

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination November 2018

B. Tech in Civil Engineering, Semester V

Roll No.....

CE509 : ENVIRONMENTAL ENGINEERING-II

Time: 3 hours

Max. Marks: 80

Instructions to students:

1. Do not write anything other than your roll number on question paper.
 2. Assume suitable data wherever required and mention it clearly.
 3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
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Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. The term 'Sullage' refers to:
 - (a) Fresh wastewater
 - (b) Septic wastewater
 - (c) Wastewater from kitchen, laundry
 - (d) Toxic wastewater
- ii. While observing flow pattern of reactors if the Dispersion number $(D/UL) \geq 3.0$ to 4.0 :
 - (a) indicates hydraulic regime approaching completely mixed conditions
 - (b) indicates hydraulic regime approaching Plug Flow conditions
 - (c) indicates Ideal Plug Flow conditions
 - (d) None of these
- iii. Self-cleansing velocity is:
 - (a) Velocity at dry weather flow
 - (b) Velocity of water at flushing
 - (c) Velocity at which no accumulation remains in the drains
 - (d) Velocity of water in a pressure filter
- iv. In waste water treatment plant the 2⁰ (Secondary) treatment refers to :
 - (a) Physical Unit operations
 - (b) Chemical Unit operations
 - (c) Chemical and Biological Unit operations
 - (d) None of above
- v. Membrane filter method for total coliform and thermos-tolerant (faecal) coliform detection is :
 - (a) Not suitable for turbid water
 - (b) Suitable for turbid water
 - (c) Not suitable for field use
 - (d) None of these
- vi. Generally the nitrogen content in the untreated sewage is observed to be in the range of :
 - (a) 5 to 10 mg/L measured as TKN
 - (b) 10 to 40 mg/L measured as TKN

- (c)) 20 to 50 mg/L measured as TKN
 (d)) 5 to 10 mg/L measured as TKN
- vii Which of the following is most likely to be a significant problem when manually cleaned bar screens are left uncleaned too long:
- (a) Anaerobic acids will form to de-glavanize the bars and cause high concentrations of zinc in the plant effluent.
 (b) Grit will be trapped in the screenings causing excessive wear on the manual "rag rake".
 (c) Flow will back up to overflow either the screen channel or upstream manholes.
 (d) Hydrogen sulfide will be reduced to form zinc sulfide deposits on the bars of the screen
- viii. In a WWT plant , the submerged area of the surface of the screen, including bars and opening should be about :
- (a) 300% of the cross sectional area of the incoming sewer for separate system
 (b) 200% of the cross sectional area of the incoming sewer for combine system
 (c) 200% of the cross sectional area of the incoming sewer for separate system
 (d) 100% of the cross sectional area of the incoming sewer for combine system
- ix. The kinetics of BOD reaction can be formulated in accordance with
- (a) Second order reaction kinetics
 (b) First order reaction kinetics
 (c) Zero order reaction kinetics
 (d) Pseudo order reaction kinetics
- x. Suspended- culture system of waste water treatment consist of :
- (a) Ponds and Lagoons
 (b) Rotating Biological Contactors
 (c) Both a & b are correct
 (d) Both a & b are incorrect
- Q.2 Short answer type questions (4 questions @ 2.5 marks) 10
 Write short note on the following terms w.r.t. ASP:
 a. Solid Retention Time (SRT) or Mean Cell Residence Time (MCRT)
 b. Sludge Volume Index
 Define the following terms:
 a. Indicator micro-organism
 b. Hydraulic Profile
- Q.3A Determine the 1 day BOD and ultimate first stage BOD for a waste water whose 5 day 20 °C BOD is 200 mg/L. The reaction rate constant k (base e) = 0.23 per day. 05
- Q.3B The treated waste water is being discharged in to a river of 15 °C. The BOD rate constant determined in the laboratory for this mixed water is 0.12 per day. What fraction of maximum oxygen consumption will occur in first four days? 05
- Q.4A Explain the various sampling methods used for water and waste water analysis. 05
- Q.4B With the help of BOD Model , explain the kinetics of BOD reaction and also derive the expression for the following: 05

- i. Amount of BOD remaining at time t
- ii. Five Day BOD

Q.5A The BOD of sewage incubated for 1 day at 30°C has been found to be 100 mg/L . What will be the five day 20°C BOD? Assume $K = 0.12$ (base 10) at 20°C , and $\theta = 1.056$. 05

Q.5B Design a Low Rate Trickling Filter (LRTF) to treat 6.0 MLD of sewage of BOD of 210 mg/L . The final effluent should be 30 mg/L and organic loading rate is $320\text{ g/m}^3/\text{d}$. 05

Q.6A "Characterization of waste is essential for an effective and economical waste management programme and treatment methods". Justify the statement by explaining important characteristics of sewage 05

Q.6B Write down the design criteria for the following filters: 05

- i. LRTF
- ii. HRTF

OR

Q.6B Illustrate with brief explanation, the basic engineering approach for developing a well operating, cost effective treatment system for industrial wastewater 05

Q.7 Design a Primary settling tank to treat waste water with average flow rate of 10 MLD and peak flow of 22.5 MLD . Assume the following data as: 10

- detention time = 1.5 h
- width = 6.0 m

Q.8 Explain in detail the following "Aeration Units" with diagram, used for aeration purpose in activated sludge process (ASP): 10

- a. Diffused air aeration unit
- b. Mechanical aeration unit

OR

Q.8 Design a grit chamber for population 50000 with water consumption of 135 LPCD . Assume the following data as: 10

- Sewage generation = 80% of water supply
- Horizontal velocity = 0.2 m/s
- Detention time period = 1 minute