Civil Services (Main) Examination, 2013

CIVIL ENGINEERING
(Paper II)

Time Allowed : Three Hours **Maximum Marks : 250**

QUESTION PAPER SPECIFIC INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two Sections.
Candidate has to attempt FIVE questions in all.
Question Nos. 1 and 5 are compulsory and out of the remaining, any THREE are to be attempted choosing at least ONE question from each Section.
The number of marks carried by a question/part is indicated against it.
Wherever any assumptions are made for answering a question, they must be clearly indicated.
Word limit in questions, wherever specified, should be adhered to.
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.

SECTION 'A'

1. (a)(i) What do you understand by rubble masonry block? Show a cross-section. **5**

(a)(ii) What kind of special attention is necessary for maturing concrete made with fly ash cement as per BIS codal provision? **5**

(b) Define 'Sinking fund' with respect to an equipment. If the cost of equipment is ₹ 15 lakhs and scrap value after useful life of 8 years is ₹ 3 lakhs, calculate the annual sinking fund if the applicable rate of annual interest is 10%. There is no escalation of cost. **10**

(c) Write short explanatory notes giving sketch, if necessary, with respect to Railway track: (i) Marshalling yard (ii) Turn-table (iii) Fish plates and fish bolts (iv) Check rails and guard rails **10**

(d) The following consecutive readings, in metres, were taken by a dumpy level: 0.860, 0.785, 0.660, 1.760, 1.990, 0.665, 0.650 and 0.620 The instrument was shifted after 3rd and 5th readings. The last reading was on the bench mark whose reduced level was 130.00 metres. Book the above data in a proper tabular form and compute the reduced levels of other points using rise and fall method. Apply the usual arithmetic check. **10**

(e) Explain with sketches the salient factors controlling the alignment of a road. **10**

2. (a) A project consists of seven activities P, Q, R, S, X, Y and Z. Their sequence and duration is shown in the following table:

Activity	Duration in weeks – Pessimistic	Duration in weeks – Optimistic	Duration in weeks – Most likely	Immediate Predecessor
P	18	9	12	—
Q	17	6	10	P
R	8	4	6	P
S	26	14	17	Q, R
X	21	10	14	Q
Y	14	8	11	S, X
Z	10	6	8	S

(i) Draw the Network diagram. (ii) Show the critical path and determine the expected completion time. (iii) Find the next most critical path. (iv) What is the probability of the project being completed in 58 days? Probability may be linearly interpolated from the table of probability factors (Z).

Z	1.0	1.5	2.0	2.5	3.0
Probability	84.13	93.32	97.72	99.38	99.87

30

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(b) What are the advantages of Hydraulic Excavators over other types of excavators? Under what conditions should a HOE be preferred over a front shovel? Draw a schematic sketch illustrating various parts of a typical HOE. List the factors affecting the economical choice of a HOE. **20**

3. (a) What are the factors affecting design of brick masonry walls? Give a brief account of the method of design as per I.S. codes. **10**

(b) Name and discuss at least three advantages of adding appropriate polymer as admixture in cement concrete. **10**

(c) Explain briefly the various tests for judging the suitability of Road stones giving objectives of each test. **10**

(d) Traffic signals are to be installed on a right angled intersection with Road A, 18 m wide and Road B, 12 m wide. The heaviest volumes of traffic per hour for each lane of Road A and Road B are 275 and 225 respectively. The approach speeds are 55 and 40 kmph for Road A and Road B respectively. Design the timings of traffic signals. Take amber period for Road A as 4 seconds and for Road B as 3 seconds. **20**

4. (a) Describe the various steps in the construction of a cement concrete pavement. Show the general layout of joints in concrete pavement. **10**

(b) What is ballast? Why is ballast used in Railway track? Write briefly on different types of ballast used. Why is it necessary to replace stone ballast from time to time? **10**

(c)(i) A section line AB 300 m long on a flat terrain measures 102.3 mm on the vertical photograph. A Radio tower also appears on the photograph. The distance measured from the principal points to the image of the bottom and top of the Radio tower are found to be 70 mm and 80 mm respectively. The average elevation of the terrain was 553 m. Determine the height of the tower. Take f=152.4 mm. **15**

(c)(ii) The driver of a vehicle travelling at an initial speed of 60 kmph up a grade requires 9 m less to stop after he applies the brakes than a driver travelling at the same initial speed down the same grade. If the coefficient of friction, between the tyres and the pavement is 0.4, what is the percent grade? **15**

