[This question paper contains 6 printed pages.]

3059 *Your Roll No.* .....

MEC **J**

Paper – CE.559

WATER ENGINEERING DESIGN

Time : 3 Hours *Maximum Marks : 100*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any **FIVE** *questions.*
All *questions carry equal marks.*
Assume suitable missing data.

1. (a) Explain water quality requirements for domestic water & industrial water. (10)

   (b) For the given data design a mechanical rapid mix unit. (10)

   (i) Design flow – 6000 m^3/day

   (ii) Detention time – 30 secs

   (iii) Ratio of tank height to diameter – 1.5:1

   (iv) Impeller diameter to tank diameter ratio – 0.4:1

P.T.O.

(v) Speed of Impeller – 120 rpm

(vi) Velocity gradient – 650 sec^{-1}

(vii) Coefficient of drag C_D – 1.8 for flat blades

(viii) Absolute viscosity of water – 1×10^{-3} NS/m^2

(ix) Density of water – 1000 kg/m^3

2. (a) Prove that "The surface loading $\left[\frac{Q}{A}\right]$ and not the depth is a measure of effective removal of particles in a sedimentation tank. (10)

(b) Design a rectangular sedimentation tank for the following data & also check for resuspension of deposited particles.

(i) Flow of water 6000 m^3/day

(ii) Removal Efficiency expected = 75%

(iii) Nature of particles-discrete & non fleccutating

(iv) Size of particles to be removed = 0.02 mm

(v) Specific gravity of particles = 2.65

(vi) Kinematic viscosity of water at 20°C $= 1.01 \times 10^{-6}$ m^2/sec

(vii) Performance of tank = good (n = 1/4)

(viii) For unigrannular particles K = 0.04

(ix) Weisbach Darcy friction factors f = 0.03 (10)

3. (a) What are the different causes, effects & control of corrosion of pipes. (10)

(b) Perform a sieve analysis to transform the run of band sand into usable sand if the effective size is 6×10^{-2} cm and uniformity coefficient is 1.5. Analysis of stock sand is

Size of separation $\times10^{-2}$ cm	Cummulative weight %
1.2	0.5
1.5	1.0
2.0	5.0
3.0	10
4.2	25
6.0	40
8.5	60
12.0	75
17.0	90
24.0	95
34.0	100

(10)

P.T.O.

4. (a) Briefly explain different types of filters. What are the common problems associated with rapid sand filters ? (10)

(b) Design a rapid sand gravity filter unit for producing a net filtered quantity of 2 MLD of water. Wash water required is 4% and half hour is lost in washing & returning back to service after a filter run of 24 hrs. Assume rate of filteration as 5000 lit/m^2/hr. Design in terms of

(i) Number of units

(ii) Under drainage system (10)

5. (a) Explain different types of aerators used in water treatment system with sketches. (10)

(b) The result of a 4 m deep column test is as follows

Time (min)	Conc (mg/lit)
0	300
60	190
90	180
120	150
140	130
200	110
240	80
420	30

What is the percentage removal of particles if the hydraulic loading rate is 35 m^3/m^2/day. (10)

6. (a) Explain briefly the process of removal of iron & fluorides from water. (10)

(b) Design a tube settler module for the given data :

(i) Average output required = 200 m^3/hr

(ii) Water lost in desludging = 2% of output

(iii) Size of tube 50 mm×50 mm

(iv) Length of tube = 1 m

(v) Angle of Inclination = 60° with horizontal

(vi) Settling velocity V_S = 120 m/day

(vii) Kinematic viscosity = 1×10^{-6} m^2/sec

(viii) For square section S = 11/8 (10)

7. (a) Explain following intake structures with a neat sketches.

– Dry and wet intake tower

– Canal intake and valve tower (10)

(b) Explain Hardy cross method for water distribution system with a suitable example. (10)

P.T.O.

8. Write short notes on any **four** :–

(a) Mechanism of disinfection

(b) Coagulation & flecculation

(c) Taste & odour control

(d) Equivalent pipe technique

(e) Functions of various types of valves in distribution networks (5×4=20)