Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–II EXAMINATION – WINTER 2015

Subject Code: X 20603 **Date:30/12/2015**

Subject Name: Structural Analysis-I

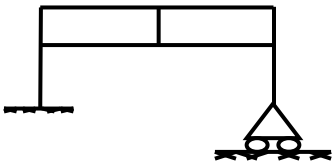
Time: 02:30pm to 05:00pm **Total Marks: 70**

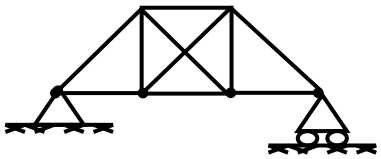
Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) Derive equation for hoop stresses change in dimensions and change in volume for a thin spherical shell with usual notations. **07**

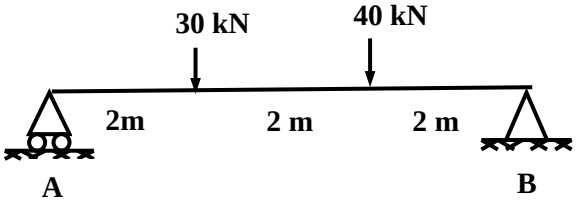
Q.1 (b) Find out S.I. and K.I. for the structures as shown in figure below. Also give comment on stability. **04**





Q.1 (c) Define ILD and explain its uses. **03**

Q.2 (a) Calculate slope and deflection at mid-span for a beam as shown in figure below. Take EI = 5000 kN-m^2. Use any appropriate method. **07**



Q.2 (b) Derive equation for hoop stresses change in dimensions and change in volume for thin spherical shell subjected to internal pressure 'p'. **07**

OR

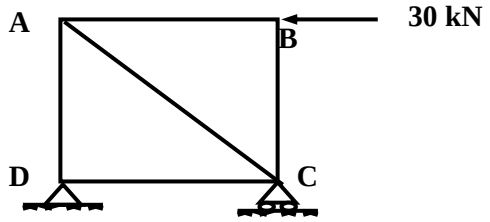
Q.2 (b) A closed cylindrical vessel of length 5 m, diameter 400 mm and thickness 12 mm is subjected to internal pressure of 2 MPa. Calculate longitudinal stress, hoop stress, shear stress change in length, change in diameter and change in volume. Take poisson's Ratio = 0.30 and E = 200 GPa. **07**

Q.3 (a) Calculate slope & Deflection at free end for a cantilever beam of span 3 m subjected to u.d.l. of 12 kN/m over entire span. Use Moment-area method. Take EI = 20000 kN m^2 **07**

Q.3 (b) Calculate slope and deflection at mid span for a simply supported beam of span 5 m subjected to udl of 10 kN/m over entire span. Use Conjugate beam method. **07**

OR

Q.3 (a) Calculate Horizontal Displacement at point B for a truss shown in figure below using Unit Load Method. Length of AB=BC=CD=AD=3 m **07**



Q.3 (b) Calculate safe load using Euler's Formula for a column with effective length of 4.2 m and both ends fixed, having following cross sectional details. **07**
Size of Top and Bottom Flange : 250 mm x 20 mm
Size of Web: 360 mm x 12 mm
Take E = 2 x 10^5 N/mm^2

Q.4 (a) A hollow circular shaft of diameter ratio of 0.8 has to transmit 200 kW power at 100 rpm. The maximum torque being 25% greater than the mean torque. The shear stress in the shaft should not exceed 100 N/mm^2. The twist in a length of 4 m should not exceed 2 degree. Calculate external and internal diameter of the shaft. Consider Modulus of rigidity = 0.4 x 10^5 MPa. **07**

Q.4 (b) A hollow circular cast iron column of length 4 m has to carry an axial load of 300 kN. The diameter ratio for the column is 0.9. The permissible compressive stress of material is 100 N/mm^2 and Rankine's constant is (1/1600). One end of column is fixed and other is hinged. Calculate diameter of the column. **07**

OR

Q.4 (a) A concrete column having cross-sectional dimension 400 mm x 500 mm is loaded by a point load 200 kN is acting at any one corner of the column. Calculate stresses on all four corners of the column. **07**

Q.4 (b) A retaining wall of 6 m height, 2 m wide at top and 5 m wide at bottom retains soil up to 5 m height on its vertical face. Check stability of retaining wall in any two parameters. The unit weight of soil is 18 kN/m^3 and Density of masonry is 20 kN/m^3. Consider Angle of repose = 30 degree. SBC of soil = 200 kN/m^2 **07**

Q.5 (a) Define Strain Energy. Derive that stress due to suddenly applied load is twice than stress due to gradually applied load. **07**

Q.5 (b) A three hinged parabolic arch is subjected to a point load of 50 kN at 5 m from left end support. The arch has a span of 16 m and central rise of 4 m. Calculate support reactions and maximum positive bending moment. **07**

OR

Q.5 (a) Four wheel loads of 10 kN, 15 kN, 20 kN and 25 kN with a fixed distance of 2 m between them are crossing a simply supported beam of span 20 m from left to right with 25 kN load leading. Calculate maximum bending moment at a section 8 m from left support.

Q.5 (b) A u.d.l. of 8 kN/m and 4 m in length passes a simply supported beam of 10 m span from left to right. Draw ILD for shear force and bending moment at a section 4 m from left end support. Also calculate maximum values of shear force and bending moment at section. **07**

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