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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION – December 2018

M.Tech I Semester

COURSE CODE: 14M31CE112

MAX. MARKS: 35

COURSE NAME: SIMULATION AND MODELING

COURSE CREDITS: 03

MAX. TIME: 2 Hr

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Assume suitable data if required.

- Q1. a) Write the fundamental diffusion equation used in deriving the Gaussian Plume Model and mention the notations used in the equation. [02 Marks]
- b) What are the assumptions made in deriving the Gaussian Plume Model? [03 Marks]
- c) A Power plant burns 7.30 tonnes of coal per hour and discharges the combustion products through a stack with an effective stack height of 75 m. The coal has a sulfur content of 4.1 percent, and the wind velocity at the top of the stack is 3.0 m/s. Atmospheric conditions are stable (Class C). Consider Urban Wind Profile Exponent [02+04+04]
- i. Determine the maximum ground-level concentration of SO₂ and the distance from the stack at which the maximum occurs.
- ii. Calculate the centerline concentration for SO₂ at the following distances downwind:
500m, 1km, 3km, 5km, 7.5km, 10km and 15km
Plot these values on a graph and include the maximum concentration
- iii. Using the above information, develop the crosswind concentration profiles for SO₂ at 1km, 5 km and 10km. Sketch the profiles.

- Q2. a) An Industrial wastewater is discharged into a municipal wastewater sewer. The characteristics of the two wastes area as follows: [05 Marks]

Characteristics	Wastewater	Stream
Flow	0.25 m ³ /s	432 MLD
BOD ₅	0.1 kg/m ³	3 mg/L
Temperature	17°C	20.5°C
Phosphate	0.125 kg/m ³	2.3g/m ³
NH ₄	30.0g/m ³	0.002mg/ml
TDS	0.55 mg/mL	100mg/L

Determine the characteristics of the mixture.

- b) A wastewater – treatment plant disposes of its effluent in a surface stream. Characteristics of the stream and effluent are shown below. [02+03+03+02]

	Wastewater	Stream
Flow	17280 m ³ /day	5.0 m ³ /s
Dissolved Oxygen, mg/L	1.0	8.0
Temperature, °C	15	25
BOD ₅ @20°C	0.2mg/mL	2 mg/L
K ₁ at 20°C, day ⁻¹	0.2	
K ₂ at 20°C, day ⁻¹		0.3

- What will be the dissolved oxygen concentration in the stream after 2.0 d?
- What is the critical oxygen level in the stream and how far downstream will it occur?
- Determine the maximum BOD₅ (20°C) that can be discharged if a minimum of 4mg/L of oxygen must be maintained in the stream
- Sketch the Dissolved oxygen profile a 100-km reach of the stream below the discharge

(Assume Velocity of Mixture as 0.15 m/s)

- Q3. a) What do you mean by "Monte Carlo Simulation" and how it is different from a deterministic simulation? [02 Marks]
- b) Discuss the steps involved in Monte Carlo Simulation [01 Marks]
- c) Mention the several application areas of Monte Carlo Simulation and elaborate on any one of the application areas. [02 Marks]