Question Paper 2010

Civil Engineering

(Paper II)

SECTION – I

(Civil)

1. (*a*) Describe the classification of rocks. (10)

(*b*) What are the ingredients of a varnish? Describe the various types of varnishes. (10)

(*c*) Discuss the manufacture of cement. (10)

2. (*a*) A steel tape is 30 m long at a temperature of 15° C and a pull of 50 N when laid on the flat. The tape weight 18 N. It is stretched between end supports only allowing it to sag. Find the correct length of the tape at a field temperature of 25°C at a pull of 115 N. If in the above condition a base line is measured and the recorded length of the line is 600 m, find the correct length of the base line.

Take $\alpha = 12 \times 10^{-6}$ per °C and $E = 2 \times 10^5$ N/mm^2. Sectional area of the tape = 7.50 mm^2 (14)

(*b*) Write brief notes on the following: (16)

(*i*) Prismatic compass

(*ii*) Plane table and its accessories.

3. (*a*) The following properties of the soil were determined by performing tests on clay sample:

Natural moisture content = 25 %.

Liquid limit = 32%

Plastic limit = 24%

Diameter of 60% size = 0.006 mm

Diameter of 10% size = 0.006 mm

Calculate the liquidity coefficient, uniformity coefficient and relative consistency. (15)

(*b*) A sample of soil 10 cm diameter, 15 cm length was tested in a variable head permeameter. The initial head of water in the burette was found to be 45 cm and it was observed to drop to 30 cm in 195 seconds. The diameter of the burette was 1.9 cm. Calculate the coefficients of permeability in metre/day. (15)

4. (*a*) Explain standard penetration test for measuring the penetration resistance of the soil. (12)

(*b*) An earthen embankment is compacted to a dry density of 1.82 gm/cc at a moisture content of 12%. The bulk density and moisture content are 1.72 gm/cc and 6% at the site from where the soil is borrowed and transported at the site of construction. How much excavation should be carried out in the pit of borrowed area for each cu-m of the embankment. (18)

5. (*a*) An oil of viscosity 1.0 poise and relative density 1.05 is flowing through a circular pipe of diameter 5 cm and of length 200 m. The rate of flow is 3.52 *l*/sec. Find the shear stress at the pipe wall. (12)

(*b*) Lubricating oil of specific gravity 0.85 and dynamic viscosity 0.01 kgf-s/m^2 is pumped through a 3 cm diameter pipe. If pressure drop per metre length of the pipe is 0.15 kgf/cm^2, determine the mass flow rate in kg/min, the shear stress at the pipe wall, the Reynolds number of flow and the power required per 40 m length of pipe to maintain the flow. (18)

6. (*a*) Discuss in detail the physical and chemical characteristics of sewage. (18)

(*b*) Design a rapid sand filter system for a water supply of 9 m.l.d. to a township. All the principle components shall be designed. Enumerate your assumptions during the design steps. (12)

SECTION – II

(Structural)

7. (*a*) Draw S.F. and B.M. diagram for the beam shown in Fig. 1. (10)

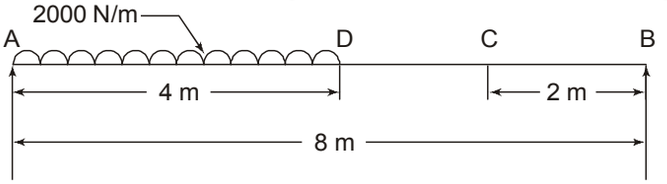

Fig. 1

(*b*) Find the moment of inertia of the triangular section shown in Fig. 2. (10)

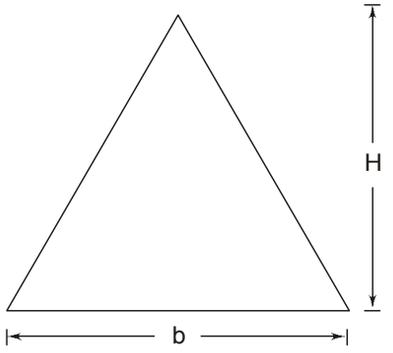

Fig. 2

(*c*) A straight circular bar of steel 1 cm in diameter and 120 cm long is mounted in testing machine and located axially in compression till it buckles. Assuming the Euler formula for pinned ends to apply, estimate the maximum central deflection before the material reaches its yield stress of 350 N/mm^2.

$E = 0.21 \times 10^5$ N/mm^2. (10)

8. (*a*) For the beam shown in Fig. 3, find deflection at the free end and the middle of span. (15)

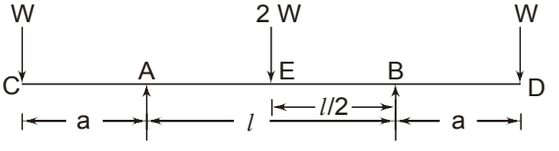

Fig. 3

(*b*) Describe the properties of water which are necessary to be used to get good concrete. What do you understand by the term 'water cement ratio'? (15)

9. (*a*) Describe various methods of mixing concrete. (15)

(*b*) Discuss in detail the 'underwater concreting'. (15)

10. (*a*) Determine the maximum superimposed distributed load which the beam section 220 mm × 440 mm (effective cover = 40 mm) reinforced with total area of tension steel 1256.64 mm^2, can carry, if the effective span is 5 m. Use M 20 concrete and Fe 415 steel. Take m = 13.33. (15)

(*b*) Design a floor slab simply supported over a clear span of 3.5 m. The roof is to be finished with 18.5 mm thick layer of lime concrete terracing. The superimposed load on the slab is 3000 N/m^2. Use M 20 grade of concrete and high yield strength deformed bars. Take weight of lime concrete as 19.2 kN/m^3. (15)

11. Design a square footing of uniform thickness for an axially loaded column of 400 mm × 400 mm in size. The safe bearing capacity of soil is 200 kN/m^2, load on column = 1000 kN. Use M 20 grade of concrete and HYSD bars. (30)

12. (*a*) A 16 mm thick plate is joined by double cover butt joint using a 10 mm thick cover plate. The steel of main and cover plate has permissible tensile strength of 150 MPa. Determine the strength and efficiency of the joint per pitch of 9 cm if.

(*i*) 20 mm diameter power driven shop rivet is used.

(*ii*) 20 mm diameter close tolerance and turned bolts are used. (20)

Take σ_p = 300 MPa, T_{vf} = 100 Mpa.

(*b*) Find the safe load that can be transmitted by fillet-welded joint shown in Fig. 4. The size of the weld is 6 mm. (P_q = 108 MPa). (10)

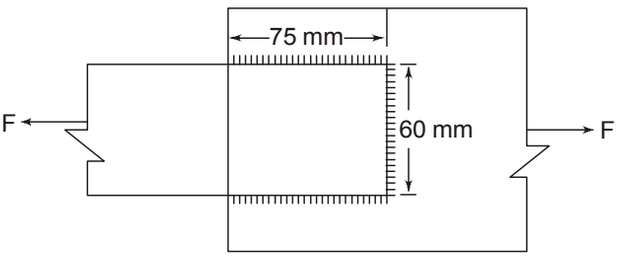

Fig. 4