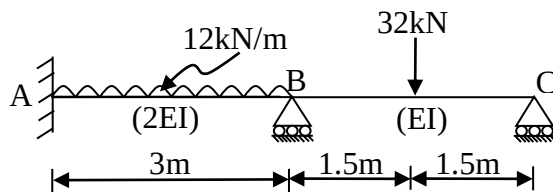


Fig. (i) Q.2(b) OR



**Fig. (ii) Q.3(a), Q.3(b),
Q.4(a) & Q.4(b)**

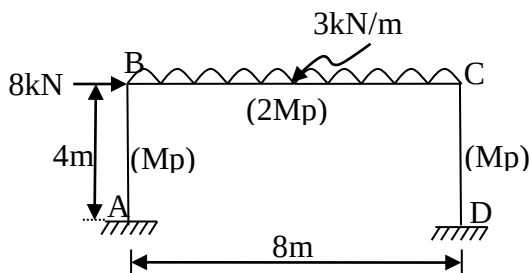


Fig. (iii) Q.3(b) OR

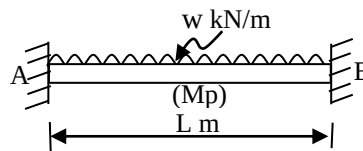


Fig. (iv) Q.4(b) OR