Roll No.

ASME-24BC-CENG-II

CIVIL ENGINEERING (PAPER-II)

Time Allowed: 3 Hours   [Maximum Marks: 100

QUESTION PAPER SPECIFIC INSTRUCTIONS

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

1.   There are EIGHT questions printed in English.

2.   Candidate has to attempt **FIVE** questions in all.

3.   Question No. 1 is compulsory. Out of remaining seven questions, **FOUR** are to be attempted.

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

5.   Write answers in legible handwriting. Each part of the question must be answered in sequence and in the same continuation.

6.   Wherever assumptions are made for answering a question, they must be clearly indicated prior to their use.

7.   Diagrams/ Figures, wherever required, shall be drawn neatly. All standard notations carry usual meaning. Any missing data can be suitably assumed.

8.   Attempts of the 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 answer book must be clearly struck off.

9.   Re-evaluation/ re-checking of answer book of the candidate is not allowed.

1. (a) Explain two basic assumptions made in the derivation of unit hydrograph. What are the uses and limitations of unit hydrograph? **2+3**

(b) Explain the terms Base period and crop period. After how many days will you order irrigation in order to ensure healthy growth of crop if: Field capacity = 29%, Permanent wilting point = 11%, density of soil = 1300 kg/m³, Effective depth of root zone = 700 mm, Daily consumptive use of water of the given crop = 12 mm. **5**
Consider moisture content must not be less than 25% for the water holding capacity between field capacity and permanent wilting point.

(c) What are the causes and effects of Creep of rails? Discuss in detail. **5**

(d) It was required to ascertain the elevation of two points P and Q and a line of levels was run from P to Q. The levelling was then continued to a bench mark of 83.0 m, the readings obtained being as shown below. Obtain the R.L. of P and Q. **5**

B.S.	I.S.	F.S.	R.L.	Remarks
1.622				P
1.874		0.354		
2.032		1.78		
	2.362			Q
0.984		1.122		
1.906		2.824		
		2.036	83.500	B.M

2. (a) Following are the ordinates of a 4-hr unit hydrograph. Using this, derive the ordinates of a 12-hr unit hydrograph (don't plot the graph) **10**

Time (hr)	0	4	8	12	16	20	24	28	32	36	40	44
Ordinates of 4-hr	0	20	80	130	150	130	90	52	27	15	5	0

(b) A simple circular curve of radius 30 chain length has been set out to connect two tangents with external deflection angle of 30°. The chainage of point of tangency is 300 chains. On further inspection, it is proposed to alter the radius of curve and point of tangency for revised curve. Also calculate the length of long chord for revised curve. Also calculate the length of long chord for revised curve. [Chain length = 20 m] **10**

3. (a) What is ϕ index? A storm with 10 cm precipitation produced a direct runoff of 5.8 cm.   10
The tie distribution of the storm is given below. Estimate the ϕ index of the storm.

Time from start (h)	Incremental rainfall in each hour (cm)
1	0.4
2	0.9
3	1.5
4	2.3
5	1.8
6	1.6
7	1.0
8	0.5

(b) A water contains 110 mg/L carbonate ion and 80 mg/L bicarbonate ion at a pH of 10.   8+2
Calculate the alkalinity exactly at 25°C. Approximate the alkalinity by ignoring
hydroxide and hydrogen ion. What is the percentage error in approximation?

4. (a) Treated wastewater having a peak flow rate of 12000 m³/day, BOD_5 of 30 mg/L, DO   10
concentration of 1 mg/L and temperature of 27°C is discharged in a stream. Before
getting mixed with the wastewater, the stream has a minimum flow rate of 0.4 m³/s,
BOD_5 of 4 mg/L, DO concentration of 7 mg/L and temperature of 25°C. After
instantaneous and complete mixing, the velocity of the mixed flow is 0.2 m/s. For the
mixed flow, the BOD reaction rate constant is 0.2 day^{-1} and the reaeration constant is
0.4 day^{-1} at 20°C. Estimate the initial oxygen deficit and DO after two days of flow.
Take temperature coefficient for BOD reaction rate constant as 1.047 and for stream
reaeration rate constant as 1.016. Take equilibrium concentration of DO for water after
mixing as 8.3 mg/L.

(b) Find the depth and top width of a V – notch capable of discharging a maximum of 0.7   10
m³/sec and such that the head shall be 75 mm for a discharge of 56 litres per second. Its
Cd is the same as that of a similar (in material and sharpness of edges only) right angled
V – notch for which Q = 1.40?

5. (a) The average normal flow of traffic on cross roads A and B during design period are 480   10
and 250 PCU per hour; the saturations flow values on these roads are estimated as 1200
and 1000 PCU per hour respectively. The all-red time required for pedestrian crossing
is 12 seconds and amber time for clearance in each phase as 2 seconds. Design two phase
traffic signal by Webster's method.

(b) The BOD rate constant (k) for a river's BOD assimilation was determined to be 2.0/day   7+3
(base e). The BOD of this river after leaving a heavily populated town was determined
to be 50 mg/l. Determine the distance after which the river's BOD would become 4 mg/l
when the average velocity of the river was 1 m/sec. What would have been the k value
if this distance would have been 300 km and state what k demonstrates?

6. (a) Water is pumped through a 600 mm diameter pipe with a head loss of 20 m. It is intended   10
to reduce the power consumption by laying another parallel pipe of appropriate diameter
laid by the side of the existing pipeline with the same overall length and the same friction
factor – by reducing the head loss to 10 m, but still delivering the same discharge jointly
through both pipes. What should be the diameter of this additional pipe?

(b) Flood frequency computations for a flashy river at a point 50 km upstream of a bund site   10
indicated the following:

Return Period (T years)	50	100
Peak flood (m³/sec)	20,600	22,150

Estimate the flood magnitude in the river with a return period of 500 years through use
of Gumbel's method.

7. (a) Show that the normal depth of flow in a triangular channel having side slope ZH:1V is   10
given by $y_n = 1.189 \left[\frac{Q.n}{\sqrt{S_o}}\right]^{3/8} \cdot \left[\frac{Z^2+1}{Z^5}\right]^{1/8}$

(b) A road has a total width of 7.5 m including extra widening on curve and design speed of   10
60 kph. Calculate the length of transition curve and its shift on the curve of 200 m radius.
Allowable super elevation 1 in 150 and the pavement is rotated about centre lines.

8. (a) A bend in pipe conveying water gradually reduces from 0.6 m to 0.3 m diameter and   10
deflects the flow through an angle of 60°. At the larger end the gauge pressure is 171.675
kN/m². Determine the magnitude and direction of force exerted on the bend when there
is no flow.

(b) There are two different areas A and B to be drained by means of closed tile drainage   6+4
system. If $\frac{k_A}{k_B} = \frac{2}{1}$; $\frac{S_A}{S_B} = \frac{1}{1.5}$ and $\frac{(b^2-a^2)_A}{(b^2-a^2)_B} = \frac{5}{6}$. Find the discharge ratio $\frac{Q_A}{Q_B}$. If the drains carry
1% of average annual rainfall in 24 hours in both the cases. Find the average annual
rainfall ratio $\frac{P_A}{P_B}$.

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