Question Paper 2007

Civil Engineering

(Paper II)

SECTION – I

(Civil)

1. Differentiate between the following materials giving specific uses in the building industry: (6 + 8 + 8 + 8)

(*a*) Igneous, sedimentary and metamorphic rocks

(*b*) Bitumen, coal tar and asphalt

(*c*) Common burnt clay bricks, firebircks and flyash bricks

(*d*) Paints and varnish

2. (*a*) A river is flowing from West to East. For determining the width of the river, two points A and B are selected on the southern bank such that the distance AB = 75 m. Point *A* is Westward. The bearings of a tree C on the Northern bank are observed to be 38° and 338°, respectively from A and B. Calculate the width of the river. (20)

(*b*) What are contour gradients? Explain their importance in the location of a hill road. (10)

3. (*a*) A 10 m thick bed of sand is underlain by a layer of clay 6 m thick. The water table that was originally at ground level is lowered by drainage to a depth 4 m, whereupon the degree of saturation above lowered water table reduces to 20%. Determine the increase in the effective pressure at mid of clay layer due to water table lowering. Given saturated densities of sand and clay as 2.1 g/cm^3 and 1.8 g/cm^3, and the dry density of sand = 1.7g/cm^3.

Note : [g/cm^3 = 10^3 kg/m^3 × 9.8 m/s^2 = 9.81 kN/m^2]. (20)

(*b*) An earth embankment is compacted at water content of 17% to a bulk density of 1.9 g/cc. If the sp. gr. of soil grains is 2.65 calculate the void ratio of the compacted embankment. (10)

4. (*a*) The space between two parallel horizontal plates is kept 5 mm apart. This is filled with crude oil of dynamic viscosity 2.5 kg/m.s. If the lower plate is stationary and the upper plate is pulled with velocity of 1.75m/s, determine the shear stress on the lower plate. (15)

(*b*) An open tank 5 m long, 2 m deep and 3 m wide contains oil of relative density 0.9 to a depth of 0.9 m. If the tank is accelerated along its length on a horizontal track at a constant value of 3 m/s^2, determine the new position of oil surface. (15)

5. (*a*) Calculate the diameter and discharge of a circular sewer laid at a slope of 1 in 400, running half-full and with velocity 1.9 m/s (n = 0.012). (15)

(*b*) The 5-day BOD of a waste is 280 mg/*l*. The ultimate BOD is reported to be 410 mg/*l*. At what rate the waste is being oxidised? (15)

6. (*a*) What are the various methods of doing theodolite traversing? Describe the deflection angle method in detail. (10)

(*b*) What soil investigations are required for constructing (*i*) an embankment and (*ii*) a building? Give details. (10)

(*c*) Write a note on flow measurement methods employed for pipe flow and open channels (with specific reference to drains). (10)

SECTION – II

(Structural)

7. (*a*) Draw SF and BM diagrams for the beam with applied moment as shown in Fig. 1. (15)

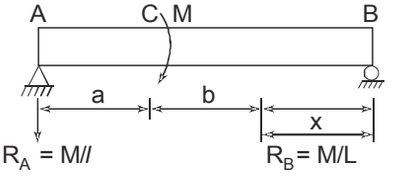

Fig. 1

(*b*) A bar 40 mm in diameter is subjected to a tensile force of 40000 kg. The extension of bar measured over a gauge length of 200 mm

was 0.318 mm. The decrease in diameter was found to be 0.02 mm. Calculate the values of Young's modulus of elesticity and modulus of rigidity of the material. (15)

8. (*a*) Find the slope and deflection at the free end of a cantilever shown in Fig. 2. Moment of inertia of AC is twice the moment of inertia of BC. (15)

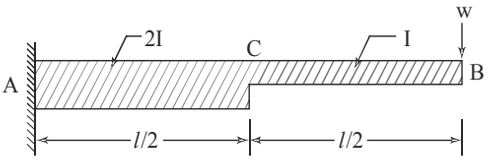

Fig. 2

(*b*) The *I*-beam shown in Fig. 3 is simply supported at its ends over a 4 m span and carries central load of 50000 *N* which acts through the centroid, the line of action being as shown in Fig. 3. Calculate the maximum stress. (15)

