SEAT No. :

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[6269]-301

T.E. (Civil) (Insem)
WASTE WATER ENGINEERING
(2019 Pattern) (Semester - II) (301012)

Time : 1 Hour]   *[Max. Marks : 30*

Instructions to the candidates:

1)   *Answer Q.1 or Q.2, Q.3 or Q.4.*

2)   *Figures to the right indicate full marks.*

3)   *Draw neat figures wherever necessary.*

4)   *Assume necessary data.*

5)   *Use of scientific calculators is allowed.*

Q1) a)   Define and explain self-cleansing and non-scouring velocity.   **[3]**

b)   Determine the storm water discharge produced from 45 hectors comprising different types of sub catchments as given below. The average intensity of rainfall in the area is 45 mm/hr.   **[6]**

Sr. No.	Type of catchment	% Area	Runoff Coefficient
1.	Roof	25	0.90
2.	Pavement	30	0.85
3.	Lawns and Garden	35	0.10
4.	Wooded Area	10	0.05

c)   The BOD of sewage incubated for 5 day at 20°C has been found to be 400 mg/l. What will be ultimate BOD and 3 day BOD at 30°C? Assume $k_d = 0.1$ d^{-1} at 20°C.   **[6]**

OR

Q2) a)   Differentiate between centralized and decentralized sanitation infrastructure.   **[3]**

b)   Find the minimum velocity and gradient required to carry coarse sand particles of size 0.5 mm and specific gravity 2.65 through a sewer of diameter 0.9 m. Assume constant beta = 0.4, $f = 0.03$ and N = 0.013. The sewer is assumed to run half full.   **[6]**

c)   If BOD$_5$ of a sewage sample at 30°C is 150 mg/L, determine BOD$_5$ at 20°C. Assume $k_d = 0.1$ d^{-1} at 20°C.   **[6]**

Q3) a) Explain the importance of grit chamber. **[3]**

b) Design a grit channel using the following data. **[6]**

Sewage Flow = 10 MLD

Grit size = 0.2 mm, Specific Gravity = 2.65

Temperature of sewage = 10°C

Desired removal efficiency = 80%

Constant $n = \frac{1}{4}$

Width of grit channel = 2.5 m

Freeboard = 0.3 m

Space of the sludge accumulation = 0.3 m

Determine: i) Required surface overflow rate ii) Number and dimensions of grit channels.

c) Determine diameter and depth of primary sedimentation tank for sewage flow 10 MLD. Given data: Detention time = 2.5 hours and surface loading rate = 40000 l/m²/d. **[6]**

OR

Q4) a) Explain various treatment units in primary treatment of waste water. **[3]**

b) Determine the dimensions and detention period of a rectangular grit chamber for following data. **[6]**

Maximum Flow of sewage = 20MLD

Specific gravity of grit = 2.65

Diameter of grit particle to be removed = 0.2 mm and above

Average temperature = 20°C

Flow through velocity = 0.23 m/sec

Width of grit chamber = 1.2 m

Freeboard = 0.3 m

Space of the sludge accumulation = 0.25 m

c) A plain sedimentation tank with a length of 20 m, width 10 m, and a depth of 3 m is used in a sewage treatment plant to treat 4 million litres of sewage per day (4 MLD) The dynamic viscosity of water is 1.002×10^{-3} N-s/m² at 20°C. Density of water is 998.2 kg/m³. Average specific gravity of particles is 2.65. What is the surface overflow rate in the sedimentation tank? What is the minimum diameter of the particle which can be removed with 100% efficiency in the above sedimentation tank? **[6]**

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