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PRESIDENCY UNIVERSITY BENGALURU

**SET-B**

SCHOOL OF ENGINEERING

**END TERM EXAMINATION – MAY/JUNE 2024**

**Semester :** Semester VI - 2021

**Course Code :** CIV3035\_v02

**Course Name :** - Waste Water Treatment and Disposal Systems

**Program :** B.Tech. Civil Engineering

**Date :** June 14, 2024

**Time :** 1:00 PM-4:00 PM

# Max Marks : 100

**Weightage :** 50%

# Instructions:

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

**PART A**

**Answer any ten questions 10\*2 = 20**

1. Sewage indicates all forms of liquid waste produced by the community. It includes domestic waste water , industrial waste water and storm water. In relation to this what is Sullage and Sewer?

(CO1) [Knowledge]

1. Sewage treatment is a type of wastewater treatment which aims to remove contaminants from sewage to produce an effluent that is suitable to discharge to the surrounding environment or an intended reuse application, thereby preventing water pollution from raw sewage discharges. Write the purpose of sewage treatment.

(CO2) [Knowledge]

1. The organic substance is decomposed into stable substances via the biological process of sludge digestion. List the types of sludge digesters.

(CO3) [Knowledge]

1. A modern trickling filter consists of a bed of highly permeable media to which micro-organism are attached and sewage percolates or trickle down and hence the name **“Trickling Filter”**. Name the types of trickling filters.

(CO2) [Knowledge]

1. Bureau of Indian Standards [formerly known as Indian Standards Institution (ISI)] has framed standards which lay down the tolerance limits, for discharging domestic and industrial sewage effluents into inland surface waters of such characteristics as total solids, hydrogen ion concentration, BOD, oils and grease, cyanides, Sulphides, radioactive materials and various minerals such as arsenic, barium, cadmium, zinc, chromium, etc. Write the tolerance limits of BOD and Total suspended solids.

(CO3) [Knowledge]

1. Activated sludge is probably the most versatile of the biological treatment processes capable of producing an effluent with any desired BOD. Write the factors affecting Activated sludge process.

(CO2) [Knowledge]

1. Write a note on any one of various natural water bodies into which sewage can be discharged for dilution.

(CO3) [Knowledge]

1. The design of activated sludge systems involves several parameters to ensure an efficient and effective wastewater treatment process. What is F/M Ratio?
2. List the factors affecting natural forces in self purification of natural streams.

(CO2) [Knowledge]

(CO3) [Knowledge]

1. The sludge volume index is used to design Activated sludge systems. Write about sludge volume index.

(CO2) [Knowledge]

1. Write about Zone of recovery and clear water zone in relation to the zones of pollution in a river- stream.

(CO3) [Knowledge]

1. Sewer is used for carrying waste water and human waste away from buildings to a place where they can be safely got rid of. Write a short note on any one standard shapes of sewer.

(CO1) [Knowledge]

1. If the chemical formulae of the constituents of organic matter are known, ThOD can be easily computes. In relation to this define chemical oxygen demand(COD).

(CO1) [Knowledge]

1. A waste water sample diluted in 100 times with aeration water had an initial DO of 7 mg/l and after 5 days of incubation at 20 degree Celsius, the DO was zero. The BOD of waste water is?

(CO1) [Knowledge]

**PART B**

**Answer any eight questions 8\*5 = 40**

1. It is necessary to treat properly or dispose the sludge generated during the various stages of wastewater treatment like primary sedimentation, secondary sedimentation and sludge generated from advanced (tertiary) treatment, if any. Paraphrase about Secondary sludge.

(CO3) [Comprehension]

1. The activated sludge process(ASP)was developed in England in 1914 and was so named because it involved the production of an activated mass of microorganisms capable of aerobically stabilizing the organic content of a waste. Describe Mixed Liquor Suspended Solids which is an important criteria in the design of ASP.

(CO2) [Comprehension]

1. When sewage is discharged into the river , the receiving water Gets polluted due to waste products present in sewage effluent. But the conditions do not remain same forever, because the natural forces of purification go on acting up on the pollution elements and bring back the water into its original condition. Relate the conditions necessitating the treatment of sewage before its disposal by dilution.

(CO3) [Comprehension]

1. The secondary wastewater treatment is required to remove the soluble and colloidal organic matters which remain after primary treatment. As it is mostly biological process also called

biological treatment. In relation to this discuss about Attached growth and Suspended growth process.

