Reg. No. :

Question Paper Code : X10470

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020 AND APRIL/MAY 2021
Fifth/Sixth Semester
Civil Engineering
EN 8592 – WASTEWATER ENGINEERING
(Common to Environmental Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Egg-shaped/ovoid shaped sewers are more advantageous at small flows. State true or false and justify your answer.

2. Identify the purpose of providing anti-siphonage pipes in house plumbing.

3. What are the advantages and limitations of septic tanks in sewage treatment ?

4. What is the necessity of providing velocity control devices in grit chamber ? Name the control devices used.

5. Distinguish between suspended growth process and attached growth process of secondary treatment with suitable examples.

6. What is the working principle of Up-flow anaerobic sludge blanket reactor (UASBR) ?

7. Identify the conditions favourable for disposal of sewage by dilution.

8. What is meant by sewage sickness ? Mention some measures to prevent it.

9. Identify the potential for recovery of energy and resources from the sludge.

10. State the objectives of sludge digestion. Classify the sludge digestion methods.

PART – B **(5×13=65 Marks)**

11. a) A city having a projected population of 60,000 have a rate of water supply of 200 liters per capita per day. Assume 80% of water-supplied turns into sewer. The area of city is 30 hectares with runoff coefficient of 0.4 and time of concentration of storm 30 minutes. The ratio of peak to average sewage flow is 2. Find the design discharge for the combined flow. Also determine the diameter of the sewer pipe when it runs half full at maximum flow conditions for a maximum permissible slope of 1 in 600. Use Manning's equation and take Manning's constant as N = 0.013 for all flow conditions.

(OR)

b) Discuss the steps involved in the laying and testing of sewers. Describe with neat sketch a drop manhole and indicate where it is used.

12. a) State the objectives of providing screens and grit chamber in wastewater treatment plants. Outline the classification of screens and grit chambers. Discuss the factors on which the head loss of a screen would depend.

(OR)

b) Outline the theory of various types of settling. Which type of settling is predominant in primary settling tanks ? Design diameter and depth of circular primary sedimentation tank to treat a peak discharge of 84 million liters per day of sewage. Take surface loading rate as 40 $m^3/m^2/d$ and detention time as 2 hours.

13. a) With a neat diagram of various elements explain the removal mechanism of sewage in conventional activated sludge process (ASP). An conventional ASP is designed to treat a wastewater flow rate of 5 MLD, containing influent BOD_5 of 200 mg/l, food to micro-organism ratio of 0.25 and hydraulic residence time of 6 hours. Determine the volume of the reactor and MLVSS to be maintained in the reactor.

(OR)

b) Describe the removal mechanism of organic content by attached growth process. Explain the various elements involved in the operation of tricking filter. Classify the different types of trickling filters. Discuss the main operational problems encountered in the TF.

14. a) Explain the various actions involved in the self-purification process of streams and various zones of pollution in a stream. Write the equation of oxygen sag curve and explain the terms.

(OR)

b) Provide the conditions favourable for land application of sewage. Explain sewage farming with its advantages, types of crops used and precautions taken in its operations and in consumption of such crops.

15. a) Categorize the sources of sludge produced from various stage of conventional wastewater treatment plant. Provide flow chart of various processes involved in sludge treatment and disposal mentioning objectives of each process.

(OR)

b) Differentiate between low rate and conventional and high rate sludge digesters. A high rate digester plant is used to digest primary sludge with the following data; quantity of wastewater = 50000 m^3/d, raw effluent suspended solids (SS) concentration = 350 mg/l, SS removal efficiency in primary sedimentation tank = 75%; SS concentration in primary sludge = 35 kg/m^3; solids retention time required for volatile solids destruction = 20 days; diameter of the tank = 25 m. Determine the total depth of the tank.

PART – C **(1×15=15 Marks)**

16. a) As city planning engineer you are responsible for planning and design of sewerage system for a city. Show a flow chart showing the various stages involved in the sewerage system from collection to disposal. Summarize what are all the data required for planning and design of each stages of sewerage system.

(OR)

b) A river is having discharge of 22 m^3/s receives wastewater discharge of 5 m^3/s. The initial DO of the river water is 6.3 mg/L, and DO content in the wastewater is 0.6 mg/L. The five day BOD in the river water is 3 mg/L, and the wastewater added to river has five day BOD of 130 mg/L. Consider saturation DO of 8.22 mg/L and deoxygenation and reoxygenation constant values of 0.1 and 0.3 per day (both to base 10), respectively. The average velocity of flow in the stream after mixing of wastewater is 0.18 m/sec. If the river forms source of water supply to a town 30 km downstream, by applying DO sag model identify the zone prevailing and suitability for uptake of water for the town at the point. Give your inference on the result.

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