Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – WINTER 2015

Subject Code: 150605 Date:11/12/2015

Subject Name: Structural Analysis - III

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.**

Q.1 **(a)** A truss is made up of 6 members AB, BC, CD, DA, AC & BD of equal axial rigidity. Co-ordinates of joints are A(0,3), B(3,3), C(3,0) & D(0,0). It carries a vertical downward load of magnitude 24kN at joint 'B'. Support 'D' is hinged. 'C' is roller support offering a vertical reaction. Find the redundant force in member 'AB' using flexibility method **08**

(b) Solve the following **06**

1. Find the vertical reaction at support 'C' of a beam ABCDE curved in plan if it carries concentrated loads 'P' acting vertically downwards at 'B' and 'D'. Straight segments AB and DE are perpendicular to straight segment BCD. Consider 'A' as a hinged support. 'C' and 'E' are roller supports. Take AB = BC = CD = DE = L.
2. Find the shape factor for a beam of solid circular section

Q.2 **(a)** Find the vertical displacement at the free end C of a beam ABC semicircular in plan and of radius 'R' with end A fixed. Point C is diametrically opposite to A. Point B is at centre of arc AC and carries a vertical downward load 'W'. Take EI = GJ = 1 **07**

(b) A ring beam of radius 'R' is supported symmetrically using 12 supports. It has constant flexural and torsional rigidity. It carries u.d.l. of intensity 'w' including self-weight. Prove that hogging BM over any support is $0.02295\ wR^2$ **07**

OR

(b) Find the twisting moment developed at any general section of a cantilever in the form of a quarter circle, curved in plan, carrying a uniform transverse vertical downward load of intensity 'w' on entire length. The beam has a uniform c/s and radius 'R'. Hence draw the TMD. Show ordinates at quarter points. **07**

Q.3 **(a)** Find the rotations at supports 'B' and 'C' of a 2 span continuous beam ABC of constant flexural rigidity 'EI' carrying a clockwise moment of magnitude 12 kN-m at 'B'. Supports 'B' & 'C' are simple supports and 'A' is a fixed support. Spans AB and BC are 4 m long. Use stiffness method **07**

(b) For above beam ABC find member end actions. Hence draw BMD **07**

OR

Q.3 **(a)** A 2 span continuous beam ABC of constant flexural rigidity 'EI' carries a clockwise moment of magnitude 12 kN-m at 'B'. Supports 'B' & 'C' are simple supports and 'A' is a fixed support. Spans AB and BC are 4 m long. Using flexibility method, find redundant vertical reactions at 'B' and 'C'. Hence or otherwise find the fixed end moment at 'A' **07**

(b) An axially rigid right angled bent ABC has column AB of height 'h' and beam BC of length '*l*'. If 'EI' is constant, 'A' is a fixed end and 'C' is a hinged support find the flexibility matrix considering reactions at 'C' as redundant **07**

Q.4 **(a)** A conical dome of base diameter 12m and central rise 6m carries a vertical downward concentrated load of magnitude 8kN at the crown. Find the meridional stress developed at 2m vertically above base, if the thickness of the shell is 90mm **07**

(b) A spherical dome has a radius of 14m and central rise 4m. It is made up of concrete weighing 25kN/m^3. The thickness of the dome is 110mm. If the maximum permissible compressive stress in the concrete is 1.2N/mm^2, find what additional load can be safely carried by the dome per unit surface area. **07**

OR

Q.4 **(a)** A hemispherical concrete dome of diameter 28m, carrying its own weight, rests on level ground. Find stresses induced at crown and base. Show the distribution of meridional and hoop stresses in the dome. Take thickness of dome as 125mm and density of concrete as 25kN/m^3. Identify the zone in which tension reinforcement may be required. **07**

(b) A segmental spherical dome with an opening at top has a diameter 16m. The diameter of opening is 4m and height of opening above the base of dome is 5.5m The dome is subjected to u.d.l. of intensity 12kN/m^2 distributed per unit surface area of dome including self-weight. In addition, it carries a total load of 50kN distributed uniformly all along the circumference of opening through the ring beam provided at the circumference of the opening. Find the meridional thrust per unit length induced in the dome at a point 2m below the opening. **07**

Q.5 **(a)** A three span continuous beam resting on rigid simple supports A, B, C, D carries gravity loads of magnitude 100kN, 80kN and 160kN at 2m from the left support on spans AB, BC and CD respectively. Plastic moment carrying capacities of spans AB, BC and CD are 210kN-m, 140kN-m and 250kN-m respectively. Sketch all possible mechanisms leading to collapse of beam. Hence find the collapse load factor for individual spans. **07**

Take spans as AB = 5m, BC = CD = 4 m

(b) For problem of Q.5(a) above find the collapse load factors for remaining mechanisms not covered above. Hence find collapse load for the beam **07**

OR

Q.5 **(a)** Find the collapse load for a prismatic propped cantilever, of span 'L' subject to u.d.l. on entire span, using kinematic method. The plastic moment carrying capacity of section is 'M_P' **07**

(b) Using static approach, find the collapse load for a prismatic fixed beam carrying u.d.l. 'w' on entire length 'L' in addition to a concentrated load equal to total distributed load on span 'wL' at centre of span. The plastic moment carrying capacity of section is 'M_P' **07**

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