

King Saud University
College of Engineering - Civil Engineering Department

CE 442 Water & Wastewater Treatment
 Sections: 16569 and 17236

Final Examination
Time allowed: 3 hours (Aid Sheets are Provided)

Student Name: Section:.....

Student Number:

Mid-Term Exams and Reports:

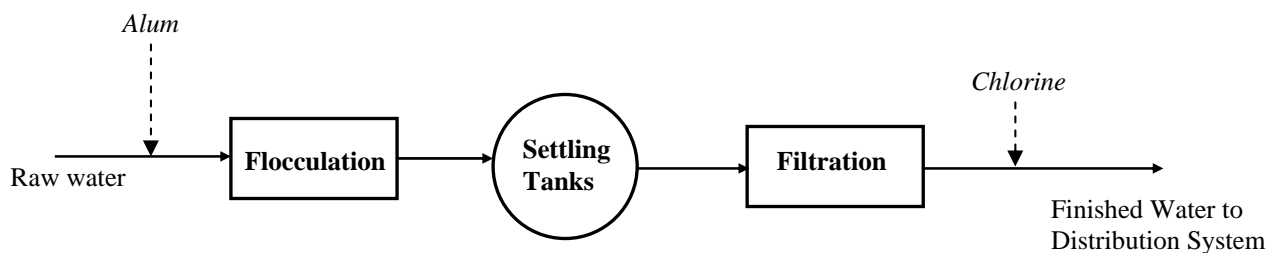
Final Exam:

Final Mark:

Question One (35%)

A schematic diagram of a water treatment plant processing $45,000 \text{ m}^3/\text{day}$ of river water is shown below. The characteristics of the raw water are:

Parameter	Concentration or value
pH	7.5
Total Dissolved Solids (mg/L)	430
Turbidity (NTU)	37
Total Coliform (colony/100 mL)	10
Fecal Coliform (colony/100 mL)	1
Calcium (mg/L)	22
Magnesium (mg/L)	11
HCO_3^- (mg/L)	17
CO_3^{2-} (mg/L)	10
SO_4^{2-} (mg/L)	15
Cl^- (mg/L)	20



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Question Three (30%)

An activated-sludge system consists of four circular aeration tanks and four clarifiers. The total influent flow is 88,000 m³/day with a BOD₅ of 160 mg/L.

(1) If the water depth in the aeration tanks is 4 meters, determine the diameter of each tank such that the F/M ratio is 0.4 g BOD₅ / g MLSS.day, and the MLSS is 4500 mg/L.

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(2) Calculate the sludge age assuming that the excess solids production is 0.5 g of MLSS per g of BOD_{applied}

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(3) if a SVI test was performed on the mixed liquor, and the sludge volume after 30-min settling in a 1-L graduated cylinder was found 350 mL. Calculate the SVI, and the solids concentration in the returned sludge.

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(4) Estimate the mass (kg/day) and volume (m³/d) of the waste activated sludge.

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(5) If the waste sludge is thickened to 3.5%, what is the volume of the thickened sludge?

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Question Four (15%)

Two aerated lagoons, 2-m deep, are required to treat a domestic wastewater flow of 2500 m³/day with a BOD₅ of 180 mg/L. The reaction-rate constant of the wastewater (K₂₀) is 0.46 day⁻¹. The design specification is to achieve a BOD₅ removal of about 85% at 15 °C.

(1) Calculate the area of each lagoon.

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(2) Calculate the BOD removal efficiency if the wastewater temperature is 30 °C.

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