I.F.S. EXAM-2015

C–GEQ–O–DWFB

CIVIL ENGINEERING
Paper—II

Time Allowed : Three Hours

Maximum Marks : 200

QUESTION PAPER SPECIFIC INSTRUCTIONS

Please read each of the following instructions carefully before attempting questions :

*There are **EIGHT** questions in all, out of which **FIVE** are to be attempted.*

*Question Nos. 1 and 5 are compulsory. Out of the remaining **SIX** questions, **THREE** are to be attempted selecting at least **ONE** question from each of the two Sections **A** and **B**.*

Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

All questions carry equal marks. The number of marks carried by a question/part is indicated against it.

*Answers must be written in **ENGLISH** only.*

Unless otherwise mentioned, symbols and notations have their usual standard meanings.

Assume suitable data, if necessary and indicate the same clearly.

Neat sketches may be drawn, wherever required.

SECTION—A

Q. 1(a) (i) What are different constituents of brick earth ? How do they effect the quality of brick ? 5

(ii) Name five types of estimates in practice to anticipate the cost of a construction project. Explain them. 5

Q. 1(b) (i) What is seasoning of timber ? What are different methods of seasoning ? 3

(ii) Differentiate Flash set and False set. 2

(iii) A construction project has to borrow the following amounts at 8% interest rate in three years :

I Year — Rs. 8,00,000

II Year — Rs. 6,00,000

III Year — Rs. 2,00,000

If loan amount is to be paid back at the end of 2 years after completion of the project in lumpsum, find the amount. 5

Q. 1(c) (i) Briefly explain what do you understand by the term 'Photogrammetry' ? Write three important points comparing characteristics of aerial photographs with maps. 2+3=5

(ii) Write five important advantages of channelizing an intersection for mix traffic conditions prevailing in India. 5

Q. 1(d) (i) Briefly explain why rail gauge are disturbed due to creep of rails. Also briefly explain why undue stresses are induced in the fish plates due to rail creep. 5

(ii) Briefly explain why too steep cross slope is not desirable in highway pavement. 5

Q. 2(a) (i) What is Fibre Reinforced Concrete ? What are the applications of FRC ? Mention the classification of fibres based on the geometry. 5

(ii) With the help of a neat sketch explain Line organisation. Mention the merits and demerits. 5

Q. 2(b) (i) List out different methods of damp prevention in building. 3

(ii) Define Fire Load. Give the classification of fire load as per IS:1640. 3

(iii) What are different time estimates of an activity and explain how these time estimates help in determining the expected time of activity. 4

Q. 2(c) The reduced level (R.L.) of a room floor is 45.450 m. The observed staff reading on a staff held at a point P on the floor was 2.350 m. The staff was found to be 0.10 m off the vertical through its bottom. Determine the correct staff reading.

Further, the reading on a staff held vertically inverted with the bottom touching the bottom of the roof slab of the room was 1.450 m. Also determine the height of the roof slab above the floor. 5+5=10

Q. 2(d) (i) A train is to be diverted from a railway track A to the right hand side railway track B. Draw a typical sketch of a turn out for this arrangement and show the following on sketch :

(i) Facing direction (ii) Throw of switch (iii) Check rails (iv) Outer curve lead rail (v) Heel of switch. 5

(ii) What is the significance of low-cost roads in India ? Briefly explain how stabilization technique can be utilized to construct low cost roads. 2+3=5

Q. 3(a) Nine activities of a project are given in the table below, along with activity duration. Find the critical path. Also find total float and free float of all activities :

Activity	1–2	1–3	2–4	2–5	3–4	3–6	4–7	5–7	6–7
Duration (days)	12	11	22	18	10	15	11	13	10

10

Q. 3(b) (i) What is curing of concrete ? Explain the advantages of Autoclaving. 5

(ii) What is bleeding of concrete ? How can it be avoided ? 5

Q. 3(c) A highway is designed for a design speed of 80 kmph. However, it is observed that a driver is travelling at a speed of 120 kmph on this highway at a descending gradient of 2.5%. Determine the increase in the stopping sight distance required for this driver. Assume reaction time of driver as 2.5 seconds and coefficient of friction f as 0.35. If required, other data may be assumed as per IRC recommendations. 10

Q. 3(d) Differentiate between spot speed and average speed of vehicles. A spot speed study was conducted at the mid point of Section AB of a 2 lane road. The length of Section AB measured is 0.9 m. The spot speeds for vehicles 1, 2, 3, 4, 5 and 6 measured with radar speedometer were 42, 38, 52, 39, 44 and 45 kmph respectively. Determine the time-mean speed and space-mean speed at this Section AB. Assume all vehicles were travelling at constant speed over this roadway Section AB. 10

Q. 4(a) (i) Define workability. What is the effect of the following on the workability of concrete : Aggregate size, Cement content, Shape of aggregate, Grading of aggregate ? 5

(ii) What is efflorescence of bricks ? Classify the bricks based on the strength of brick. 5

Q. 4(b) (i) What are the main compounds of cement ? Mention their relative behaviour on hydration and rate of strength gain. 5

(ii) Differentiate Rubble Masonry and Ashlar Masonry. Mention further classification of Rubble masonry. 5

Q. 4(c) Write the four important points highlighting the importance of sub-surface drainage of roads. Also write the special problems in drainage of surface water in following : (i) Rural highways (ii) Urban roads (iii) Hill roads. 4+6=10

Q. 4(d) Determine the steepest gradient for a 3° curve railway track for moving a 18 wagons (weight of 1 wagon = 22 tonnes) train at a speed (v) of 60 kmph. Use the following data :

(i) Weight of locomotive with tender = 150 tonnes

(ii) Number of pairs of driving wheel of locomotive = 4

(iii) Axle load of the driving wheel = 28.45 tonnes

(iv) Coefficient of friction (μ) = 0.166.

