CSM – 19/17

Civil Engineering

Paper – II

Time : 3 hours

Full Marks : 300

The figures in the right-hand margin indicate marks.

Candidates should attempt Q. No. 1 from Section – A and Q. No. 5 from Section – B which are compulsory and any ***three*** *of the remaining questions, selecting at least* ***one*** *from each Section.*

SECTION – A

1. Answer any **three** of the following :

   (a) What are the different types of materials used for damp proofing in building ? With diagrams explain how damp proofing treatment to foundation of basement of ordinary soil, parapet wall and flat roofs are carried out. 20

(b) Describe at least five different methods of valuation of a building and state their limitations. 20

(c) What is Ferro-cement ? Describe its various uses in low cost rural mass housing. 20

(d) What are the guidelines for selecting a rotary type of intersection ? State its advantages and disadvantages. Describe the various rotary design elements. 20

2. (a) A small project comprises of the following activities as mentioned in the following Table – 1 :

Activity i – j	Estimated Duration in weeks		
	Optimistic	Most Likely	Pessimistic
1 – 2	1	1	7
1 – 3	1	4	7
1 – 4	2	6	8
2 – 5	3	1	1
3 – 5	2	5	14
4 – 6	2	8	8
5 – 6	3	6	15

(i) Draw netwok diagram of the activities and find the expected project duration.

(ii) Find the total and independent floats for each activity. 10+10 = 20

(b) A Government is planning for a hydroelectric project that will also provide flood control, irrigation and recreation benefits. The established benefits and cost of three alternatives are given in the following Table – 2. The interest rate to be used for the analysis is five percent, and the life of each of the alternatives A, B and C is to be 50 years. Choose the best alternative.

Table – 2 : Data for B / C ratio computation (All values are in Millions of rupees) 20

Alternatives →			
Cost / Benefits under different heads ↓	**A**	**B**	**C**
Initial cost	250.00	350.00	500.00
Annual power sales	10.00	12.00	18.00

Alternatives → Cost / Benefits under different heads ↓	A	B	C
Annual flood control benefits	2.50	3.50	5.00
Annual irrigation benefits	3.50	4.5	5.00
Annual recreation benefits	1.0	2.00	3.50
Annual operation and maintenance cost	2.00	2.50	3.50

(c) A construction equipment costs Rs. 1,20,000.00 and has an expected life of 5 years and salvage value of Rs. 20,000.00. It is expected to work 2000 hours in a year. Compute the yearly depreciation for the equipment using : 10+10 = 20

(i) Sum-of the – year digit method.

(ii) Sinking fund method.

3. (a) What should be the maximum height of an elementary profile of a dam, if the safe limit of normal stress on the masonry should not exceed 350 tones / m^2 ? Assume weight of masonry 2.4 tones / m^3. Determine height and base width of the dam, if uplift intensity factor is 0.67 and factor of safety is 2.0. 20

(b) (i) Differentiate the characteristics between slow sand filter and rapid gravity filter in water treatment plant. Design a rapid gravity filter to treat 50,000 m^3/day. Assume any suitable data required for the design. 4+8 = 12

(ii) Describe various physical principles involved in control devices to control particulates at source, generated in industrial process. 8

(c) What is the importance of Time and Motion Studies ? The time and motion study for a

crane at construction site was carried out and the following observations were made :

Operation	No. of observations
Crane lifting or lowering load	160
Crane moving to place of work	80
Unloading or loading crane hooks	60
Crane is idle	100

(i) Determine the portion of time the crane was idle and degree of accuracy of the result. Ninety five percent confidence is required.

(ii) If the accuracy required is ± 2%, how many further observations are needed ?

5+8+7 = 20

4. (a) (i) The 3 hour unit hydrograph of a basin can be approximated as a triangle with a base period of 75 hours and a peak discharge of 55.5 m^3/s.

(A) What is the area of basin ?

(B) What should be the volume of direct runoff , if there will be a 10 cm effective rainfall in that catchment of 3 hour duration ? 4+4 = 8

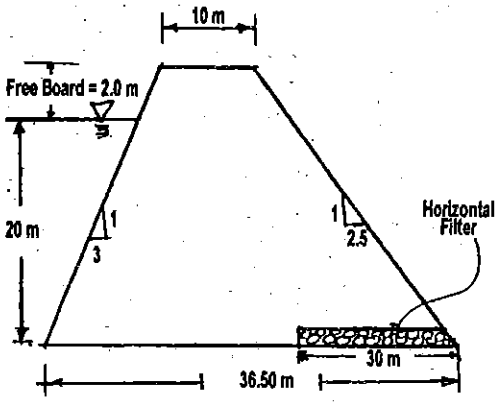
(ii) From the analysis of a 30 year flood data at a section of a river, it was yielded that mean flood discharge and its standard deviation are 1200 m^3/s and 650 m^3/s respectively. Estimate the design flood discharge for a bridge across that section of the river by Gumbel's extreme value method with 10% risk in its expected life of 50 years. Take reduced mean (y_n) and reduced standard deviation (s_n) in Gumbel's extreme value distribution as 0.53622 and 1.11230 respectively for number of year flood data (N) equal to 30 years. 12

