M. TECH. ENVIRONMENTAL BIOTECHNOLOGY FIRST YEAR SECOND SEMESTER - 2018

Subject: WASTEWATER TREATMENT & BIOREMEDIATION **Time: Three Hours Full Marks: 100 (70/30 for Part-I/Part-II)**

Part: Part-I

Use a Separate Answer-Script for Each Part
Answer any 3 (Three) questions (One Mark for Neatness)

1. Design grit chamber to remove grit particles based on the following given data. Also design a proportional flow weir (symmetrical sharp-edged; c = 0.61) which acts as a control device at the effluent point. Average Flow = 55 MLD; Peak Flow = 165 MLD; Size and Specific Gravity of the Grit Particles to be removed = 0.15 mm and 2.65; The Minimum Temperature = 15^{O}C and Viscosity $\nu = 1.14 \times 10^{-6}$ m^2/s; Efficiency of Removal η = 75%; Measured Settling Basin Performance n = 1/8; K = 0.04 and f = 0.03. Assume any other suitable data and suitable formula as and when necessary. 23

2. (a) Draw two typical flow charts for single stage and two stage trickling filters with recirculation. Write down the expressions for filter efficiency (η) for them. 6

(b) Design a high rate single stage trickling filter for a town of 40000 people based on following data. Also determine the filter efficiency and BOD of the treated effluent. Domestic Sewage = 120 lpcd with BOD = 220 mg/L; Industrial Sewage = 300000 lpd with BOD = 900 mg/L; Primary Sedimentation Efficiency for BOD Removal = 35%; Allowable Organic Loading = 10000 kg/ ha-m/ day (excluding recirculation); Allowable Surface Loading = 170 ML/ ha/ day (including recirculation). 17

3. (a) Applying the mass balance approach on bio-mass and food derive the driving equations for an activated sludge process with a completely mixed reactor (with a neat diagram). 5

(b) An activated-sludge system is to be used for secondary treatment of 55 MLD of municipal wastewater. Raw Wastewater BOD_5 = 300 mg/L; Raw Wastewater SS Concentration = 400 mg/L; Primary Sedimentation Efficiency for BOD Removal = 30%; Primary Sedimentation Efficiency for SS Removal = 70%; Primary Sludge SS Concentration = 40 kg/m^3. It is desired to have not more than 5 mg/L of soluble BOD in the ASP effluent. A completely mixed reactor is to be used, and pilot plant analysis has established flowing kinetic values: Y = 0.5 kg/kg, k_d = 0.05/day. Assuming an MLSS concentration of 3000 mg/L and an underflow concentration of 10 kg/m^3 from the secondary clarifier. Determine the following: Volume of the Reactor; Quantity of the Secondary Sludge; The Sludge Recycle Ratio. Assume any other suitable data and suitable formula as and when necessary. 18

4. Design a secondary sedimentation tank (circular) to treat effluent from an Activated Sludge Process based on the following data: Average Flow = 55MLD and Peak Flow Factor = 2.25; Influent MLSS concentration = 3000 mg/L; Surface Loading Rate = 20 m^3/ day/ m^2; Solid Loading Rate = 80 kg/ day/ m^2 (Average Flow); Solid Loading Rate = 210 kg/ day/ m^2 (Peak Flow); Permissible Weir Loading = 150 m^3/ day/ m; For effluent weir, provide 90^{O} V-notches @ 20 cm c-c with C_d = 0.60. 23

Ref. No. EX/PG/EBT/T/127/2018

M. TECH. (ENVIRONMENTAL BIOTECHNOLOGY)
2ND SEMESTER EXAMINATION, 2018

Wastewater Treatment and Bioremediation

Time 3 hours **Full marks 100**

Part II (Bioremediation)
30 marks

Use separate answer script. Answer any three questions. Each question carries 10 marks.

1. Describe terminal and sub-terminal oxidation of alkanes by the application of microorganisms. (5+5)

2. Discuss the bioremediation of TCE and PCE. (5+5)

3. Discuss with examples the molecular structural consideration for design of biodegradable pesticides.

4. Describe a practical demonstration of bioremediation of polychlorinated biphenyl contaminated river sediments.

5. Describe the "Lasagna" process for remediating contaminated soils.

6. Discuss the practical approach towards bioremediation of marine oil spills.