Code : C-301

Register Number						6	4

III Semester Diploma Examination, May 2009

CIVIL ENGINEERING BOARD

STRENGTH OF MATERIALS

Time : 3 Hours] **[Max. Marks : 100**

Notes : (1) Section – **I** is *compulsory*.

(2) Answer any ***two*** full questions from each Section – II, III and IV.

SECTION – I

1. (a) Fill in the blanks with appropriate word/words **5**

(i) The point where bending moment changes its sign is known as _____.

(ii) The M.I. of circular section about centroidal axis is _____.

(iii) If P_1 and P_2 are principal stresses, then maximum shear stress will be _____.

(iv) The ratio of shear stress to shear strain is known as _____.

(v) The unit of polar modulus is _____.

(b) What are the assumptions made in theory of pure torsion ? **5**

SECTION – II

2. (a) A hollow steel column of external dia. 250 mm has to support an axial load of 2000 kN. If the ultimate stress for the column is 480 N/mm^2. Find the internal diameter of the column. Allowing load factor 4. **5**

(b) A steel bar 300 mm long, 50 mm wide, 12 mm thick is subjected to an axial pull of 90 kN. Determine the changes in length, width, thickness and volume of the bar. **10**

Take $E = 2 \times 10^5$ N/mm^2

$\frac{1}{m} = 0.3$

3. (a) A bar of 20 mm dia is subjected to a pull of 38 kN. The measured extension on a gauge length of 200 mm is 0.12 mm. Change in dia is 0.0036 mm. Calculate : (i) Young's Modulus

(ii) Bulk Modulus

(iii) Modulus of Rigidity **9**

(b) A steel rod is 25 mm dia, 8 m long is connected at the Ends rigidly at 40 °C. Find the stresses induced when the temperature falls to 20 °C. **6**

(i) If the ends do not yield.

(ii) If the ends yield by 0.92 mm.

Take $E = 2 \times 10^5$ N/mm^2

$\alpha = 1.2 \times 10^{-5}$/°C

4. (a) At a point in a strained material the principal stresses are 120 MPa (tensile) and 80 MPa (compressive). Determine the normal stress, shear stress, resultant stresses on a plane inclined at 45° to the axis of major principal stress. Also find the direction of resultant stress and maximum shear stress at that point. **10**

(b) An axial pull of 45 kN is suddenly applied to a bar 2 m long, 35 mm ×35 mm in cross-section. Calculate the strain energy stored. **5**

Take $E = 2 \times 10^5$ N/mm^2

SECTION – III

5. (a) Locate the centroid of a T section 120 mm × 120 mm × 20 mm. **5**

(b) Find the moment of inertia about their centroidal XX and YY axes of an angle section 120 mm × 100 mm × 20 mm with its longer leg vertical. **10**

6. (a) A rectangular beam 300 mm deep is simply supported over a span of 4 m. What uniformly distributed load per metre of the beam may carry, if the bending stress is not to exceed 120 N/mm^2 ? **9**

Take $I = 8 \times 10^6$ mm^4

(b) A steel plate is bent into circular arc of radius 10 mts. If the plate section is 120 mm wide and 20 mm thick. Find the maximum stress induced and the bending moment which can produce this stress. **6**

Take $E = 2 \times 10^5$ N/mm^2

7. (a) A cantilever 1.5 m long is loaded with uniformly distributed load of 2 kN/m run over a length of 1.25 m from the free end. It also carries a point load of 3 kN at a distance 0.25 m from the free end. Draw SFD and BMD. 6

(b) A beam AB 10 mts. long has supports at its ends A and B. It carries a point load of 5 kN at 3 mts. from A and a point load 5 kN at 7 mts. from A and a uniformly distributed load of 1 kN per mt. between the point loads. 9

Draw SFD and BMD.

SECTION – IV

8. (a) A solid circular shaft 75 kW at 200 RPM. Calculate the shaft diameter if the twist not to exceed 1° in 2 m length of shaft and the shearing stress is limited to 50 N/mm^2. 9

Take C = 1×10^5 N/mm^2.

(b) A boiler is subjected to an internal pressure of 2 N/mm^2. The thickness of boiler plate is 20 mm and the permissible tensile stress is 120 N/mm^2. Find the maximum permissible tensile stress when the efficiency of longitudinal joint is 90% and that of the circumferential joint is 40%. 6

9. (a) A double rivetted cover butt joint is to be provided for connecting 10 mm thick plates with 20 mm dia rivets. Determine the pitch and efficiency of the joint. Taking f_s = 80 N/mm^2, f_c = 160 N/mm^2 and f_t = 120 N/mm^2. 9

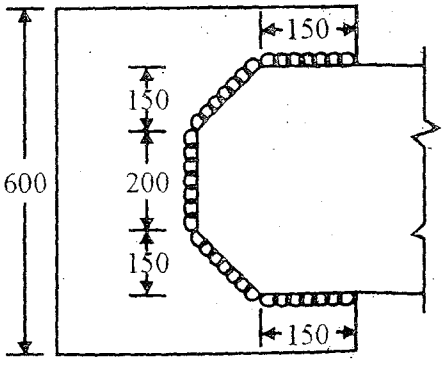
(b) Find the strength of fillet welded joint shown in figure (1). 6

Thickness of plate = 10 mm

Size of the weld = 6 mm

Take f_t = 150 N/mm^2

f_s = 100 N/mm^2



All measurements are in mm.

Fig. (1)

10. (a) A system of concurrent co-planar forces is shown in fig. (2). Find the magnitude of the unknown forces P and Q, so that they are in equilibrium. 6

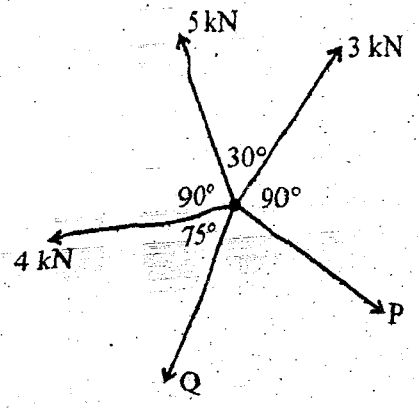


Fig. (2)

(b) A simply supported beam of 6 M span carries three point loads 25 kN, 15 kN, and 10 kN at 1 m, 2.5 m and 4.5 m respectively from the left support. 9 Determine graphically the reactions at the supports.