**2022**
**Environmental Engineering -I**

*Full Marks: 100*

Time: Three hours

**The figures in the margin indicate full marks for the questions.**

*Answer **any five** questions.*

1. a) What is the purpose of screening in water treatment process? Describe in brief various types of screens used for screening water — 6

   b) What do you understand by coagulation and flocculation? Explain the mechanism of floc formation. — 7

   c) Show that the settling velocity of a spherical particle in a liquid under condition when Reynold's number less than 0.5 may be given by the expression $V_s = g/18 \, (G_s-1) \, d^2/\upsilon$ — 7

2. a) What are the actions takes place during filtration — 6

   b) Explain in brief different types of pipes in water work practice — 7

   c) A rectangular sedimentation tank is to handle 20 million litres/day of raw water. A sedimentation basin width to length ratio of 1/5 is proposed to trap all particles larger than 0.05 mm in size. Assume a relative density of 2.62 for the particles and 25° C as the average temperature, determine the basin dimensions. If the effective depth of tank is 3 m, calculate the detention time. — 7

3. a) Distinguish between slow sand filter and rapid sand filter with reference to i) rate of filtration ii) period of filtration iii) method of cleaning iv) filter media of sand — 8

   b) Explain the necessity of various appurtenances in distribution system. Explain briefly various types of valves used in distribution system — 7

   c) What is the difference between disinfection and sterilization? Mention various methods of disinfection of water — 5

4. a) Describe various types of coagulant commonly used in water treatment. What are the various factors affecting coagulant? Write down the chemical reactions when the alum and chlorinated copperas are used as coagulant — 8

   b) Find the settling velocity of silica particles of specific gravity 2.65 at 20° C, if the diameter of particles is 0.02 cm. — 2

   c) Describe the working of slow sand filter with the help of neat sketch — 10

5. a) Design a rapid sand filter to treat 4 million litres of raw water per day. Half an hour per day is used for backwashing. The rate of filtration is 5000 l / h / m² of bed. Assume necessary data.    15

   b) What are the different types of settling in sedimentation    5

6. a) Design a plain sedimentation tank to treat 10 million litres water per day. take a detention period of 12 hours and assume a depth of 3m.    6

   b) What is meant by water softening. Explain lime/soda ash method of water softening    8

   c) Explain various types of distribution system depending upon methods of distribution    6