SECTION 'B'

5. (a) What are the different approaches for estimating sedimentation in Reservoirs? Draw a typical sketch to show the profile of silt deposition in Reservoir. **10**

(b) Explain what is meant by filtration for drinking water. Draw a schematic diagram of a slow sand filter showing inlet, outlet and other components. **10**

(c) Write briefly on the suitable river training measures to be adopted for the protection of upstream side of a barrage during flood time. **10**

(d) Explain briefly the procedure to be followed in developing a unit hydrograph from the recorded flood hydrograph of a stream, stating the assumptions. **10**

(e) Define the following terms: (i) Sewage (ii) Sewers (iii) Sewerage Explain the Rational method for the design of storm sewers. What are the disadvantages of this method? **10**

6. (a) Explain the following: (i) Meteorologically homogeneous areas (ii) Recurrence interval of rain-storm The accumulated rainfalls at a raingauge station for various durations are listed below. Construct maximum intensity – duration curve. Comment on the nature of curve.

Time in minutes	Accumulated Rainfall in cm	Time in minutes	Accumulated Rainfall in cm
0	0	40	5.23
5	0.15	45	5.64

20

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10	0.38	50	6.05
15	1.78	60	6.86
20	3.05	80	8.71
25	3.86	100	10.54
30	4.32	120	11.05
35	4.83		

(b) Compare the following in irrigation system: (i) Water application efficiency vs. Water distribution efficiency (ii) Water storage efficiency vs. Consumption use efficiency The available moisture holding capacity of the soil of a field is 16 cm/m and the root zone depth is 1 m. A 12 hectare area is to be irrigated when 50% of the available moisture is depleted. The rate of peak consumption use is 4 mm/day and there is no effective rainfall. If the field application efficiency is 50%, determine the capacity of the irrigation stream. **15**

(c) Determine the dimensions of a circular Bio-filter to treat waste water with the following characteristics: Daily Flow Rate = 100 m^3/day Five-days BOD after primary sedimentation = 160 mg/lit The filter is to be designed in accordance with the following criteria: Surface loading = 2 m^3/m^2/day Organic loading = 0.15 kg 5-days BOD value per m^3 per day **15**

7. (a) (i) Explain the difference between contour canal and side slope canal. (ii) What are the losses of water from canals? State the various factors affecting their magnitude. (iii) Propose with a sketch, a suitable cross drainage work at the location of a canal crossing a stream. Give reasons for the selection. The canal and stream data are as under: Canal data Full supply discharge = 0.45 cumec Full supply level = R.L. 300.600 Canal bed level = R.L. 300.000 Canal bed width = 2 m Stream data High flood discharge = 6 cumec High flood level = R.L. 300.500 Stream bed level = R.L. 299.400 Natural ground level = R.L. 299.500 State the characteristic features of the selected structure. **20**

(b) Explain with the help of diagrams the Grid iron system and the Radial system of water distribution for a town. **10**

(c) Find out the effective height of a stack from the following data: Physical stack height = 200 m Inside diameter of the stack = 1 m Wind velocity = 3.5 m/sec Air temperature = 13°C Barometric pressure = 1000 millibars Stack gas velocity = 9 m/sec Stack gas temperature = 140°C Draw a sketch to show the effective height. **20**

8. (a) A well is drilled to an impermeable base in the centre of a circular island 1760 m diameter located in a large lake. The well completely penetrates a sandstone aquifer 16 m thick overlaid by an impermeable clay. The sandstone has permeability of 16 m per day. What will be the steady discharge if the drawdown of the piezometric surface is not to exceed 3 m at the well? The diameter of the well is 0.3 m. Draw a sketch showing the well and the aquifer system. **20**

(b) State the circumstances under which the following types of energy dissipators will be suitable for spillways: (i) Solid roller bucket (ii) Ski-Jump bucket **10**

(c) A water treatment plant is to treat a design discharge of 60 million litres per day. The plant has a paddle flocculator 20 m long, 12 m wide and 3.5 m deep. It is fitted with four horizontal shafts to which revolving paddles are attached which rotate at 150 rpm. Each shaft supports four paddles which are 10 m long, 20 cm wide and centred 1.5 cm from the shaft. Assume mean velocity of flow of water as 20% of the paddle velocity, temperature of water as 10°C and C_D=1.8. Determine the difference in velocity between paddle and water, mean velocity gradient and detention time. Dynamic viscosity can be taken as 1.31×10^{-4} m^2/sec at temperature of 10°C. **20**

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