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 = 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 reactons 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 $\varphi = 0^\circ$, $\varphi = 30^\circ$ and $\varphi = 60^\circ$. (Mid span and Supports) **07**

(b) Determine collapse load in terms of Mp 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/m^2 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 Mp, 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 θ = 10˚ 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 mm x 600 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**

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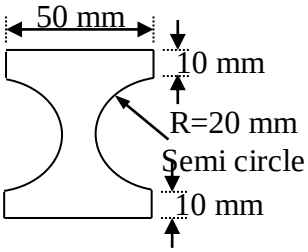

Fig. (i) Q.2(b) OR

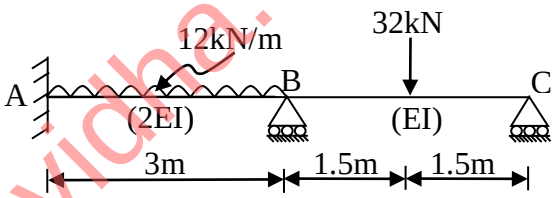

Fig. (ii) Q.3(a), Q.3(b), Q.4(a) & Q.4(b)

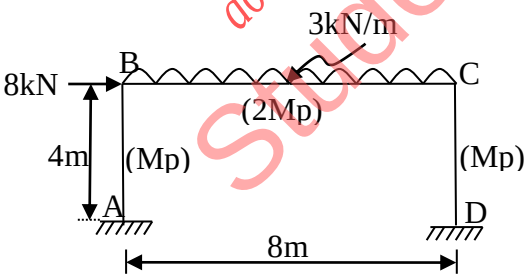

Fig. (iii) Q.3(b) OR

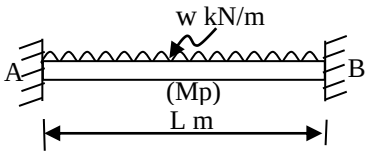

Fig. (iv) Q.4(b) OR