I.F.S - 2009

Sl. No. 451

B–JGT–J–DFB

CIVIL ENGINEERING

Paper—II

Time Allowed : Three Hours	Maximum Marks : 200

INSTRUCTIONS

Candidates should attempt Question Nos. 1 and 5 which are compulsory, and THREE of the remaining questions, selecting at least ONE question from each Section.

The number of marks carried by each question is indicated at the end of the question.

Answers must be written in ENGLISH only.

If any data is considered insufficient, assume suitable value.

Unless otherwise indicated, symbols and notations have usual meanings.

Section—A

1. Answer any *four* parts from the following :

(a) Briefly describe the most common materials used in Dampproofing Course (DPC). 10

(b) Explain the various measures adopted for termite control. 10

(c) What are the sources of error in plane-table survey? 10

(d) (i) What are the advantages of welding of rails? 5

(ii) What should be the length of railway track to overcome temperature stresses and to prevent creep for equilibrium?

Assume :

$A = 60\ cm^2$

$\alpha = 1{\cdot}15 \times 10^{-5}$ per degree centigrade

$E = 21{\cdot}5 \times 10^5\ kg/cm^2$

Rise in temperature = 30 °C

Resistance to track movement = 700 kg per km 5

(e) What are the various forms of intersection of road at grade? Enumerate the basic requirements of an intersection. 10

2. (a) Explain merits and demerits of brick and stone masonry. 10

(b) Explain the following terms : 2½×4=10

(i) Privacy

(ii) Circulation

(iii) Ventilation

(iv) Orientation of buildings in hot and arid regions

(c) State the various types of bituminous-dense surfacings. Write the construction steps and quality control tests for dense bituminous concrete-surface course. 10

(d) The distance between two benchmarks A and B was 40 metres. A dumpy level was placed at C on an extension of AB such that $AC = 60$ m. The following data were recorded :

Staff reading on BM A = 0·750 m

Staff reading on BM B = 1·750 m

RLs of BM A and RLs of BM B were 10·750 m and 11·750 m respectively.

(i) Calculate the readings that should be obtained on A and B to have a horizontal line of sight.

(ii) Was the line of collimation inclined upwards or downwards and by how much?

(iii) State in which direction the diaphragm has to be moved for adjustment. 10

3. (a) What are the primary factors which should be considered while selecting the type and size of power shovel? 10

(b) What do you understand by economic life of construction equipment? 10

(c) Explain clearly the following : 2×5=10

(i) Creep of rail

(ii) Suspended rail joint

(iii) Tractive resistance

(iv) Conning of wheels

(v) Objectives of signalling

(d) (i) What are the guidelines for selecting a rotary-type intersection? 5

(ii) Calculate practical capacity of the weaving section of the rotary in PCU per hour from the following data : 5

(1) Proportions of weaving traffic = 0·72 PCU/hr

(2) Length of weaving section between the ends of channelising islands = 55 metres

(3) Width of weaving section = 13·5 metres

(4) Average entry width of rotary = 10 metres

4. (a) Explain the various steps involved in time-cost optimization. 10

(b) How would you make economic evaluation of facilities in a project? 10

(c) A bituminous-mix contains coarse aggregates, fine aggregates and mineral filler in proportion of 60 : 30 : 10 by weight. When these aggregates are mixed with bitumen and compacted, which contains 5% voids, how much bitumen does this specimen contain?

Assume :

(i) Specific gravity of coarse aggregates, fine aggregates and mineral filler as 2·7, 2·6 and 2·5 respectively

(ii) Specific gravity of bitumen-binder = 1·0

(iii) Specific gravity of mix (SGM) = 2·4

10

(d) What are the different types of traffic surveys conducted? What is the purpose of origin and destination (O-D) survey? In what way these data are utilized by a highway engineer? 10

Section—B

5. Answer any *four* parts from the following :

(a) Explain the following : 2½×4=10

(i) Application of unit hydrograph and S-hydrograph

(ii) Flood-control reservoir and debris dam

(iii) Sodium Absorption Ratio (SAR) and its limitations in soils for irrigation

(iv) Causes of failures of weirs

(b) In the analysis of flood frequency of a river using Gumbel's method, the peak flood discharge for a return period of 40 years is 25500 m^3/s. After considering the flood discharges for 40 years and 75 years return periods, the flood discharge in the river for a return period of 180 years was estimated as 35600 m^3/s. Calculate the flood discharge in the river for a return period of 150 years. 10

(c) Answer the following in brief : 2×5=10

(i) What is waterborne disease? Name any two waterborne diseases.