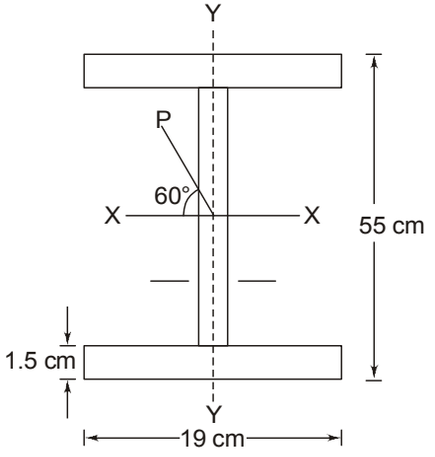

Fig. 3

9. (*a*) Explain briefly the importance of different concretes in construction. (10)

(*b*) List the properties of cement concrete in plastic and hardened stage (5)

(*c*) Explain briefly the terms batching, mixing transporting, compacting and curing. (15)

10. (*a*) A reinforced concrete beam 30 cm × 60 cm in section is reinforced with 4 bars 16 ϕ at top and 5 bars 22 ϕ at bottom with an effective cover of 4 cm. Assume safe compressive strength of concrete = 50 kg/cm^2; σ_{sc} = 1400 kg/cm^2; m = 19. Find moment of resistance (*WSM*). (15)

(*b*) Design a reinforced concrete beam with balanced section for flexure by working stress method for the data given below: (WSM) (15)

Effective span (simply supported) = 8 m

Live load = 12 kN/m

Breadth of the beam = 300 mm

Concrete grade = M 20

Reinforcement steel grade = Fe 415

11. Design a circular tank of 13.75 m diameter and 3.0 m height of wall. Free board = 0.3 m. The tank rests on a firm ground. The walls are fixed at base and free at top. (LSM). (30)

12. (*a*) The bracket shown in Fig. 4 consists of pair of mild steel plates riveted to the flanges of 305 mm × 152 mm I-column. If the resultant force on the critical rivet is limited to 45 kN, determine the load *P*, the bracket can support. (15)

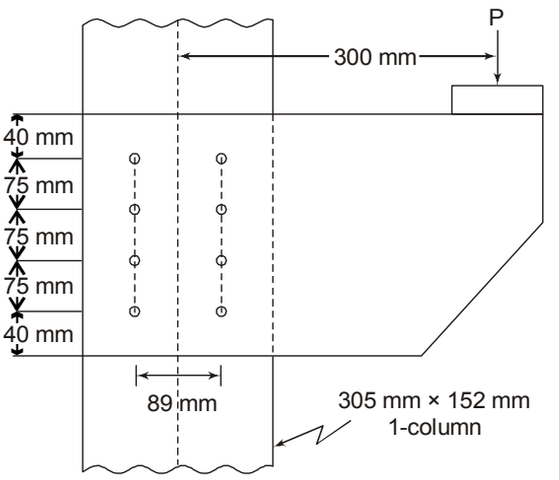

Fig. 4

(*b*) Calculate the size of the weld required for the welded bracket loaded as shown in Fig. 5. (15)

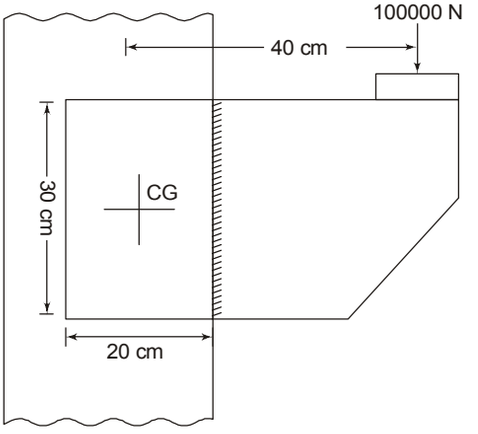

Fig. 5