

PART B — (5 × 16 = 80 marks)

11. (a) (i) State the different sources of wastewater that are produced from a community. Discuss the systems of sewerage with its merits and demerits. (8)
- (ii) A city with a population of 100, 000 has an area of 50 km². Rate of water supply is 110 liters per capita per day of which 80% turns into sewer. The average run off coefficient is 0.5 and intensity of rainfall is 14.5 mm/hour. Estimate the quantity of combined sewage. Take peak factor as 2.5 (8)

Or

- (b) (i) Discuss the significance of total solids and BOD in determining the characteristics of sewage. (8)
- (ii) The BOD of a sewage incubated for one day at 30°C has been found to be 120 mg/l. What will be the 5-day BOD at 20°C? Assume BOD rate constant $K = 0.21$ (base e) per day at 20°C and temperature correction coefficient $\theta = 1.056$. (8)
12. (a) (i) Determine the diameter of a separate sewer section running half full at maximum discharge for a town with a population of 100, 000 persons. Water is supplied at a rate of 200 liters per capita per day. Assume 80 % of water supplied turns as sewage. Take peak factor as 2.25 and Manning's constant $N = 0.013$ at all depths of flow. The permissible slope is 1 in 600. (10)
- (ii) What do you understand by sewer appurtenances? Discuss with neat sketch a drop manhole and indicate where it is used. (6)

Or

- (b) (i) Under what circumstances pumping of sewage is needed. Enumerate the problems faced during the pumping of sewage. What is the function of wet well in sewage pumping station? (8)
- (ii) With help of a neat sketch discuss one-pipe and two-pipe systems of plumbing used for drainage. (8)
13. (a) Design a septic tank with dispersion pit for a hostel with a population of 150 and peak discharge of 205 liters per minute. Take desludging period as one year. Assume suitable design criteria and draw a neat sketch of the designed tank.

Or

- (b) (i) State the objectives of preliminary treatment. Discuss the various types of screens adopted in sewage treatment. (10)
- (ii) Name various types of settling and discuss the significance of surface overflow rate in the design of sedimentation tanks. (6)

14. (a) (i) Explain with sketch the treatment of sewage by activated sludge process. Mention the advantages and disadvantages of the process. (8)
- (ii) What do you understand by waste stabilization ponds? Discuss the principle of working of aerobic stabilization pond. (8)

Or

- (b) (i) Design the size of standard rate trickling filter to treat 6 million liters of sewage per day having BOD of 160 mg/l. Take hydraulic loading of $6 \text{ m}^3/\text{m}^2/\text{d}$ and organic loading of $0.35 \text{ kg}/\text{m}^3/\text{d}$. (10)
- (ii) Discuss the operational problem of standard rate trickling filters and their remedies. (6)
15. (a) (i) A large stream has a rate of reaeration constant, $K_r = 0.24$ per day (to base 10) and deoxygenation constant, $K_d = 0.1$ per day (to the base 10). The initial deficit of the mixture of stream and wastewater at the point of reference $D_o = 4 \text{ mg/l}$ and the ultimate 5 day BOD, $L_o = 35 \text{ mg/l}$. Calculate the DO deficit at a point one day from the point of reference. Also calculate critical deficit and critical time. (10)
- (ii) What is sewage farming? List the methods and state its advantages over the method of disposal of sewage dilution. (6)

Or

- (b) With help of flow chart explain various processes involved in sludge treatment and disposal. Explain the mechanism of anaerobic and aerobic sludge digestion with their relative merits and demerits.