(ii) What is coagulation? Name any two coagulants.

(iii) What is the objective of pressure-reducing valve and reflux valve in water distribution system?

(iv) What is the purpose of balancing reservoir in water distribution system?

(v) How are the water pipelines tested for water tightness after they are laid?

(d) Differentiate between : 2×5=10

(i) Combined system and separate system of sewerage

(ii) Drop manhole and lamphole

(iii) Design of sewers and water pipes

(iv) Aerobic and anaerobic oxidation ponds

(v) Step aeration and extended aeration

(e) Three tube wells having 150 mm diameter each are formed as an equilateral triangle having side distance of 120 m. All the three wells are penetrated into a confined aquifer of 14 m thickness and all the tube wells have the same characteristics. What is the discharge from one well, if only one well is discharging under a depression head of 4 m? Also find the percentage decrease in the discharge of the well, when the three wells are discharging simultaneously under the depression head of 4 m. Assume coefficient of permeability of aquifer as 60 m per day and radius of influence for each well is 300 metres. 10

6. (a) Answer the following :

(i) Explain the effects of waterlogging and explain the causes of water-logging in the States of West Bengal and Punjab. 7

(ii) Explain the function of cistern and write equations for length and depth of cistern as per Montagu's formula. 3

(b) The catchment area of a river basin up to the reservoir site is 35 sq. km. From contour survey map of the reservoir site, the elevation capacity curve is prepared and data is given below :

Elevation (m)	*Capacity* (hectare-metre)
RL + 150	31·2
RL + 152	36·4
RL + 154	40·0
RL + 156	44·2

The rate of silting for the catchment has been assessed to be 250 m^3/km^2/year. The life of the reservoir is estimated as 40 years. Water is supplied to fields through a main canal having 8 km length and with bed slope of 1 in 1500. The canal bed level at the tail end is +145·32. The crop water requirement is 280 ha-m. The full supply depth of the canal at the head is 75 cm. Calculate the dead storage capacity of the reservoir and lowest sill level of the head sluice of the reservoir. Consider 10% of crop water requirement for dead storage as one of the conditions for computing dead storage of the reservoir. 10

(c) Explain clearly the quality and quantity of surface and sub-surface water sources. 10

(d) What is manhole? With a neat diagram, explain its functions and design principles. 10

7. (a) Answer the following :

(i) Why are joints necessary in the construction of gravity dams? Explain how the foundation treatment is done in the gravity dams. 5

(ii) Explain the seepage control measures through the body of earth dam. 5

(b) The head over the crest of an ogee spillway is 2·5 m and coefficient of discharge of the spillway is 2·2. The discharge of hydraulic jump formed at the downstream of the spillway per metre is same as discharge per metre over spillway. The pre-jump depth of hydraulic jump formed at the downstream of the spillway is 1·0 m. What type of stilling basin shall be proposed as per IS criteria? Explain the IS code procedure for design of various components of this stilling basin and draw the figure of the stilling basin with various components. 10

(c) (i) With a sketch, describe the zeolite process of removal of hardness. What are the advantages of it? 5

(ii) Calculate the quantity of zeolite required to soften 2·27 ML of water of 572 ppm to 286 ppm hardness. The interval between successive generation is 3 hours and the capacity of exchanger is $27{\cdot}46 \times 10^6$ mg/m^3. 5

(d) (i) Explain hydraulic elements of sewer design. 4

(ii) A circular sewer of cast iron flowing full with a velocity of 2 m/sec carries a discharge of 2400 litres/sec. Find the required diameter and grade for the sewer. Use Manning's formula and $n = 0{\cdot}012$. 6

8. (a) Flood discharge of a channel is measured using gauges at different sections. It is a wide rectangle channel. During a flood, it was observed that the depth of flow at a section increased by 60 percent and water surface slope at this section became $\frac{1}{3}$ of its original value in a given interval of time. Find the percentage of change in the discharge of the channel using Chezy's equation. 10

(b) A particular soil is having wilting coefficient of 9% and field capacity of 24%. The dry unit weight of soil is 1·8 gram/cm^3. If the root zone depth is 60 cm, find the storage capacity of the soil. If water is to be applied when moisture content falls to 14% and water application efficiency is 70%, calculate the depth of water required to be applied in the field. 10

(c) Explain clearly different methods of solid waste disposal. 10

(d) Define air pollution as per WHO and explain different types of air pollutants. 10

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