Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC 2ND Semester Examination – July- 2011

Subject code: X 20603

Subject Name: Structural Analysis-I

Date:16/07/2011 **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.**

Q.1 (a) Derive generalized formula for torsion of circular shaft (with usual notation) **06**

$$\frac{T}{I_P} = \frac{\tau}{r} = \frac{C\theta}{L}$$

(b) A solid shaft is to transmit 300kW power at 100 r.p.m. If the shear stress is not to exceed 80MPa, find the diameter of shaft. What percentage of material saving will take place when it is replaced by a hollow shaft with diameter ratio 0.6. **08**

Q.2(a) Derive the relationship to determine longitudinal stress and hoop stress in closed cylindrical vessel under an internal pressure. **07**

(b) A closed cylindrical vessel of length 3m, diameter 750mm and thickness 12.5mm is subjected to internal pressure 1.5MPa. Calculate, **07**

(i) Longitudinal stress (ii) Hoop stress (iii) Change in diameter

(iv) Change in length (v) Maximum shear stress

Take Poisson's ratio 0.25 and modulus of elasticity 210GPa.

OR

(b) Find the forces in truss shown in Fig.1 using strain energy concept. Assume all the members have same cross sectional area and are made from same material. **07**

Q.3(a) A simply supported beam of span 14m carries two point loads 120kN and 80 kN at 3m and 9.5m from left support. If the moment of inertia of section is 16 x 10^8 mm^4 and modulus of elasticity of material is 2.1 x 10^5 MPa, calculate deflection under point load 120kN. Use moment curvature relationship. **07**

(b) A simply supported concrete beam of cross section 200 x 400mm and span 4m, carries two point loads 10kN and 20 kN at 1m and 2m from left support. If the modulus of elasticity of concrete is 2 x 10^4 MPa, calculate **07**

(i) Slope at both ends

(ii) Location and magnitude of maximum deflection.

Use Macaulay's method.

OR

Q3(a) Find the vertical deflection of joint D of truss shown in Fig.2 due to point load 10kN at joint D. All the members have cross-sectional area 200mm^2 and modulus of elasticity 210 GPa. **07**

(b) Draw bending moment diagram for the frame shown in Fig.3 using strain energy concept. Assume all the members have same moment of inertia and modulus of elasticity. **07**

Q.4 (a) A three hinged parabolic arch of span l and rise h carries a uniformly distributed load over its entire span. Show that the arch is not subjected to any bending moment at any section. **07**

(c) A hammer of 100N falls from a height of 1.25m on a cube of dimension 50x50x50mm before coming to the rest. Calculate the instantaneous deformation and stress produced in cube. Also determine the fall velocity of hammer. The modulus of elasticity of material is 200 GPa. **07**

OR

Q.4 (a) Use first principal to derive influence lines diagram for a simply beam has span l (i) Reaction at one of the supports (ii) Shear force at any section (iii) Bending moment at any section. **07**

(b) Draw influence diagram for member U_1L_1, U_1L_2, L_1L_2, and U_1U_2 for the truss shown in Fig 4. **07**

Q.5 (a) What do you understand by the kernel of the section? Determine kernel region for (i) rectangular section (ii) Circular section **07**

(b) A concrete column having cross-sectional dimension 300x400mm is loaded by a point load 120kN acting eccentrically at 50mm distance from center along one of the diagonals. Find out the stress at all four corners. **07**

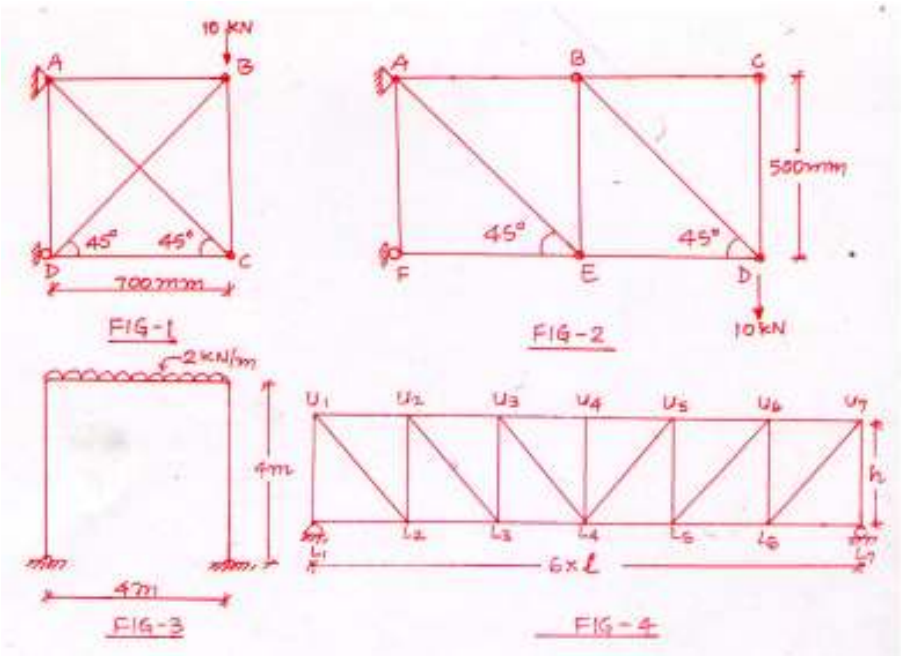
OR

Q.5 (a) What do you understand by effective length of column? Write the significance of slenderness ratio. In which circumstances Euler's formula cannot be used? **05**

(b) A 3m long hollow cylindrical cast iron column of external diameter 150mm and internal diameter 120mm is hinged at one end whereas its other end is fixed. Find the strength of column as per (i)Euler's formula and (ii) Rankine's formula **09**

Also determine at what length of column, the strength by both formulae will be same.

Take modulus of elasticity E = 8 x 10^4 MPA, Crushing stress f_c = 550 MPa and Rankin's Constant α = 1/1600



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