Question Paper 2009

Civil Engineering

(Paper II)

SECTION – I

(Civil)

1. (*a*) Describe briefly the characteristics of good stones. (10)

(*b*) What do you mean by Seasoning of Timber? Describe the methods of seasoning timber. (10)

(*c*) Describe the various ingredients of a paint. (10)

2. (*a*) Discuss in detail the methods of plane table surveying. (15)

(*b*) The true bearing of a tower T as observed from a station A was 357°; the magnetic bearing of the same was 9°. The back bearings of the lines AB, AC and AD were found to be 286°, 337° and 30° respectively when measured with a prismatic compass. Find the true bearings of the lines AB, AC and AD respectively. (15)

3. (*a*) A sample of soil has a porosity of 35 percent and specific gravity of solids is 2.67. Calculate void ratio, dry density and unit weight if

(*i*) the soil is 50% saturated,

(*ii*) the soil is 100% saturated. (15)

(*b*) A sample of soil is 5 cm high and 8 cm in diameter. It was tested in a constant head permeameter. Water percolates through the soil under a constant head of 45 cm for 8 m. The water was collected and weighed. Its weight was recorded as 500 gm. On oven drying the sample of soil, the weight was recorded as 450 gm. If G is 2.65 calculate

(*i*) coefficient of permeability,

(*ii*) seepage velocity of water when the water was under operation. (15)

4. (*a*) An embankment was compacted at a moisture content of 15%. Its density was determined with the help of a core cutter and the following data was collected:

empty weight of the cutter = 1200 gm

weight of cutter when it is full of soil = 3200 gm

volume of the cutter = 1000 cc

Calculate bulk density and saturation percentage of the embankment. If the embankment becomes fully saturated due to rains, then, determine its moisture content and saturated density. Take G = 2.70. (20)

(*b*) Explain the factors which affect the bearing capacity of soils. (10)

5. (*a*) The space between two parallel plates 4 mm apart is filled with an oil of specific gravity 0.85. The upper plate of area 800 cm^2 is dragged with constant velocity of 0.75 m/s by applying a force of 0.2 kgf to it. Assume straight line velocity distribution and calculate velocity gradient, dynamic viscosity of oil in poise and kinematic viscosity of oil in stokes. (15)

(*b*) A bend in pipeline conveying water gradually reduces from 60 cm to 30 cm diameter and deflects the flow through an angle of 60°. At the larger end the gauge pressure is 1.75. kg/cm^2. Determine the magnitude and direction of the force exerted on the bend

(*i*) when there is no flow,

(*ii*) when the flow is 876 lit/sec. (15)

6. (*a*) Describe in detail the methods employed to purify water, before supplying to the consumers. (18)

(*b*) Design a septic tank, for a small colony of 300 persons with average daily sewage flow of 85 litres per head. Detention period is 30 hours. Clearing interval is 6 months. (12)

SECTION – II

(Structural)

7. (*a*) A bar 40 mm in diameter is subjected to a tensile force of 40,000 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 values of Young's modulus of elasticity and modulus of rigidity of the material. (10)

(*b*) Draw S.F and B.M. diagrams for beam loaded with varying load as shown in Fig.1 (10)

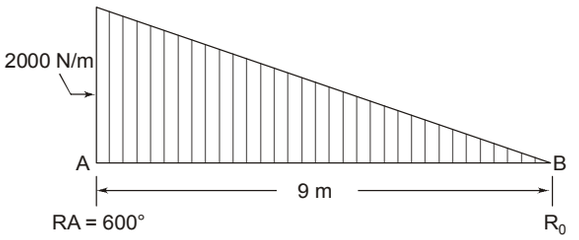

Fig. 1

(*c*) An R.S.J. 55 cm deep and 19 cm wide having flange and web thicknesses of 1.5 cm and 0.99 cm respectively is used as a beam. Calculate the moments of resistance at a section where maximum stress is 100 N/mm^2.

8. (*a*) A cantilever of length '*l*' and depth '*d*' tapers in plan in such a way that the breadth '*b*' at the fixed end, decreases to zero at the free end. Determine the deflection at the free end due to load '*W*' acting at the free end (Fig.2.)

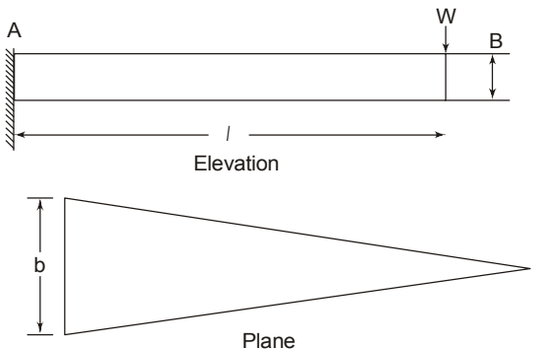

Fig. 2

(*b*) Write short notes on:

(*i*) Workability of concrete

(*ii*) Slump test (18)

9. (*a*) What do you understand by the term 'curing'? Why is it essential to cure concrete? What are the various methods commonly adopted in curing? (15)

(*b*) Discuss in detail "placing of concrete in cold and hot weather". (15)

10. (*a*) A reinforced concrete beam 400 mm × 650 mm (effective) in section is reinforced with 3 bars of 28 mm φ. If the effective span is 5 m, find the concentrated load the beam can support at the centre. Assume M 20 concrete and Fe 250 steel (n = 13.33). (15)

(*b*) Design a column to carry a load of 590 kN. Height of the column is 3.5 m effective, one side of the column is restricted to 250 mm. Use σ_{CC} = 5 N/mm^2, σ_{SC} = 190 N/mm^2 and 10 mm φ lateral lies. (15)

11. Design a cantilever slab to carry a superimposed load of 4188 N/m^2. The overhang of the slab is 1.2 m. Adopt M 20 concrete and Fe 415 steel. (30)

12. (*a*) What are the advantages and disadvantages of welded joints? (12)

(*b*) Determine the maximum load in the rivets of the eccentric connection shown in Fig. 3. (18)

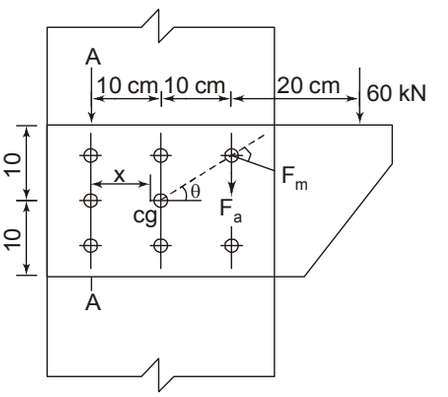

Fig. 3

Essential Tables of IS 456:2000 Code of Practice

26.2.1.1 Design bond stress in limit state method for plain bars in tension shall be as below:

Grade of concrete	M 20	M 25	M 30	M 35	M 40 and above
Design bond stress, τ_{bd}, N/mm^2	1.2	1.4	1.5	1.7	1.9

Table 16: Nominal Cover to Meet Durability Requirements (Clause 26.4.2)

Exposure	Nominal Concrete Cover in mm Not Less Than
Mild	20
Moderate	30
Severe	45
Very severe	50
Extreme	75

Notes:

1. For main reinforcement up to 12 mm diameter bar for mild exposure the nominal cover may be reduced by 5 mm.
2. Unless specified otherwise, actual concrete cover should not deviate from the required nominal cover by +10 mm.
3. For exposure condition 'severe' and 'very severe' reduction of 5 mm may be made, where concrete grade is M 35 and above.