

CSM – 19/19
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) Define super elevation and derive the equation for finding super elevation if design coefficient of lateral friction is f . 20
 - (b) Explain the objective of plastering and pointing. 20

- (c) Define and compare CPM and PERT. When PERT is used as opposed to CPM in project management ? Explain phrase "Critical Path". 20
- (d) Explain polymer concrete and its application. What is fiber reinforced concrete and mention its advantages and disadvantages ? 20
2. (a) Draw plan of one and half and two brick wall for English Bond and Double Flemish Bond. 20
- (b) Define water-cement ratio in concrete. Draw the relation of water-cement ratio vs compressive strength and explain. 20
- (c) The following table gives activities in a construction project and duration. 20
- Draw network for project and find critical path :

Activity	Duration
1-2	20
1-3	25
2-3	10
2-4	12
3-4	6
4-5	10

3. (a) Explain superelevation and camber. How they are different ? 20

(b) Calculate stopping sight distance on a highway at a descending gradient of 2% for a design speed of 80 kmph. Coefficient of friction = 0.35, reaction time = 2.5s. 20

(c) Explain the following : 20

(i) Types of Crossings

(ii) Degree of a simple rail track curve

4. (a) The following levels were taken by 4m staff. Find the reduced level of the stations by Height of Instrument method. Bench Mark = 58.250m, BS = 0.578, IS 0.933, 1.768, 2.450. Change point (2.005, 0.567), 1.888 1.181, Change Point (3.679, 0.612), 0.705, 1.810. Also prepare the table indicating CP and BS, IS, FS, HI and RL.

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(b) Explain flexible pavement and rigid pavement and bring out points out difference.

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- (c) What is transition curve and for which objective it is used ? Name some types of transition curves. 10
- (d) What are the different forces acting on Gravity dam ? Explain stability of Gravity dam with respect to compression and tension. 10

SECTION – B

5. Answer any **three** of the following four options :
- (a) (i) Explain Prechlorination and break point chlorination. 10
- (ii) Explain Slow sand filter and Rapid sand filter. 10
- (b) Draw a typical hydrograph and show the important features. Define unit hydrograph. Write the assumptions. 20
- (c) Define canal in cutting and canal in filling. What is balancing depth ? Draw a canal section and show the given items Berm, Counter berm, Dowel, Hydraulic gradient, Spoil bank. 20
- (d) Define BOD and COD. Deduce an expression for BOD with time. Discuss the factors on which the de-oxygenation constant k depends. 20

6. (a) The normal annual precipitation of five raingauge stations P, Q, R, S and T are respectively 125, 102, 76, 113 and 137. During a particular storm the precipitation recorded by stations P, Q, R and S are 13.2, 9.2, 6.8 and 10.2 respectively. Find the missing rainfall of station during this storm at T which was inoperative. 10
- (b) The isohyets due to a storm in a catchment was drawn and area of catchment bounded by isohyets were tabulated. Estimate mean precipitation due to storm. 10

As Isohyetes (in cm) Vs Area in Km²

Station – 12	30
12 – 10	140
10 – 8	80
8 – 6	180
6 – 4	20

- (c) The mass curve of a rainfall of duration 100 minutes is given below. The ϕ -index of

catchment is 0.6 cm / hour. Calculate total surface runoff from catchment. 20

Time(min) of start of rainfall	Cumulative rainfall
0	0
20	0.5
40	1.2
60	2.6
80	3.3
100	3.5

- (d) The 6-h unit hydrograph of a catchment is in the form of a triangle with peak 100 cubic meter per second occurring at 24h from start and base is 72h. 20
- (i) What is the area of catchment represented by this unit hydrograph ?
- (ii) Calculate flood hydrograph due to a storm of 2cm rainfall excess during the first 6h and 4cm during second 6h interval. The base flow can be assumed $25 \text{ m}^3/\text{s}$ uniform throughout.
7. (a) Route the following hydrograph through a river reach for which $K = 12.0\text{h}$ and $x = 0.2$. At the

start of the flood and outflow discharge is $10 \text{ m}^3/\text{s}$.

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Time(h)	Inflow(m^3/s)
0	10
6	20
12	50
18	60
24	55
30	45
36	35
42	27
48	20
54	15

- (b) Design a regime channel for a discharge 50 cumecs and silt factor 1.1. Use Lacy's theory.

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- (c) A well penetrate into an unconfined aquifer having a saturated depth of 100m. The discharge is 250 liters per minute at 12 meters drawdown. Assuming equilibrium flow condition and homogeneous aquifer, estimate the discharge at 18m drawdown. The distances from well where drawdown

influences are not appreciable may be taken to be equal for both cases. 20

8. (a) Two million liters of water per day is passing through a sedimentation tank which is 6m wide, 15m long and 3m water depth.
- (i) Find detention time for tank.
 - (ii) What is the average flow velocity through the tank ?
 - (iii) If 60 ppm is concentration of suspended solids present in turbid raw water, how much dry solids will be deposited per day in the tank assuming 70% removal in the basin, specific gravity of deposit is 2.
 - (iv) Compute overflow rate. 30
- (b) Chlorine usage in the treatment of 20000 cubic meter per day is 8kg / day. The residual after 10 minutes contact is 0.2 mg/liter. Calculate the dose in milligrams per liter and chlorine demand of the water. 20
- (c) Explain why water is softened. Describe zeolite process of softening hard water. 10

