

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Date: _____ Time : 2 Hr. Full Marks : 30 No. of Students : 27
Autumn Semester: 2017-18 Deptt. : Civil Engineering Sub No. CE 60023
M.Tech. (Environmental Engg. & Management; Water Management)
Subject Name: Wastewater Management

Instruction: Assume suitable data required for design clearly stating the same.

Q. 1. a) Estimate the quantity of sewage to be considered for designing the sewage treatment plant for a city with past census population as given in the table below. Use incremental increase method for population forecasting using appropriate design period. The per capita domestic water demand of 135 LPCD should be considered. In addition to this about 35 LPCD water is supplied to meet commercial and institutional water demand.

Year	1971	1981	1991	2001	2011
Population	50,000	85,000	130,000	190,000	280,000

- (5)
- b) A test bottle containing only seeded dilution water has its DO level drop by 1.0 mg/L in a 5-day incubation. A 300 mL BOD bottle filled with 10 mL of wastewater and the rest seeded dilution water experiences a DO drop of 6.2 mg/L in the same time period. What would be five day BOD of the wastewater? If BOD reaction rate constant $K = 0.23$ per day (base e), what will be three days BOD at 27 °C incubation temperature. Consider temperature coefficient of 1.047. (4)
- c) Calculate the velocity of flow and corresponding discharge in a sewer of circular section having diameter equal to 800 mm and laid at a gradient of 1 in 600. The sewer runs 0.6 full at maximum discharge. Use Manning's formula $n = 0.012$. For $d/D = 0.6$; $v/V = 1.072$; $q/Q = 0.671$. (4)

- Q.2 a) Describe factors that affects self-purification of natural stream. (3)
- b) Design square grit chamber for a town having population of 80000 and water supply of 180 LPCD. (3)
- c) Write short notes on sewer appurtenances. (3)
- Q.3 Write short notes on *any TWO* of the following: (8)
- a) Self-cleansing velocity and non-scouring velocity used in the design of sewers
- b) Various patterns of collection system
- c) Sewage and storm water pumping station

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