(b) Determine the capcity of a storage reservoir required to maintain a constant water supply of $2 \times 10^6 m^3$ / month given the following monthly mean-runoff values at proposed reservoir site. 20

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

(c) (i) Determine the seepage through the homogeneous earthen dam section shown below, if coefficient of

permeability of soil material of dam is 5×10^{-4} cm/sec. 10



[Dimension of dam section shown is not to the scale]

(ii) A hydraulic jump is formed in a 5.0 m wide outlet at a short distance downstream of a control gate. If the flow depths just u/s and d/s of the gate are 0.8 m and 2.15 m respectively, and the outlet discharge is 100 m^3/s, calculate the energy loss due to hydraulic jump and thrust on the gate. 10

SECTION – B

5. Answer any **three** of the following :

(a) What is the necessity of transition curves and how its length is computed ? Explain stopping sight distance, overtaking sight distance and set-back distance. 20

(b) Explain, with diagram, the principle of treating waste water in oxidation pond. Describe the design procedure of a series of oxidation ponds, taking into consideration of the soluble BOD, reaction rate coefficient, hydraulic detention time, flow rate and volume of pond and the water temperature. 10+10 = 20

(c) Describe the salient features of the empirically derived silt theories of Kennedy and Lacey for design of canals. Discuss the limitations in their applicability. 20

(d) Draw the cross-section of a flexible pavement showing its different layers

of material. Explain how the thickness of these layers are found out, taking CBR value, traffic volume and drainage into account. 20

6. (a) To determine the distance between two points 'A' and 'B' and their elevations, the following observations were recorded upon vertically held staves from two traverse stations 'C' and 'D'. The tacheometer was fitted with an analytic lens and the instrument constant was 100.

Traverse Station	RL (m)	H.I. (m)	Coordinates of station (m)		Staff station	Bearing	Vertical angle
			L	D			
C	1020.6	1.5	800	1800	A	$15^0 14'$	$+8^0 9'$
D	1021.21	1.53	950	2500	B	$340^0 18'$	$+2^0 3'$

Compute the distance AB, the gradient from A to B and bearing of AB. 30

(b) A 45 cm well in an unconfined aquifer was pumped at a constant rate of 15001 pm at the equilibrium stage the following drawdown values at two observation wells were noted.

Observation well	Radial distance from pumping well (m)	Drawdown (m)
A	10	5.0
B	30	2.0

The saturated thickness of the aquifer is 45 m. Assuming the radius of influence to be proportional to the discharge in the pumping well, calculate : 30

(i) Drawdown at the pumping well.

(ii) Transmissibility of the aquifer.

(iii) Radius of influence for discharge of 20001pm.

7. (a) What is cant deficiency ? Design a turnout with 1 in 12 crossing from the following given data :

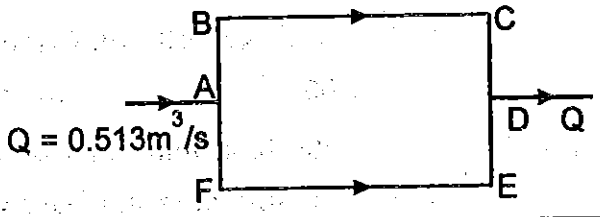
Gauge = 1.676m, Heel divergence (d) 13,3 cm , straight arm between TNC and Tangent Point (TP) of crossing curve = 1.346m, angle of crossing = 4^{o} 45' 49" and angle of switch = 1^{o}8' 00". 15+5 = 20

(b) Design a septic tank and soak pit for a community of 500 persons. Draw the sectional views of this designed septic tank. 20

(c) A stream having a flow of 0.75 m^3/s and B. O. D. 4 mg/l is saturated with DO. It receives an affluent discharge of 0.25 m^3/s, B. O. D. of 18 mg/l and DO 4 mg/l. If the average velocity of flow is 0.16 m/s, calculate the DO deficit at section 30 km downstream. Assume that the temperature is 20°C through the length of the stream and B. O. D. is measured at 5 days. Take rate constants for effluent and stream as 0.15 and 0.25 per day respectively. 20

8. (a) A looping pipe system is shown in the given figure. Calculate how much flow passes

through each branch of the loop using Hardy Cross Method. 20



Pipe Branch	Length (m)	Diameter (mm)	Chezy's 'C' value
ABCD	1524	305	120
AFED	915	406	120

(b) Route the following flood hydrograph through a river reach for which Muskingum coefficient K = 8 hour and x = 0.25. 20

Time (h)	Inflow (m^3 / s)
0	8
4	16
8	30
12	30
16	25
20	20
24	15
28	10

(c) (i) Explain, with diagrams, various channelized intersection on roads. 10

(ii) An isolated 3-h storm occurred over a basin in the following pattern : 10

% of Catchment area	□ -index (cm / h)	Rainfall (cm)		
		1st hour	2nd hour	3rd hour
20	1.0	0.8	2.3	1.5
30	0.75	0.7	2.1	1.0
50	0.50	1.0	2.5	0.8

Estimate the runoff from the catchment due to the storm.