D–GT–M–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 any **THREE** of the remaining questions, selecting at least **ONE** question from each Section.*

All questions carry equal marks.

The number of marks carried by each part/ sub-part of a question is indicated against each.

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

If any data is considered insufficient, assume suitable value and indicate the same in your answer.

Unless otherwise indicated, symbols and notations have usual meanings.

Neat sketches may be drawn; wherever required.

SECTION—A

1. (a) Explain five different types of R.C.C. flat floors (which can support live loads).   10

    (b) (i) Differentiate between float and slack in Networks and discuss on discounted Present Worth Analysis.   5

         (ii) The following consecutive readings were taken with a dumpy level and a 4.0 m levelling staff on continuously sloping ground at a common interval of 30 m :

         0.585 on A, 0.936, 1.953, 2.846, 3.644, 3.938, 0.962, 1.035, 1.689, 2.534, 3.844, 0.956, 1.579, 3.016 on B.

The elevation of A is 520.450 m. Make level book and apply usual checks. Determine level of B and the gradient of line AB.　　5

(c) (i) Explain CBR value for the design of flexible pavement. Determine the CBR value of a given soil sample, if load carried by the sample at penetration level of 2.5 mm and 5.0 mm are 64.6 kg and 91.20 kg respectively.

　　5

(ii) Soil subgrade sample collected from site was analysed for the highway pavement design and results obtained are given below. Calculate Group Index Value of the sample.

Soil portion passing 0.075 mm sieve = 55 %

Liquid limit　　　　　　　　= 45 %

Plastic limit　　　　　　　　= 20 %

　　5

(d) Calculate curve lead, radius, switch lead and lead required to set out a 1 in 8.5 turnout, taking off from straight B.G. track with its curve starting from the toe of the switch, i.e. tangential to the gauge face of the outer main rail and passes through theoretical nose of crossing i.e. NTC.

Given heel-divergence = 11.4 cm.　　10

2. (a) (i) What are the problems encountered for concreting in hot weather ? 3

(ii) Mention the main components of Portland cement. 2

(iii) What is unity of command in organisation ? 2

(iv) What is segregation and bleeding ? 3

(b) Explain the term "Orientation" with reference to buildings and two important rooms in a house. 10

(c) (i) Calculate warping temperature stresses at interior, edge and corner region for rigid pavement having panel of cement concrete slab of size 4.50 × 3.5 m. The following design parameters are to be considered.

· (i) Design wheel load = 8000 kg

(ii) Elastic modulus of concrete
$$= 3 \times 10^5 \text{ kg/cm}^2$$

(iii) Poisson's ratio of concrete = 0.15

(iv) Effective modulus of subgrade

reaction over the DLC base

$$= 8 \text{ kg/cm}^2/\text{cm}$$

(v) Tyre pressure = 8 kg/cm^2

(vi) C/C distance between two tyres

$$= 31.0 \text{ cm}$$

(vii) Thickness of concrete slab = 32.0 cm

(viii) Thermal coefficient of concrete

$$= 10 \times 10^{-6} \text{ per } °C$$

(ix) Temperature differential = 15.8°C

(x) Bradbury's coefficients $C_x = 0.57$ and

$$C_y = 0.30$$

15

(ii) Calculate the maximum permissible train load that can be pulled by a locomotive having four pairs of driving wheels carrying an axle load of 24 tonnes each. The hauling capacity of train is 1/6 times the load on driving wheels. The train has to run at a speed of 80 kmph on a straight level B.G. track.

5

3. (a) (i) Discuss in detail the maintenance and repair cost of construction equipment. 3

(ii) Mention the parameters involved in vibratory compactors. 2

(iii) Discuss in detail the pumping of concrete. 3

(iv) Define motion study and mention its objectives. 2

(b) (i) What are factors affecting economic life of an equipment ? 3

(ii) Differentiate between Wheel tractor and Crawler tractor. 2

(iii) State the National Building Code Provisions for (i) Bathroom (ii) W.C. (iii) Bedroom (iv) Kitchen (v) F.A.R. 5

(c) A tacheometer is used to obtain the difference of levels between two points A and B. The instrument is set up at another point C, and following

(Contd.)

observations were taken :

Staff at	Vertical angle	Stadia reading
A	– 6° 30′	3.500, 2.815, 2.130
B	– 8° 30′	1.870, 0.990, 0.110

Assume the additive constant $C = (f + d) = 0.50$ and multiplying constant $K = (f / i) = 50.0$.

10

(d) A valley (sag) curve is formed by a descending gradient of 1 in 20 meeting an ascending gradient of 1 in 25. Design the length of a valley curve to fulfil both comfort condition and head light distance requirements for a design speed of 80 kmph. Assume allowable rate of change of centrifugal acceleration = 0.60 m/sec^3 and average reaction time = 2.50 seconds. Take longitudinal skid resistance = 0.35.

10

4. (a) The following table gives the data for the duration and cost for each activity of a building project. The indirect cost of the project is Rs. 1000 per

(7)

day. Determine optimum time and cost of the project.

Activity	Normal duration (days)	Normal cost (Rs.)	Crash duration (days)	Crash cost (Rs.)
1—2	8	7,000	3	10,000
1—3	4	6,000	2	8,000
2—3	0	0	0	0
2—5	6	9,000	1	11,500
3—4	7	2,500	5	4,500
4—6	12	10,000	8	16,000
5—6	15	12,000	11	16,000
5—7	7	12,000	6	14,000
6—8	5	10,000	5	10,000
7—8	14	6,000	7	7,400
7—9	8	6,000	5	12,000
8—9	6	6,000	4	7,800

10

(b) (i) What are the deficiencies of bar chart ? 3

(ii) Differentiate between CPM and PERT. 2

(iii) Write down five different methods of "valuation" and explain them briefly. 5

(c) A fixed time 2-phase isolated signal is to be provided at a square intersection having a North-South and an East-West road where only straight-ahead traffic is permitted. The design hour flow of traffic from various approaches of the intersection and corresponding saturation flow of traffic are given in the following table. Assume the loss of time per phase due to starting delay of 3.0 seconds and All Red period per cycle is 6 seconds. Calculate optimum cycle length and green times for minimum overall delay using Webser's approach. Sketch the timing diagram for each phase and phase diagram.

