This question paper contains 8+3 printed pages]

H.P.A.S. (Main)—2011

CIVIL ENGINEERING—II

Time : 3 *Hours* *Maximum Marks :* 150

Note :— Question No. 1 is compulsory. Attempt any *four* questions out of the remaining questions. In all *five* questions are to attempted.

1. (*a*) Explain the Plate load test for determining the bearing capacity of soils. What are the limitations of this test ? 10

(*b*) How does a river purify itself after disposal of sewage effluent into it ? Draw and explain a typical DO sag curve. 10

(*c*) Briefly describe the qualities required of a good structural stone. 10

P.T.O.

2. (a) What do you understand by bonds in brickwork ? What are the rules for bonding ? Draw plans of alternate coursee for the following walls at their corners : 15

(i) One and a half brick thick wall constructed in English bond.

(ii) Two-brick thick wall constructed in Double Flemish bond.

(b) The network for a construction project is shown in Fig. 1. The three time estimates for each activity are given. Compute : 15

(i) Expected time of completion of each activity

(ii) Earliest expected time for each event

(iii) Latest allowable occurrence time for each event

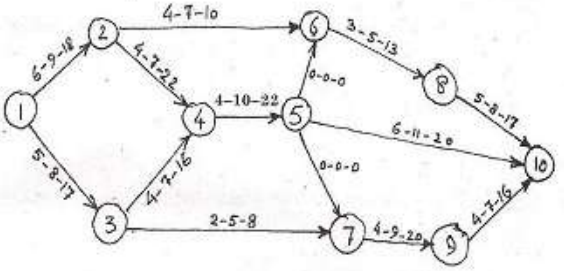

Fig. 1

3. (a) Enumerate the various tests conducted on cement for suitability and explain the following two tests in detail : 15

(i) Compressive strength of cement

(ii) Soundness of cement.

(b) What are the major causes of defects in timber? Enumerate comprehensively. Discuss the various preservatives employed for the prevention of decay of timber. 15

4. (a) Calculate overtaking sight distance on a 2-lane one-way SH passing through a plain terrain and having a design speed of 100 kmph. Take acceleration of the overtaking vehicle as 0.52 m/sec^2. The reaction time as 2.0 sec. Suitably assume any other missing but required data. 15

(b) A 2-lane NH passing through a plain terrain encounters a horizontal curve. For this curve calculate :

(i) Absolute minimum radius

(ii) Extra widening

(iii) Superelevation, and

(iv) Raising to be provided to the outer edge if the pavement is rotated about the inner edge of the road to attain the required super-elevation.

Assume the design speed of the road as 80 kmph and other required data suitably as per IRC recommendations. 15

5. (a) What is meant by a crossing ? What are the essential requirements of a good crossing ? What are the various types of crossings in use on Indian Railways ? 15

(b) What should be the actual ruling gradient (i.e. compensated gradient), if the ruling gradient as 1 in 250 has been fixed on a B.G. section and a horizontal curve of 3° is also to be introduced. 15

6. (a) What is a phreatic line ? Explain the stepwise procedure for determination of phreatic line when the dam section is homogeneous and provided with a horizontal filter. 15

(*b*) Excess rainfall and direct runoff recorded from a storm are as follows : 15

Time (h)	Excess Rainfall (cm)	Direct Runoff (m^3/s)
1	1.0	100
2	2.0	120
3	1.0	400
4		560
5		500
6		450
7		250
8		100
9		50

Calculate the one-hour unit hydrograph.

7. (a) An isolated storm in a catchment produced a runoff of 3.5 cm. The mass curve of the average rainfall depth over the catchment was as follows :

Time from beginning of the Storm (h)	Accumulated Average Rainfall (cm)
0	0
1	0.50
2	1.65
3	3.55
4	5.65
5	6.80
6	7.75

Calculate the ϕ-index for the storm. 15

(b) A confined aquifer is 25 m thick and 2 km wide. Two observation wells located 2 km apart in the direction of flow indicate heads of 45 and 39.50 m. If the coefficient of permeability of the aquifer is 30 m/day, calculate : 15

(i) The total daily flow through the aquifer, and

(ii) The piezometric head at the observation well located 300 m from the upstream well.

8. (a) Draw a typical layout diagram for treatment of water to be supplied to an area. Discuss the requirement of each process. 15

(b) A rectangular sedimentation tank is treating 2.5×10^6 litres of water per day. The size of the

tank is 17.5 m × 5.5 m × 3.5 m. If 80 ppm suspended solids of specific gravity 2.0 are present in water and assuming 75% removal in the basin, determine the following : 15

(*i*) Average flow of water through the tank

(*ii*) Detention time

(*iii*) Deposition of solids in the tank

(*iv*) Overflow rate.

9. (*a*) A 90 cm diameter sanitary sewer is laid at a slope of 1 in 250. Calculate the velocity of flow and discharge when flowing : 10

(*i*) Full

(*ii*) Half full.

Assume Manning's n = 0.013.

(b) Chlorine usage in the treatment of 20,000 cubic metre per day of water is 8 kg/day. The residual after 10 minute contact is 0.20 mg/litre. Calculate the dosage in mg/l and chlorine demand of water. 10

(c) 5-day 30°C BOD of a sewage sample is 110 mg/l. Calculate its 5-day 20°C BOD. Assume the deoxygenation constant at 20°C, K_{20} as 0.1 10