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**HPAS (Main)—2012**  
**CIVIL ENGINEERING**  
**Paper 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 be attempted.

1. (a) What should be the composition of good brick earth or clay ? How does each ingredient affect the properties of bricks ? Discuss the various proportions of mortars for the following building works : 10
- (i) Masonry work in foundations and plinth
- (ii) Masonry work in super-structures
- (b) Explain the preservative treatment of timber and indicate the types, characteristics and methods of applications of preservatives. 10

P.T.O.

(c) Write a detailed note on different types and materials of staircases constructed in residential and office building. Explain the following terms pertaining to staircases :

(i) Tread and rise

(ii) Balustrade

(iii) Winders.

10

2. (a) After the design of a building, how is its construction process organised ? What is the necessity of inviting 'tenders' and to ensure quality check while construction proceeds ?

15

(b) Write short notes on the following :

(i) Terrazzo flooring and Mosaic flooring

(ii) Workability of concrete

(iii) Fire proof construction.

15

3. (a) (i) What is the purpose of road signs and markings ? Which of these signs are mandatory ? Draw a sketch of a traffic control signal. 10
- (ii) What are the different vehicular characteristics which affect the road design ? Briefly explain. 10
- (b) The design speed of a highway is 80 kmph. There is a horizontal curve of radius 200 m on a certain locality. Calculate the superelevation needed to maintain this speed. If the maximum superelevation of 0.07 is not to be exceeded, calculate the maximum allowable speed on this horizontal curve as it is not possible to increase the radius. Safe limit of transverse coefficient of friction is 0.15. 10

P.T.O.

4. (a) Write short notes on : 15
- (i) Creep of Rails
  - (ii) Railway Sleepers
  - (iii) Coning of Wheels.
- (b) Describe in detail the design features of horizontal curve, required in the Indian Railways. 15
5. (a) Wheat is to be grown in a field having a field capacity equal to 27% and the permanent wilting point is 13%. Find the storage capacity in 80 cm depth of the soil, if the dry unit weight of the soil is  $14.72 \text{ kN/m}^3$ . If irrigation water is to be supplied when the average soil moisture falls to 18%, find the water depth required to be supplied to the field, if the field application efficiency is 80%.

What is the amount of water needed at the canal outlet, if the water lost in the water-courses and the field channels is 15% of the outlet discharge ? 15

(b) Find the size at the outlet of a 6 hectare drainage system, if the drainage coefficient is 1 cm and the tile grade is 0.3%. Assume the rugosity coefficient for the material as 0.011. 15

6. (a) Enumerate the various types of energy dissipation devices which may be recommended below spillway in relation to the relative position of the tail water rating curve and jump height rating curve. 20

(b) (i) Differentiate between a "low gravity dam" and a "high gravity dam". 5

P.T.O.

(ii) How does the practical profile of a low gravity dam differ from that of the theoretical one, and why ? 5

7. (a) Design a sewer to serve a population of 36,000; the daily per capita water supply allowance being 135 litres, of which 80 percent finds its way into the sewer. The slope available for the sewer to be laid is 1 in 625 and the sewer should be designed to carry four times the dry weather flow when running full. What would be the velocity of flow in the sewer when running full ? 20

(b) Enumerate the various forces that act on a sewer pipe laid underground. Discuss in detail any *two* of these forces. 10

8. (a) The treated domestic sewage of a town is to be discharged in a natural stream. Calculate the percentage purification required in the treatment plant with the following data :

Population : 50,000

BOD contribution per capita = 0.07 kg/day

BOD of stream on upstream side = 3 mg/lit

Permissible maximum BOD of stream on downstream side = 5 mg/lit

Dry weather flow of sewage = 140 lit/capita per day

Minimum flow of stream = 0.13 m<sup>3</sup>/sec

Explain graphically the process of self purification of natural waters, when sewage is discharged therein.

15

P.T.O.

- (b) A 30 cm diameter well penetrates 25 m below the static water table. After 24 hours of pumping @ 5400 litres/ minute, the water level in a test well at 90 m is lowered by 0.53 m, and in a well 30 m away the drawdown is 1.11 m. Find the transmissibility of the aquifer. Also determine the drawdown in the main well.

15.