Approaches	North	South	East	West
Design hour traffic flow in PCU/hr	1500	1200	1100	1400
Saturation traffic flow in PCU/hr	3700	4800	3600	4000

10

(d) An embankment is made for road construction on ground which is level across (in lateral direction). The height of the embankment at the point A of the section is 2.5 m and formation

(Contd.)

rises uniformly on a gradient of 1 in 120. The width of the embankment at formation level is 10.0 m and the side slope of the bank 2 to 1. The surface of ground is in descending gradient from point A to point B of 1 in 25. Find the quantity of earth work in cubic metre required for embankment, if distance from point A (starting of section) to point B (i.e. end of section) using prismoidal and trapezoidal formulae. **10**

SECTION—B

5. (a) (i) A catchment has five Raingauge stations. The average annual rainfall values at these stations are 75, 90, 82, 98 & 105 cms. If the Standard Deviation of the rainfall data is 12 cms., determine the additional number of raingauges needed in the catchment for 5% error in the estimation of the mean rainfall. **5**

(ii) The discharge available from a Tube Well is 100 m^3/hr. Assuming 2800 Hrs of working for the Tube Well in a year, estimate the Culturable Area that this source can command. The intensity of irrigation is 50% and the average depth of water for the crops grown is 40 cms. **5**

(b) (i) A 30 cms well completely penetrates an unconfined aquifer of saturated depth 40 m. After a long period of pumping at a steady rate of 1500 lpm, the drawdown in two observation wells 25 m & 75 m away from pumping well were found to be 3.5 m and 2.0 m respectively. Determine the Transmissibility of the aquifer. 5

(ii) Assuming the relative density of sediment particles as 2.6 and unit weight (dry) of one cu.m. of sediment as 980 kg., estimate the weight of 1 m^3 of deposited sediment in the Reservoir bed. 5

(c) (i) Determine the horizontal floor length below a hydraulic structure founded on permeable formation if the Design Head is 6 m., depth of downstream cutoff pile is 6 m. and the value of safe exit gradient for the formation is 1/6. 5

(ii) Write a brief note on 'Tropospheric ozone and Stratospheric ozone'. 5

(d) (i) Enumerate modifications of activated sludge process and describe 'Biosorption process'. 5

(ii) Why is recarbonation carried out, while softening water by lime soda process ? 5

6. (a) A flood of certain magnitude has a return period of 50 years.

Determine :

(i) the probability of exceedence

(ii) the probability of the flood magnitude equal to or greater than the given magnitude occurring

— at least once in 20 successive years

— two times in 20 successive years

— once in 20 successive years. 10

(b) (i) Compute the discharge over an Ogee spillway with a Coefficient of Discharge $(C_d) = 2.2$ at a design head of 10 m. The effective length of spillway is 100 m. Neglect the velocity of approach. 5

(ii) Discuss the "Effect of Tension Cracks" on the stability of a Gravity Dam, with the help of a neat sketch. 5

(c) (i) Describe in brief 'Aerated grit chamber'. 5

(ii) Explain the terms 'Super-chlorination and Dechlorination'. When is Super-chlorination of water done ? 5

(d) (i) Why is it economical to remove carbonate hardness than non-carbonate hardness when lime soda process is employed for softening of water ? 5

(ii) Describe pyrolysis as one of the methods of solid waste disposal. 5

7. (a) Design an alluvial channel based on Lacey's theory of channel design to carry a discharge of 30 cumecs. The value of Lacey's Silt Factor 'f' can be assumed as 1.0 and side slopes of the channel as 1/2 H to 1 V. 10

(b) (i) At the location of a Hydraulic Jump type of Energy Dissipator the discharge intensity (q) is 20 cumec/m., the prejump depth (D_1) is 1.90 m. Determine the post jump depth required to form a stable jump. Also estimate the amount of energy dissipated if a stable hydraulic jump is formed. 5

(13) (Contd.)

(ii) What is Phreatic line in an Earth Dam ? Give the stepwise procedure of obtaining it by Cassagrande's graphical method. 5

(c) (i) Discuss in brief 'stabilization of organic matter'. 5

(ii) Calculate quantity of sludge collected in a primary settling tank per day with 60% efficiency from 25 mld sewage having suspended solids = 400 mg/l and inorganic suspended solids = 150 mg/l. 5

(d) (i) Why is it advantageous to digest sludge anaerobically ? 5

(ii) Calculate quantity of bleaching powder required per day to disinfect 200 mlpd water. 5

8. (a) Design a Channel Transition at the location of an Aqueduct using Mitra's approach. Normal width and Flumed width of the channel are 15 m and 9 m respectively. The length of Transition is 16 m. 10

(b) (i) How Reservoir capacity is determined from Mass Inflow and Mass Demand curves ? 5

(ii) What are Galleries in a Gravity Dam ? State their function. How the foundation gallery makes its impact in the reduction of uplift pressure below the structure ? 5

(c) Enumerate diseases transmitted by water. How is guinea worm disease controlled ? 10

(d) (i) Describe in brief 'Principles of house drainage'. 5

(ii) Write a brief note on 'MPN'. 5