Also assume that resistance due to friction, wave action etc. is 0.0025 per tonne weight of train. Curve resistance may be considered as 0.0004 per degree curve per tonne weight of train. Resistance due to speed may be assumed as 0.0000015 V^2 per tonne weight of train. V is the speed of train in kmph. 10

SECTION—B

Q. 5(a) Draw a schematic diagram of Hydrologic cycle and explain its various components. 10

Q. 5(b) Draw a typical Gravity Dam and indicate various forces acting on the Dam. 10

Q. 5(c) Explain the significance of the following in context of water quality :

(i) Nitrate

(ii) Hardness

(iii) Alkalinity

(iv) Iron

(v) Fluoride. 10

Q. 5(d) With respect to the settling of the suspended solids in water and wastewater treatment, what is a type-1 suspension and a type-2 suspension and what are their settling characteristics ? 10

Q. 6(a) An infiltration test on a ring with 35 cm diameter shows the following result :

Time (min)	0	2	5	10	20	30	60	90	150	210
Cumulative volume of water added cm^3	0	278	658	1173	1924	2500	3345	3875	4595	5315

Determine :

(i) Minimum infiltration capacity

(ii) Average infiltration for first 10 min.

(iii) Average infiltration for first 30 min. 10

Q. 6(b) Define a spillway. Draw a typical sketch of ogee spillway. Give the equation for crest profile of ogee spillway as recommended by USBR. Give the discharge equation for an ogee spillway. 10

Q. 6(c) Explain the mechanisms through which coagulation of colloidal particles in water is accomplished by dissolution of coagulant in water. 10

Q. 6(d) A city must treat about 20000 m^3/d of water. A column analysis on flocculating suspension indicates that an overflow rate of 20 m/d will produce satisfactory removal at a depth of 3.5 m, providing 4 tanks for flexibility in operations, determine the size of the settling tanks. Also calculate retention time, horizontal flow velocity and weir overflow rate considering the weir to occupy the width of the tank. 10

Q. 7(a) List the assumptions made in the derivation of an equation for steady radial flow into wells.

A well with a radius of 0.5 m completely penetrates a confined aquifer of thickness 50 m. The well is pomped so that water level in the well remains constant at 40 m above bottom. Determine the Steady State Discharge. Assume K = 30 m/day, R = 500 m. 10

Q. 7(b) Explain the meaning of stable channel in Alluvium.

Explain step by step procedure of designing a stable channel using Kennedy's Theory. What are the limitations of Kennedy's Theory ? 10

Q. 7(c) For a wastewater biological treatment system, the growth phase of microorganisms is very important. Draw a biomass growth curve and show and describe various phases on it. 10

Q. 7(d) (i) A residential area of about 40 ha contains 400 single family residences and 8 ha with apartments housing 400 people. Assuming five residents per single-family unit and per capita waste generation at 1.0 kg/day, determine the number of trips on each collection day, with two curb-side pickups per week, one packer truck (4 to 5 tonne capacity) needs to make to serve this area. 5

(ii) Determine the dry mass of solids in a 1ℓ volume of sludge sample containing 1% solids. If all the solids are allowed to settle and the liquid is decanted until the total volume is 500 mℓ, what will be the new solids concentration ? 5

Q. 8(a) A small water shed consists of 1.5 km^2 of Cultivated Area (c = 0.20), 2.5 km^2 under forest (c = 0.10) and 1.0 km^2 under grass cover (c = 0.35). There is a fall of 22 m in a water course of length 1.8 km. The intensity frequency duration relation for the area is given by

$$I = \frac{80\,T_r^{0.2}}{(t+13)^{0.46}}$$

where I is in cms/hr, T_r in years and t in min.

Estimate the Peak rate of run off for a 25 year frequency. 10

Q. 8(b) A canal is to be designed to suit the following irrigation requirement :

Crop	Area (ha)	Period	Duty (ha/cumec)
Wheat	5000	Dec.-Mar.	1800
Rice	6000	June-Sep.	800
Sugarcane	4000	June-Mar.	1000

Estimate the design discharge of the canal (Assume Canal losses as 20% and Field losses to be 15%). 10

Q. 8(c) I. In context of air pollution explain the following :

(i) Primary pollutants

(ii) Secondary pollutants

(iii) Primary standards

(iv) Secondary standards

(v) Criteria pollutants. 5

II. For a population of 1,00,000 with per capita waste generation of 1.0 kg/day, estimate the annual area requirements (excluding the buffer zone) for a normally compacted landfill with density of 450 kg/m^3 and having a refuse depth of 4 m excluding the cover material. 5

Q. 8(d) Determine the capacity of a storage reservoir required to maintain a constant water supply (draft) of 2×10^6 m^3/month, given the following monthly mean run-off values. Use only numerical method : 10

Month	Run-off Q_R 10^6 m^3
1	9.0
2	10.8
3	4.2
4	2.8
5	1.2
6	1.1
7	0.9
8	0.5
9	0.6
10	0.4
11	0.5
12	0.9
13	1.1
14	2.0
15	5.5
16	10.5
17	3.5
18	2.5