(CO2) [Comprehension]

1. The self purification of natural water systems is a complex process that often involves physical, chemical, and biological processes working simultaneously. The amount of Dissolved Oxygen (DO) in water is one of the most commonly used indicators of a river health. Explain the Indices of Self Purification.

(CO3) [Comprehension]

1. Waste water generated from residential area near Hebbal contains high concentration of oil and grease which will interfere with removal of organic matter in secondary treatment. Suggest a suitable preliminary treatment unit which can be used to remove oil and grease from waste water. Explain the working principle of suggested treatment unit with the help of neat diagram.

(CO2) [Comprehension]

1. Domestic sewage is made up of waste water from the bathroom, kitchen, and lavatory, among other places. Daily per capita water use, quality of water supply, type, condition, and extent of sewerage system, and people's lifestyle are all elements that influence the characteristics of domestic sewage. Describe any two physical characteristics of domestic sewage.

(CO1) [Comprehension]

1. A trickling filter is a type of wastewater treatment system. It consists of a fixed bed of rocks or plastic media over which sewage flows downward. In relation to this compare SRTF and HRTF.

(CO2) [Comprehension]

1. Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal. Differentiate the systems of sanitation.

(CO1) [Comprehension]

1. The population of a town of 78000 persons is producing the following sewages
   1. Domestic sewage at 278 lpcd having 250 mg/l of BOD
   2. Industrial sewage at 700000 lpd having 1350 mg/l of BOD

Assuming that the primary sedimentation removes 30% of BOD. Allow an organic loading of 12000 kg/ha-m/day (excluding recirculation sewage). The recirculation ratio is 0.5 and surface loading should not exceed 190 ML/ha/day (including recirculation sewage). Determine the volume of trickling filter.

(CO2) [Comprehension]

1. BOD is defined as the oxygen required for the micro-organisms to carry out biological decomposition of dissolved solids or organic matter in the wastewater under aerobic condition at standard temperature. Discuss the purpose of BOD test results.

(CO1) [Comprehension]

1. To determine the BOD5 of a wastewater sample, 5, 10 and 50 ml aliquots of the wastewater were diluted to 300 ml and incubated at 20°c in BOD bottles for 5 days. The result were as follows.

|  |  |  |
| --- | --- | --- |
| **Wastewater vol [ml]** | **[DO] initial [mg/l]** | **[DO] final after 5 days [mg/l]** |
| 5 | 9.2 | 6.9 |
| 10 | 9.1 | 4.4 |
| 50 | 8.4 | 0.0 |

Based on the data, Estimate the average BOD5 of Wastewater sample.

(CO1) [Comprehension]

**PART C**

**Answer any four questions 4\*10=40**

1. Sludge conditioning is a process whereby sludge solids are treated with chemicals or various othermeans to prepare the sludge for dewatering processes, in other words, to improve dewatering characteristics of the sludge. Demonstrate the Chemical and heat treatment method of sludge conditioning.

(CO3) [Application]

1. Aeration tank capacity and dimensions, aeration facilities, secondary sludge settling and recycling, and excess sludge squandering are all factors to consider while designing an activated sludge facility. Articulate any four design parameters of Activated Sludge Process.

(CO2) [Application]

1. A river/stream after disposal of raw or partially treated sewage undergoes self purification in four zones. Depict the zones of pollution in a River-stream.

(CO3) [Application]

1. Design a screen device for a flow of 25MLD with approach velocity 1 m/sec. Assume depth of flow as

0.9 m, size of opening is 25 mm and diameter of bars = 10 mm. The bars are provided with an inclination *60 degree* to horizontal.

(CO2) [Application]

1. The treated domestic sewage of town is to be discharged in a natural stream. Compute the percentage purification required in the treatment plant with the following data.

i.Population = 50000

ii.BOD contribution per capita = 0.07 kg/day iii.BOD stream of on u/s side = 3mg/L

iv.Permissible maximum BOD of stream on D/s side = 5mg/L v.Dry weather flow of sewage = 140ltr /capita /day vi.Minimum flow stream = 0.13 𝑚*3*m^3/s

(CO3) [Application]

1. A town has a population of 43000 with the daily per capita water supply allowance being 148 lit, of which 80% finds its way to sewer. The slope available for sewer to be laid is 1 in 650 and sewer should be designated to carry 4 times the Dry Weather Flow (DWF) while running full. Compute the velocity and diameter of sewer when running full. Take Manning’s Coefficient n=0.012.

(CO1) [Application]